

Eating a nuclear disaster:
A vital institutional ethnography of everyday eating in the
aftermath of Tokyo Electric Power Company's Fukushima
Daiichi Nuclear Power Plant disaster

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Abstract

This project explores the coordination of everyday eating in the aftermath of Tokyo Electric Power Company's (TEPCO's) Fukushima Daiichi Nuclear Power Plant disaster. With the onset of the nuclear disaster in March 2011, imperceptible radionuclides re-emerged as objects of concern for many people living throughout the archipelago of Japan. Falling over homes, farmlands, forests, waterways and oceans, TEPCO's radionuclides became unwelcomed actors within Japan's agrifood assemblage, challenging the governance of food safety in Japan and around the world. To ensure the 'safety' of food circulating within its agrifood assemblage, the Japanese government initiated an effort to coordinate the activities of human actors in the turbulence of the radiological overflow.

Beginning with the troubling experiences of *konran* (disorder) shared by forty-three people living and eating in Japan's Kansai region in 2016, this thesis borrows sensibilities from the field of institutional ethnography to explore how everyday eating is hooked up within textually-mediated ruling relations that have emerged since the onset of TEPCO's nuclear disaster. At the same time, sensibilities from material semiotics are used to attend to myriad other sociomaterial entanglements people find themselves entwined within in the aftermath of the nuclear disaster, particularly their entanglements with imperceptible radionuclides. I refer to this method of inquiry as a 'vital institutional ethnography.'

With the goal of producing knowledge that will be of use to my participants in situating their own experiences of *konran* within greater ruling relations, I follow strings from their experiences into various institutional complexes to both explicate ruling relations and explore the monstrous and ghostly sociomaterial entanglements of humans and more-than-humans they relate with in their everyday lives. Beginning with an exploration of historical cases of industrial ruination and the current case of TEPCO's nuclear disaster, I discover that ruling texts and discourses are enacted in ways to erase or obfuscate the material presence of industrial pollutants. Through explicating the various ruling relations my participants are embedded and participate within following TEPCO's nuclear disaster, I argue that the Japanese government's coordination effort attempts to establish a single, 'correct' way for humans to understand and relate with

radionuclides possibly present in the food and water they ingest. This ‘single reality’ is born out of what I refer to as the ‘transnational nuclear assemblage’—an assemblage of commissions, governments, committees, scientific associations and many other organizations which produce ruling texts that are designed to manage and contain radiological overflows within a vast and ever-expanding textual complex. In exploring the ruling relations involved in the enactment of ‘safe food,’ I discover that while single-reality-wielding coordination efforts may be efficient for maintaining the pace of commerce and in paving the textual-path forward for military and industrial projects, tensions arise when they enter and interfere with the messy, multiple realities of my locally-situated participants.

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Note on language and transliteration

In this thesis, Japanese names appear in the Japanese order: family name followed by first name. As a rule, all Japanese language words are *italicized* throughout the document, except for commonly known place-names that are regularly used in English (for example, Tokyo and Kyoto). Macrons are also used to signal Japanese long vowels, except in commonly known place-names as mentioned above.

All interviews and focus groups for this thesis were conducted in Japanese by the author in 2016. Study participants were given pseudonyms which will appear with their statements. Quotations from study participants were translated by the author and have been reviewed by a Japanese-English speaker to ensure their accuracy. Bracketed text is included within participant quotes to either point out the original Japanese term or phrase used, or to provide important contextual information missing from participants' statements.

Because this thesis was written with a Japanese audience in mind, I use American spelling and grammar as it is the style most commonly used in English publications in Japan.

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List of abbreviations

ABCC	Atomic Bomb Casualty Commission
ALARA	as low as reasonably achievable
ATSDR	Agency for Toxic Substances and Disease Registry
BEIR	Biological Effects of Ionizing Radiation
BSE	bovine spongiform encephalopathy
CAA	Consumer Affairs Agency (of Japan)
CRPPH	Committee on Radiation Protection and Public Health (of the OECD NEA)
COMEST	World Commission on the Ethics of Scientific Knowledge and Technology
CRMS	citizen radiation measuring station
DDREF	dose and dose-rate effectiveness factor
FSCJ	Food Safety Commission of Japan
IAEA	International Atomic Energy Agency
ICAN	International Campaign to Abolish Nuclear Weapons
ICRU	International Commission on Radiation Units and Measurements
ICRP	International Commission on Radiological Protection
ICXRP	International Committee on X-Ray and Radium Protection
INES	International Nuclear and Radiological Event Scale
IPPNW	International Physicians for the Prevention of Nuclear War
JCO	Japan Nuclear Fuel Conversion Co.
LNT model	linear-non-threshold model
LSS	Life Span Study (conducted on the atomic-bomb survivors of Hiroshima and Nagasaki)
MAFF	Ministry of Agriculture, Forestry and Fisheries (of Japan)
MEXT	Ministry of Education, Culture, Sports, Science and Technology (of Japan)
MHLW	Ministry of Health, Labour and Welfare (of Japan)
MOX fuel	mixed-oxide fuel
NIRS	National Institute of Radiological Sciences (of Japan)
NORM	naturally occurring radioactive material
NSCJ	Nuclear Safety Commission of Japan

OECD NEA	Organisation of Economic Cooperation and Development's Nuclear Energy Agency
RERF	Radiation Effects Research Foundation
STS	social studies of science and technology
TEPCO	Tokyo Electric Power Company
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
US	United States
US AEC	United States Atomic Energy Commission
US NAS NRC	United States National Academy of Sciences' National Research Council
US NCRP	United States National Committee on Radiation Protection and Measurements
WHO	World Health Organization

1 Introduction

In June, 2010 Ito Kahoru (pseudonym), traveled with a friend to the site of Tokyo Electric Power Company's (TEPCO's) Fukushima Daiichi Nuclear Power Plant. The then governor of Fukushima Prefecture, Sato Yuhei, had opened up discussions about using mixed-oxide (MOX) fuel—a mixture of uranium and plutonium—in the plant's reactors.¹ Kahoru was part of a group trying to stop this measure from passing; plutonium is, of course, considered to be “the world's most dangerous element.”² Before giving birth to her daughter and moving to Fukushima City, Kahoru was a nurse in Shizuoka Prefecture, home of the Hamaoka Nuclear Power Plant. It was during that period of her life that she first began learning about nuclear power:

At that time, Shizuoka's Hamaoka Nuclear Power Plant was probably the most concerning nuclear power plant. It was said to be the riskiest nuclear power plant in the world.³ The combination of nuclear power and earthquakes. At that time, I became truly aware of the real possibility of the onset of a combined earthquake and nuclear power plant disaster.

From her home in Fukushima City, Kahoru and her friend traveled three hours by car on mountain roads until they arrived at a spot near TEPCO's nuclear power plant.

If you got down and stood there, it was a sprawling peaceful landscape. Nearby there were small children playing alongside their

¹ Unlike usual nuclear fuel rods which contain uranium oxide, MOX fuel rods contain a blend of plutonium and uranium oxide. The use of MOX fuel is an important part of Japan's goal of creating a closed nuclear fuel cycle, known as the 'Pluthermal Program' (W. D. Turner, 2003b). That is, Japan's nuclear power program is based on an ambitious never-before-attained plan to generate a large percentage of the country's power using plutonium. MOX fuel was loaded into TEPCO's Fukushima Daiichi Nuclear Power Plant's reactor 3 in August 2010, one of the reactors that would explode and suffer a full meltdown in March 2011 (International Panel on Fissile Materials, 2010).

² See Bernstein (2007).

³ McNeill (2011) explains that the label of 'world's most dangerous' nuclear power plant comes from seismologists: the five nuclear reactors at the Hamaoka plant sits atop “two major subterranean faults,” a location where predictions show there is an 87 percent chance of a powerful earthquake to strike. At that time, there were plans for one more reactor to be built at the site.

young mothers. I was filled with complex feelings. In any event, at the site of a nuclear power plant, nearby it's more than usual that radioactivity is regularly leaking. [...] If it was me, I wouldn't bring my children there. [...] Immediately after having those complex feelings, "GOOOOOON!" there was a rumble in the ground. It was extremely frightening.

At 2:46 pm on March 11, 2011, Kahoru felt another earthquake, this one much bigger than the one she felt in June the previous year. By around 4pm, she had received news of the power outage at the nuclear power plant she had stood before just eight months earlier. Her husband was away, and she took refuge at a friend's house approximately 80 kilometers from the site of what would soon be a full-fledged nuclear disaster. She had seen images of the tsunami and considered evacuating in case the nuclear reactors were in trouble, even though the Japanese government was not recommending it at the time.⁴ At 11pm, she read a fax written by the Disaster Response Headquarters explaining that the TEPCO Fukushima Daiichi Nuclear Power Plant would suffer a meltdown if electricity was not restored. She kept checking for updates. There was still no power at the nuclear power plant.

In the middle of a blackout, Kahoru finally decided to evacuate. With only the clothes on their backs and a small backpack, she, her then four-year-old daughter and her female friend—whose husband was a doctor, so decided to stay behind as not to evade his work duties—made their way to Aizuwakamatsu in western Fukushima. Kahoru again found herself driving through Fukushima Prefecture's beautiful mountain roads, but this time in almost complete darkness as aftershocks large and small rumbled beneath her. There they met Kahoru's husband, and her family traveled to Niigata in a rental car. They were lucky enough to get the last two seats on a flight to Osaka after two cancellations were made. But this luck led them to leave the rental car behind, an act they would later pay for through a hefty fee. From Osaka, they took the bullet train to Hiroshima, then traveled to her husband's hometown where they stayed for a month. After a month together, her husband needed to return to work which would reopen as

⁴ The Japanese government would eventually ask people within a 30 kilometer radius to evacuate due to the nuclear disaster. The United States (US) recommended any US citizens within 80 kilometers evacuate (Kubota & Reuters Staff, 2011).

‘normal’ in April. For both Kahoru and her husband, however, these did not feel like ‘normal’ times. As her husband moved back to Fukushima City, Kahoru and her daughter relocated to the island of Kyushu.

From her previous work, Kahoru had already known about the dangers of internal radiation, especially regarding iodine-131 and thyroid glands, and even became active in a campaign to measure breast milk for radiation after iodine-131 was found in water in areas as far away as Tokyo.⁵ At the same time that she had begun traveling around the country to support various initiatives, Kahoru felt some discord in her new home in Kyushu when it came to food and the issue of internal radiation exposure. On the one hand, she was connected with a number of anti-nuclear activists there and even though they cared about ending Japan’s dependency on nuclear power, she explained that most of them were a bit older and did not seem to have many concerns about issues of food or internal exposure to radiation. On the other hand, there were mothers at her daughter’s new school who were very concerned about internal radiation from food. There were also people setting up a citizen radiation measuring station (CRMS) to test food for radionuclides. While she appreciated all of their efforts, as someone who had left Fukushima and was active on the national scale, her entanglement within these very different ways of ‘doing food’ was troubling, involving so much more effort and attention than she had to offer at that time.

Everyone was in anguish as they were choosing foods. And, also, in relation with moms who might have very different information [about radiation]. Everyone anguished trying to figure out how it will be possible to share. I just left it to those people.

Eventually Kahoru and her husband moved to the Kansai region where I met her in 2016. They are both plaintiffs in one of the many country-wide court cases demanding TEPCO and the Japanese government acknowledge losses suffered not only by officially recognized ‘evacuees’—those people who were living within the mandatory evacuation zone at the time of TEPCO’s nuclear disaster—but all people who have sought refuge from TEPCO’s radionuclides. Because they lived in Fukushima City and not in a mandatory evacuation zone, Kahoru and her family are categorized as

⁵ See, for example, Jolly and Grady (2011).

‘voluntary’ or ‘independent evacuees’ (*jishu hinansha*, 自主避難者) and have received no compensation for the disorder TEPCO’s nuclear disaster has wreaked on their everyday lives.

Sakayama Akane (pseudonym) was living in Tomioka-*mura*, less than ten kilometers from TEPCO’s Fukushima Daiichi Nuclear Power Plant and less than four kilometers from TEPCO’s Fukushima Daini nuclear power plant in March 2011.⁶ Her family had moved to Tomioka-*mura* in 1986, the same year as the Chernobyl nuclear disaster. Though she remembers questioning the safety of nuclear power as an adolescent back in 1986, she recalls how people around her seemed to view nuclear power in a positive light. Some of her relatives and neighbors had worked at restaurants, coffee shops or *bento* shops whose main customers were workers at TEPCO’s nuclear power plants. She recalls how in calligraphy class at her new school in Tomioka-*mura*, she and her classmates would delicately paint the four characters that spell out ‘nuclear future’ (*genpatsu mirai*, 原発未来). Nuclear power offered a bright future to people in her community, if only because it brought capital and business to those struggling to make a living in a small, rural town.

There were many people who supported nuclear power. There was the Energy Hall⁷ with a replica of Madam Curie’s house.

Needless to say, Akane’s post-2011 experience has not been the bright nuclear future she had learned to expect as a young girl growing up within 10 kilometers of eight of TEPCO’s nuclear reactors.

⁶ *Daiichi* means “number 1” in Japanese, while *daini* means “number 2.”

⁷ The Energy Hall, referred to as a “public relations hall,” is an over 10,000 square meter building built and owned by TEPCO (Yusuke Noda, 2017). Another of TEPCO’s PR facilities is the J-Village national soccer training center located about 20 kilometers south of TEPCO’s Fukushima Daiichi Nuclear Power Plant, about 11 kilometers from Akane’s now demolished house—her house was so overrun by wild animals and their excrement after being abandoned following the nuclear disaster that it was uninhabitable, even if she wanted to move back following the lifting of the evacuation order in April 2017 (Kyodo News, 2017). After undergoing “revitalization,” J-Village will be used to host both men’s and women’s soccer training camps for the 2020 Olympics (Kyodo News, 2016a).

On March 11, 2011 a magnitude six earthquake shook Akane's house, knocking over teacups and furniture. She heard evacuation orders come from a loudspeaker outside, warning people to escape the impending tsunami. Bringing only a blanket, underwear, her cellphone, charger, wallet and bankbook, Akane drove with her father to a designated evacuation shelter.

It was a concert hall. It was also built with money from the nuclear power plant.

They received canned food and bread, no water. The next day they heard about trouble at TEPCO's nuclear power plant, so needed to evacuate further as the concert hall was less than 10 kilometers from the troubled reactors. At 7am on March 12th, Akane's father drove them west—a trip which would usually take 45 minutes, but took almost seven hours because of the congested traffic. They stayed at a closed-down elementary school for about five days, sleeping on an aluminum sheet and receiving very little food: some bread, a very small cup of miso soup, and one saltless rice ball. This time there was a water wagon provided. She saw the nuclear reactors explode on a television screen in the hallway. She was 45 kilometers away.

After about four days, Akane and her father drove to Aizuwakamatsu, approximately 100 kilometers from TEPCO's nuclear disaster. Most of the evacuation shelters were performing screening tests on people, making sure they did not have high levels of radiation on their bodies before they entered. Akane had already thrown away the clothing she was wearing at the time of the explosions by the time she arrived. While the food was better at the new evacuation center—including hearty miso soup and curry—Akane was still sleeping on a cardboard box on a gym floor and suffering due to a chronic illness. All the futons were kindly offered to the elderly and she wanted to move to her friend's house in Tokyo, but her family angrily objected.

I said I don't want to worry [about my exposure to radiation] when I have kids. But because I don't even have a boyfriend, my relatives said it's like worrying about rebounding on a diet when you don't even go on a diet in the first place.

Akane was eventually allowed to leave, but only because her prescription could not be filled due to the high pressure people in the evacuation centers had put on local

pharmacies. After receiving her family's blessings, she quickly hopped on a bus to Tokyo. She stayed with a friend for a few days and then moved to Chiba to stay with another friend for about a week. She then moved to Yokohama where she stayed with family until April 7th when she moved to Niko with her father—he had been at the elementary school the entire time. While in Niko, she heard news about spinach being 'over the limit.' As food was provided, she could not check the origin of the ingredients. She wasn't sure about what to eat, but stopped drinking milk and cut back on seafood after learning about their susceptibility to radionuclide contamination. What was once a delicious and hearty bowl of miso soup became a brew of potentially health-damaging ingredients. In August 2011, Akane moved alone to the Kansai region where I met her in 2016. Once in Kansai, she became a member of a cooperative that tests foods for radioactive cesium-137 and cesium-134 at levels lower than the government standards. She also mournfully stopped eating mushrooms after learning they easily absorb radioactive cesium, and reminisced about the days she and her family would go foraging in the mountains of Fukushima Prefecture.

Fukushima is a place of abundant nature, so I would go foraging for edible wild plants with my dad, gather walnuts with my aunt. Being robbed of such natural blessings, that's the worst part [of the disaster].

A plaintiff in one of the lawsuits against the Japanese government and TEPCO, Akane continues to attend meetings and events about TEPCO's nuclear disaster. However, she is not able to discuss her concerns with her family who all moved back to Fukushima Prefecture. "They tell me I worry too much," she said.

Kondo Tomohisa (pseudonym) grew up in Koriyama City, Fukushima Prefecture, located approximately 60 kilometers from both TEPCO's Fukushima Daiichi and Fukushima Daini nuclear power plants. He had been living with his wife and children in the Kansai region for ten years prior to March 2011, and was there watching from afar, trying to get in touch with his many family members still in Koriyama at the time of the nuclear disaster. When I met him in 2016, he and his wife had a two year-old and a newborn child. Like Akane, and many of my other participants, he has felt pressure to keep quiet regarding his concerns about radiation, especially when he goes home to visit his family in Fukushima Prefecture.

Of course, people in Koriyama don't directly say it to my face, but there is a general atmosphere that it is not okay to talk [about radiation]. Once you start thinking about it, you will probably start thinking too much about it. It would be too much for your heart to bear. [...] In any case, I want to show them their grandchildren, so I go home. But it comes with incredible discord [kattō]. My wife is from Kansai and of course she doesn't want to go home with me. [...] But I really want to show them. I want to show them their grandchildren. I want to show people in the neighborhood. When I say I want to go home, every time [my wife and I] argue. It's really heart-wrenching.

When we spoke about food, Tomohisa explained that while in Kansai, he cares a lot about the food he and his family eats. Soon after the onset of the nuclear disaster, he and his wife began researching about radiation and how far it had spread across the country.⁸ Through their research, they set their own 'standard' (*kijun*) for food, and decided not to purchase foods grown in the Tōhoku or Kantō regions because of their concerns about contamination with TEPCO's radionuclides.

We've stopped eating seafood. Even [some food] from Kyushu. There was talk about foods grown in Fukushima being counterfeit as coming from Kyushu. [...] Even things like mushrooms. [...] Well, it may seem to be an assumption, but we came to the conclusion that it would be better not to eat much [food possibly contaminated with radiation].

But when he goes back to Koriyama and his family prepares meals for him, there is not much he can say. The discomfort of openly discussing radiation sometimes makes it impossible for him to protect his own family's 'standards.'

It's really difficult. Hmm. You know, I care about [food]. But [when I go to Koriyama], there are times that I just close my eyes.

⁸ See Figure 1 for a map of radiological fallout produced by Professor Hayakawa Yukio of Gunma University.

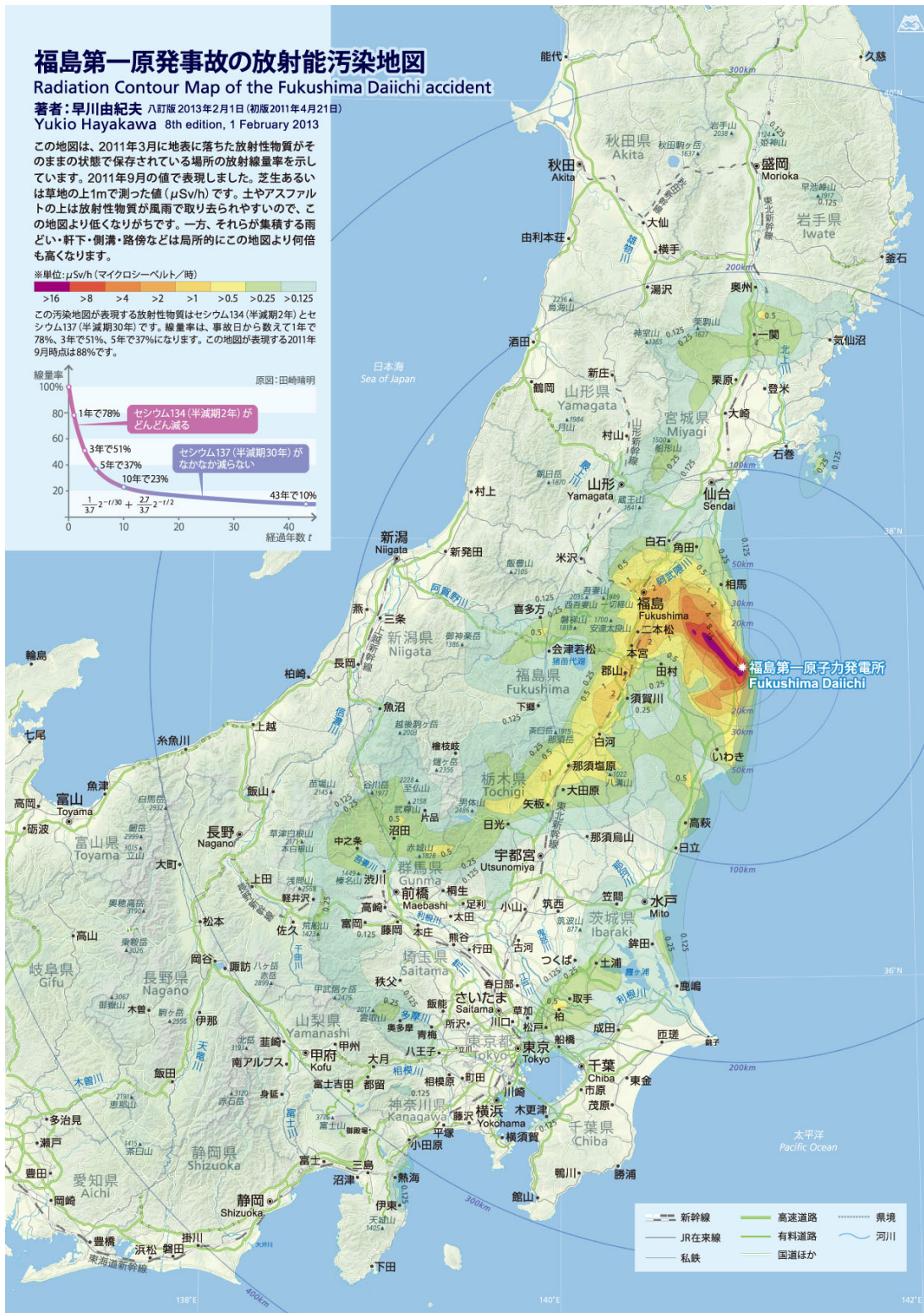


Figure 1 Radiation contour map (eighth edition) created by Professor Hayakawa Yukio (2013) of Gunma University. Measurements as of September 2011, taken one meter above turf or grassland.⁹

⁹ Permission to reprint this map is provided to those who follow the “reprinting rules” (updated January 22, 2014) stipulated on Professor Hayakawa’s website: <http://kipuka.blog70.fc2.com/blog-category-20.html>. Reproduction of this specific map requires clearly crediting Professor Hayakawa Yukio for its production.

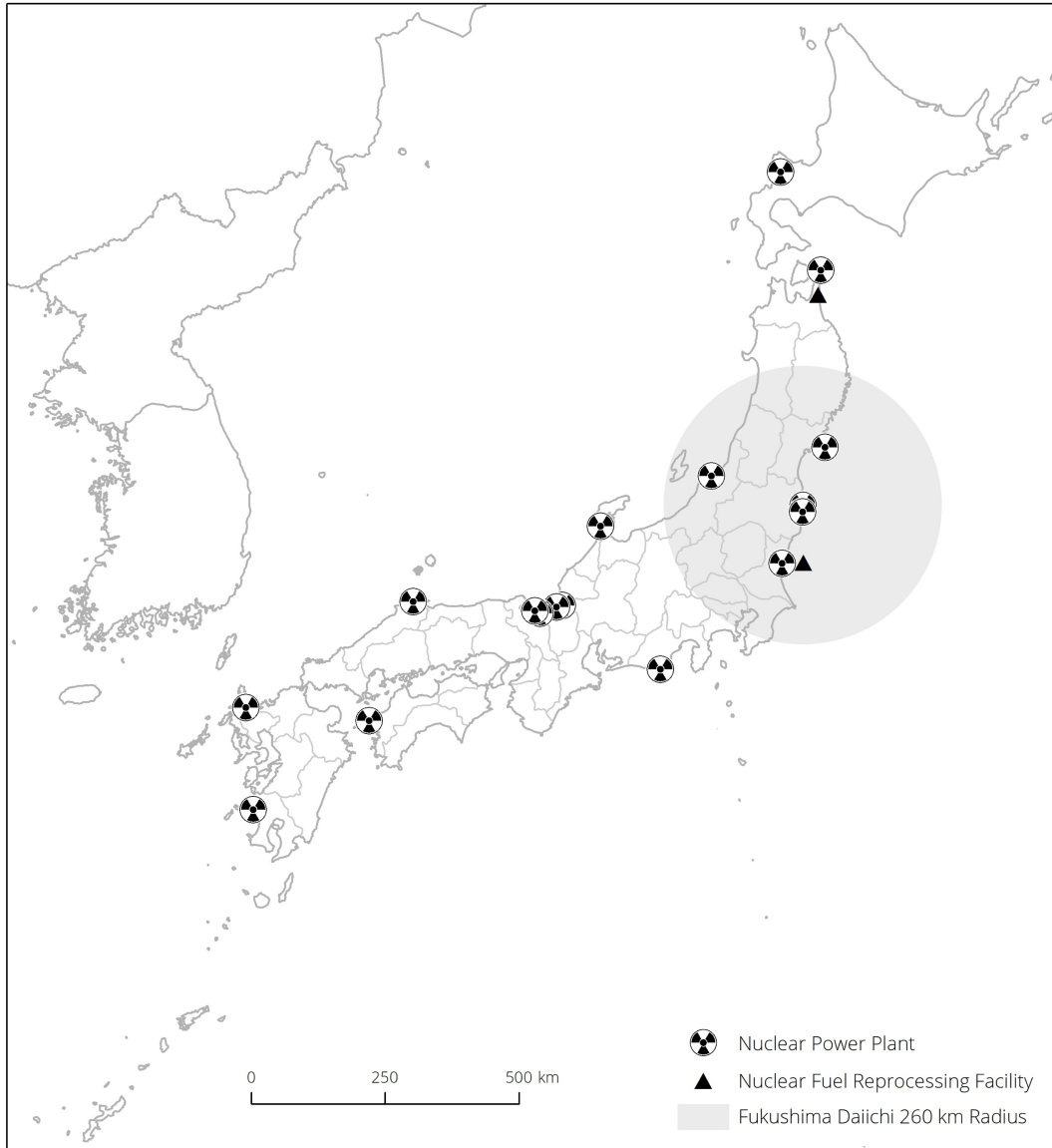


Figure 2 Map of the nineteen locations housing Japan’s fifty-four nuclear power plants and two nuclear fuel reprocessing facilities, with a 260 kilometer radius around TEPCO’s damaged Fukushima Daiichi Nuclear Power Plant.¹⁰

¹⁰ Data on the location of Japan’s nuclear power plants and nuclear fuel reprocessing facilities for this and other maps came from the World Nuclear Association (2017) as well as Koide and Nishio (2014).

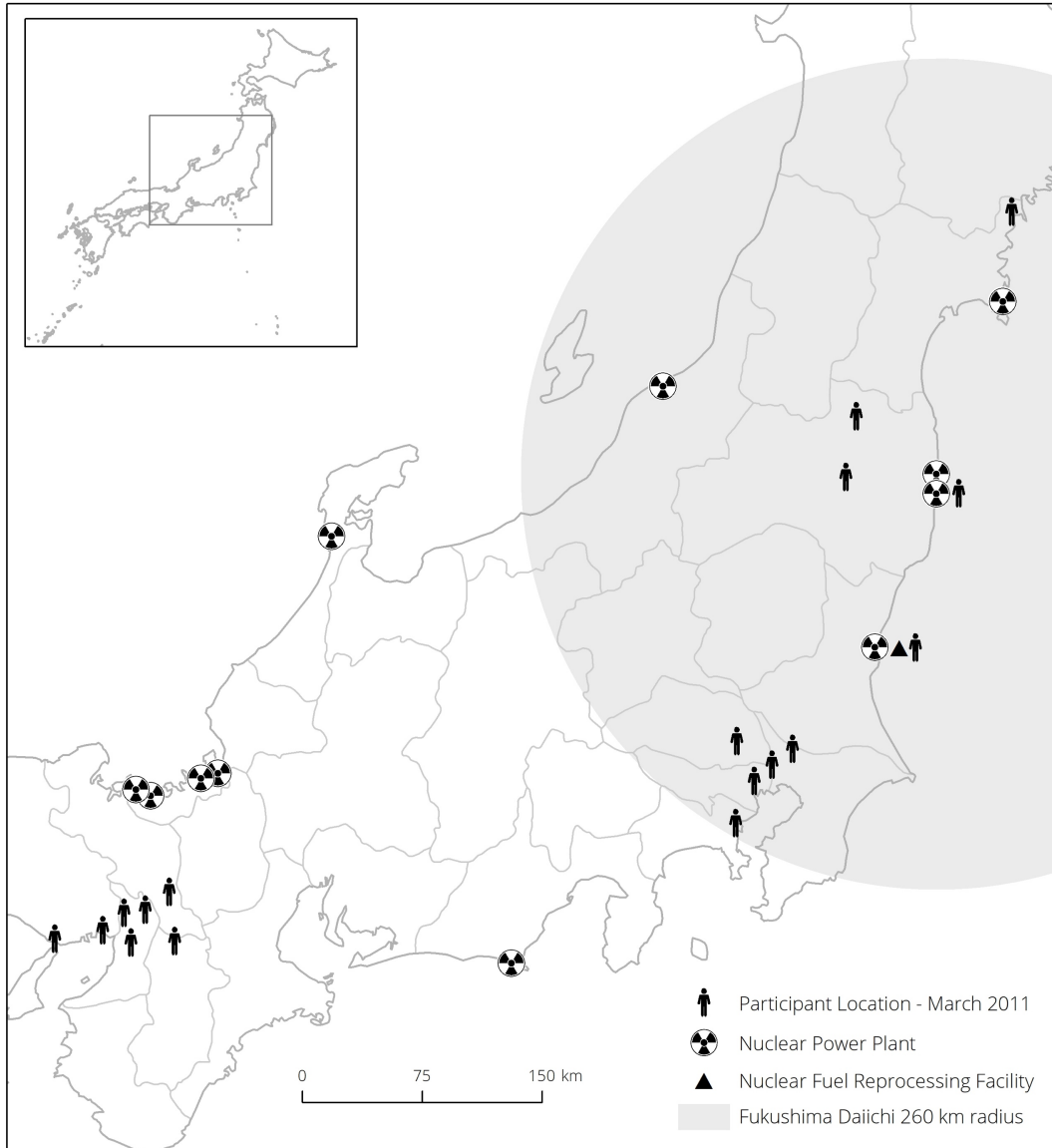


Figure 3 Seventeen locations of the study's forty-three participants in March 2011.

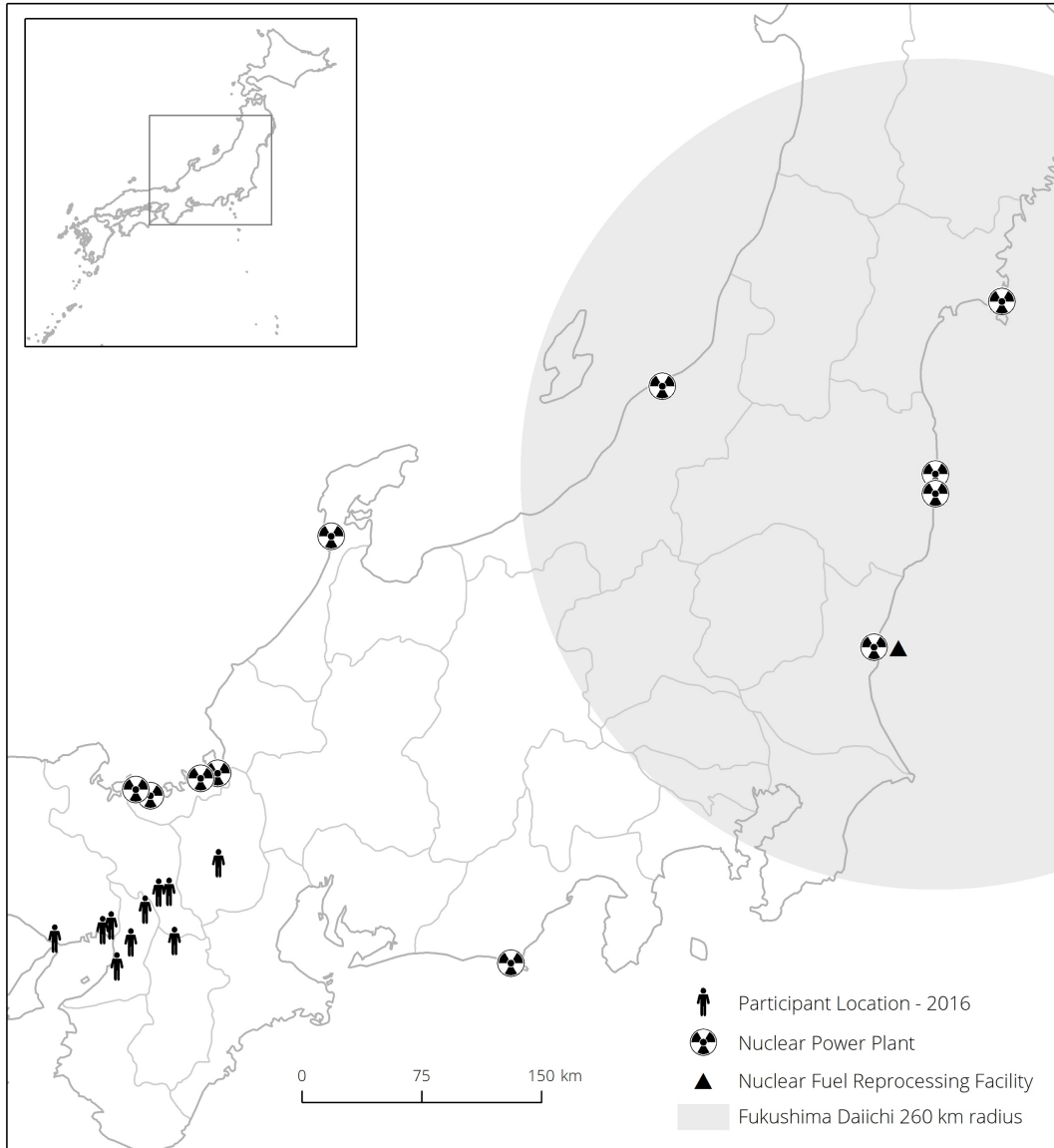


Figure 4 Ten locations of the study's forty-three participants during fieldwork for this project in 2016.

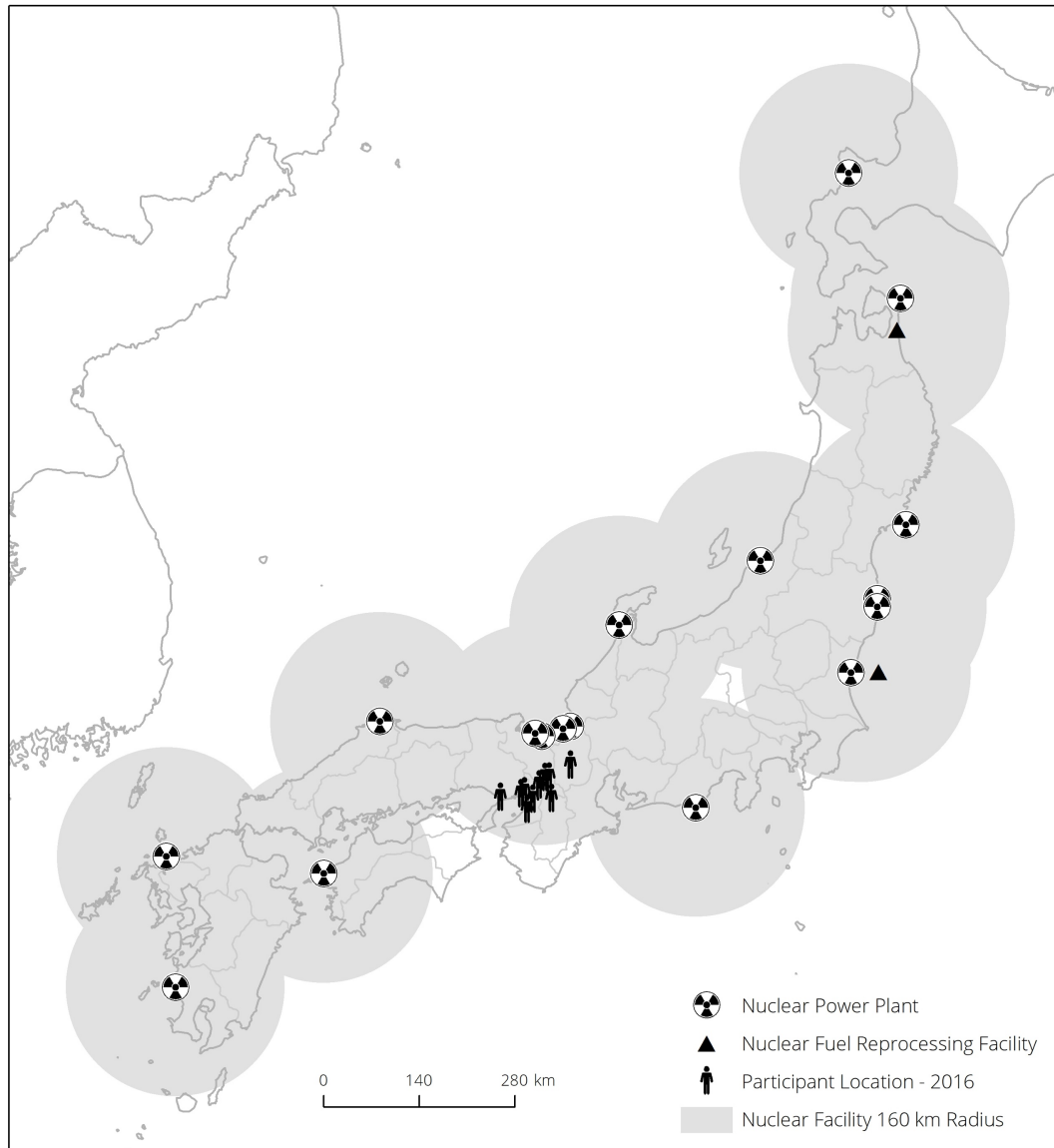


Figure 5 Location of study participants during fieldwork in 2016. They were all located within the 160 kilometer radii of Japan’s fifty-four nuclear reactors and two plutonium reprocessing facilities.¹¹

¹¹ The concept for this map came from Koide and Nishio (2014).

It was not only people in or with connections to Fukushima Prefecture whose lives were turned upside-down following the onset of TEPCO's nuclear disaster. According to maps of radioactive fallout produced by both the Japanese government and other independent sources, fallout from TEPCO's nuclear disaster reached areas over 260 kilometers from the site of the meltdowns, with some of the heaviest fallout concentrated in areas 160 kilometers from the damaged nuclear reactors (Figures 1 and 2). While all of my study's participants were living in the Kansai region during fieldwork for this thesis in 2016 (Figure 4), seventeen of them had been living within 260 kilometers of TEPCO's damaged reactors in March 2011 (Figure 3). However, the country's fifty remaining nuclear reactors and two plutonium reprocessing facilities ensured that true refuge would be difficult to come by, as almost every location in Japan is within 160 kilometers of a nuclear power plant (Figure 5). Thus, far from being a problem solely for people in Fukushima Prefecture, the patchy deposition of TEPCO's radionuclides throughout large areas of north-eastern Japan and into the Pacific Ocean caused disruption in the everyday lives of people throughout the country.¹² And not only for those people forced to live their everyday lives surrounded by TEPCO's radionuclides, but also people throughout the country ingesting foods possibly containing these imperceptible materials.

My introduction to my own entanglement with TEPCO's nuclear disaster came from questions I had regarding food and radionuclides. While I had lived in the Kansai region of Japan for almost two years prior to the onset of the nuclear disaster, in March 2011 I was studying toward my MSc in agroecology in Vienna, Austria. However, my partner was still living in the Kansai region at that time and I wanted to know how the nuclear disaster would affect his everyday life. I attended my soil science class a day or two after seeing clips of the explosions at TEPCO's nuclear power plant. The professor, who was set to retire that year, told us about his experiences remediating farmlands following the Chernobyl nuclear disaster in 1986. We spent the entire class discussing the issue. While it was clear that nuclear disasters are able to contaminate areas used for farming and fishing, I was still very vague as to what this meant for people and other

¹² Radionuclides from TEPCO's nuclear disaster were transported throughout the globe. Some scientists have estimated that approximately 18% of the fallout was on land in Japan, 1.9% on land in other areas throughout the world, while the remaining amounts fell into the Pacific Ocean (see Stohl et al., 2012: 2314).

non-humans eating food possibly contaminated with radionuclides. I asked for some clarification from a friend's partner who was a nuclear engineer. In responding to my questions, he advised that people should be more concerned about consuming bananas—as they contain potassium-40, a naturally occurring radioactive isotope—than any food possibly containing TEPCO's radionuclides. I was not convinced this was a good enough reason to stop asking questions. Around the same time, some of my friends in Japan started telling me about tap water and foods being found 'over the limit' announced on the news, and that they had stopped drinking milk based on the experiences of people following the Chernobyl disaster—strontium-90 mimics calcium, so is often found in milk and other dairy products following a nuclear disaster.¹³ It became apparent that there would be no clear or simple answers regarding everyday eating following the onset of TEPCO's nuclear disaster.

Another study participant, Ōra Mai (pseudonym), was living in Tokyo in 2011, but was in Osaka in the Kansai region at the onset of TEPCO's nuclear disaster. Though she prolonged her stay in Osaka, she eventually returned to Tokyo where she faced a shock at the supermarket.

When I returned, it was really horrible. There was nothing for me to buy at the supermarket. You know, I would have to look at the back of everything, and until that point cooking involved me preparing the food I wanted to eat. [...] It was a feeling of hopelessness, at that time. I remember questioning why every time I had so much stress when having to go to the supermarket. [...] In Osaka, basically, foods from around the area are found in the supermarket. And in Tokyo, as expected, Gunma and Ibaraki, foods from around that area and even from Fukushima. [...] It was really scary. I didn't know to what extent everything was contaminated. I avoided it all.

Mai went on to explain how a small book on radiation and food published by Crayon House in August 2011 was one of her only comforts during those turbulent days (Yasuda, 2011). "How do you describe those times?" I asked, searching for a word able to encapsulate the multiple chaotic and disordered experiences I was hearing from her

¹³ See Hirano et al. (2016).

and all of my other participants. Her response was swift and definitive: “*Konran*. It was *konran*.”

Konran is a compound word that combines the *kanji* characters¹⁴ of *kon* (‘mix,’ 混) and *ran* (‘disordered,’ 乱). In its noun form, it can refer to ‘disorder,’ ‘chaos,’ ‘a mess,’ ‘a jumble,’ ‘a maelstrom.’ As a verb, it becomes the act of being ‘thrown into disorder,’ or ‘getting mixed up’ or ‘muddled.’¹⁵ In this thesis, I explore people’s experiences of *konran* following TEPCO’s nuclear disaster, with a particular focus on experiences of *konran* related to eating. Having moved back to the Kansai region in 2012, it was clear that TEPCO’s nuclear disaster was far from over, and that food was playing a special role in drawing people throughout the country into the ongoing controversy. The “rush of troubled stories” (Tsing, 2015: 34) I shared at the outset of this chapter were to draw you, the reader, into some of my participants’ messy and disordered experiences of *konran* in the aftermath of TEPCO’s nuclear disaster. It is from these multiple experiences of *konran* that this thesis emerges.

1.1 The structure of this thesis

The purpose of this thesis is to explore how myself and my study’s participants came to experience *konran* related to everyday eating following the onset of TEPCO’s nuclear disaster. While my study’s guiding problematic—*How is everyday eating being coordinated following TEPCO’s nuclear disaster?* (see Section 3.3.2.2.)—initially emerged from my own particular experience of *konran* related to everyday eating following TEPCO’s nuclear disaster, it was clear that I was not the only person grappling with these questions. As the experiences of my participants illustrate, food possibly containing TEPCO’s radionuclides erupted as a major concern for people throughout Japan, intimately connecting those living both near and far from TEPCO’s damaged nuclear reactors to the ongoing disaster and its management. In this thesis I

¹⁴ *Kanji* characters are the Chinese characters used as logograms in Japanese writing.

¹⁵ All Japanese definitions used in this thesis were retrieved from either ALC’s (2006) *Kanji Power Handbook*, a CASIO Ex-world Dadaplus-4 portable electronic dictionary (model XD-GF9800), or the online Japanese-English dictionaries *Jim Breen’s WWWJDIC* (<http://nihongo.monash.edu/cgi-bin/wwwjdic?1C>) or *Jisho* (<http://jisho.org>), as well as from a combination of these sources.

study the multiple and emergent experiences of *konran* related to everyday eating shared by my study's participants by turning away from epistemological debates trapped within modernist ontological frames which participate in obfuscating people's experiences, categorizing them as either 'rational' or 'irrational,' 'correct' or 'incorrect.' Instead, I borrow sensibilities from the fields of institutional ethnography and material semiotics to explore the various sociomaterial entanglements that participate in enacting these disordered and chaotic experiences.

In Chapter 2, I situate my study within various bodies of literature that offer opportunities for exploring experiences of *konran* related to eating following a nuclear disaster. Designed to take readers on an ontological odyssey, my review begins with Ulrich Beck's (1992) risk society thesis, before moving to Beck and colleagues' (2005; 2003; 1994) work on reflexive modernization, and Michel Foucault's (2006; 2008) conceptualizations of governmentality and biopolitics. It is at this point that I advocate for engaging in "ontological politics" (Mol, 1999; 2002) and identify both institutional ethnography (for example, D. E. Smith, 1987; 1990b; 1990a; 1999) and material semiotics (for example, Haraway, 2016; Law, 2002; Mol, 2002; Tsing, 2015; Tsing et al., 2017) as offering promising insights for seriously attending to relational materiality and explicating the ruling relations that participate in enacting the experiences of *konran* I explored with my participants.

In Chapter 3, I situate institutional ethnography within the field of material semiotics, and demonstrate how using sensibilities from both of these fields can serve as a method of inquiry for exploring complex, multiple experiences of *konran* in a way that takes into consideration the heterogeneous sociomaterial relations involved in the emergence of such experiences. While institutional ethnography provides tools and sensibilities for explicating the textually-mediated ruling relations that my participants, and myself, are acting and being enacted within, material-semiotic sensibilities are also invaluable for attending to the other human and more-than-human¹⁶ actors involved in enacting these

¹⁶ While many scholars use the term 'non-human' to refer to animals or materials, in this thesis I would like to follow Sarah Whatmore (2002; 2014) and others (for example, Carolan, 2016; Tsing, 2013) in using the term 'more-than-human' as I agree it helps to keep alive debates over what it is to be human and to "avoid the implication that we are beyond those troubles we have been grappling with for centuries" (Carolan, 2016: 236).

experiences of *konran*. I refer to this blending of sensibilities as a methodological approach founded in ‘a vital institutional ethnography.’

In Chapter 4, I go back in time to explore historical cases of industrial pollution in Japan in search of insights that might be of use in better understanding my participants’ experiences of *konran* following TEPCO’s nuclear disaster. Using my approach of ‘vital institutional ethnography,’ I retell stories of industrial pollution in ways that attends to people’s sociomaterial entanglements within ruling texts and industrial toxins. It becomes clear that as people become more and more entangled in industrial toxins with the expansion of industrial ruins, they simultaneously become entangled with textually-mediated ruling relations which are blind to these very real, and often very vicious, entanglements. I then turn to a reflection on how to attend to monstrous entanglements and the need to notice the vital and vicious sociomaterial entanglements often ignored or obfuscated in ruling discourses and texts.

The history chapter is followed by three entangled analysis chapters (Chapters 5, 6 and 7). In Chapter 5, I explore the multiple, ghostly absences behind the single presence of Japan’s numerical standards for radiation protection. Specifically, I explore how since the dropping of the atomic bombs on the Japanese cities of Hiroshima and Nagasaki, the vast textual complex of what I term the ‘transnational nuclear assemblage’ and its numerical recommendations have been attempting to enact one, ‘correct’ way of knowing and enacting the relationship between active human bodies and unstable radionuclides. Through traversing the institutional complex of the transnational nuclear assemblage, I discover how a textually established and stabilized ‘uncertainty’ about the embodied effects of low-level exposure to ionizing radiation prevents scientists and governments from attending to and taking seriously the heterogeneity implicit in these effects—low-level exposures are difficult to measure and do not easily fit into linear statistical models. I also explore how radiation protection standards recommended by organizations active within the transnational nuclear assemblage are translated into numerical standards intended to coordinate activities within Japan’s agrifood assemblage. My analysis reveals that the mutable meaning of the term ‘safe’ as well as flexibility in the setting of standards based on ‘exposure situation’ complicate these translations.

In Chapter 6, I take a step further to explore how numerical reference limits used to coordinate activities within the agrifood assemblage participate in enacting a single, ‘correct’ way for my participants to understand and relate with radionuclides. In explicating the prescribed institutional processes for ensuring and producing ‘safe food’ using insights from institutional ethnography, I also use sensibilities from material semiotics to explore government certified ‘safe food’ as multiple. In particular, I follow Mol (2013) in using *ontonorms* as a tool for exploring the different valuations active in not only enacting government certified ‘safe foods,’ but the bodies of those people intended to ingest them. My analysis reveals the different activities involved in stabilizing the multiple enactments of ‘safe food,’ and how experiences of *konran* may emerge from the tensions and inconsistencies produced when these multiple versions of ‘safe food’ clash in practice.

In my final analysis chapter (Chapter 7), I explore the enactive quality of the embodied experiences of *konran* (disorder) and *kattō* (entangled discord). Throughout the chapter, I highlight the various ways my participants worked through feelings of disorder and discomfort, finding or curating places of refuge where they felt comfortable sharing their concerns and discovering opportunities to hear about the suffering of others. The analysis uncovers the ways in which working through their own experiences of *konran* and *kattō*, some of my participants were able to discover how their seemingly individual experiences were actually hooked into greater ruling relations and collective suffering—something that may not have emerged had they completely ignored or suppressed these feelings.

Finally, in Chapter 8, I offer a reflection on my findings and my chosen method of inquiry, providing suggestions on further possibilities of using sensibilities from both institutional ethnography and material semiotics for destabilizing modernist ontological framings and grappling with some of the biggest challenges we face in these troubling times of the Anthropocene.

2 Literature Review

2.1 Introduction

In this chapter I will locate both the theoretical framework and empirical themes of this thesis within the scholarly literature. However, instead of being a review that solely lays out the theoretical concepts used in this thesis, in the spirit of institutional ethnography and material semiotics (relational materiality)—which provide the guiding conceptual and methodological framework for this project—my review is designed to take readers on an ontological odyssey¹⁷ into the diaspora of theoretical concepts that can be used for understanding post-nuclear disaster food encounters and experiences. That is, I have written the review as a way to provoke ontological reflection among readers, bringing you along on the journey I myself took on my quest to find a theoretical framework and method of inquiry robust enough to study the multiple experiences of *konran* embodied by my study's participants. As an ontological odyssey, this journey through the literature will not only include ontological reflections concerning the theoretical concepts themselves, but regarding research ethics and researcher positionality. And while some of the following theoretical concepts and their frameworks will ultimately be left behind in the performance of this thesis, the reflections made on this journey have been fundamental to the evolution of this project, providing meaningful insights into why I ultimately turned to the fields of institutional ethnography and material semiotics to enact this particular project.

I begin the odyssey with an overview and review of Ulrich Beck's risk society thesis where I will illustrate the theory's contribution in highlighting the imperceptible and mischievous materiality of radionuclides, the potentially disruptive agency of toxic foodstuff—and thus the possibility of food to serve as a tool for rethinking the nature/society binary—and the limits to rational risk assessment approaches. My major critique of the thesis can be found in the language of the word 'risk' and the grand

¹⁷ The framing of my literature review as an 'ontological odyssey' was inspired by Campbell and Rosin's (2011) concept of an "ontological expedition." The authors' framing of their paper as an 'ontological expedition' allowed them not only to reflect on the performativity of research and the need to recognize "researcher ontologies"—here they draw on Law and Urry (2004)—but how their own ontological frameworks had evolved through their years of researching organic agriculture in New Zealand. I use the term 'odyssey' to prepare readers for the long, but hopefully not too arduous, journey through my literature review.

narrative style of theorization, both of which serve as a smokescreen to mask the relations that contribute to the emergent experiences of *konran* at focus in this thesis.

I next move to Beck's theory of reflexive modernization to see how it can contribute to understanding the emergent experiences of *konran*. I argue that the theory provides many insights for conceptualizing how the once seemingly stable ontologies and institutions of first modernity are not only being destabilized—represented by the ills of the risk society—but require re-stabilization. The theory is based on Beck's hope that this necessary re-stabilization will come from a sub-political uprising of people awakened by the presence of *new risks* in their everyday lives. However, I follow Latour (2003b) and Wynne (1996) in critiquing the language of 'reflexivity,' the theory's grand narrative style of theorization, and the irony that the theory—based on a hope that everyday people will break free from the grasp of modernist ontologies—is both trapped within and reproduces modernist ontological frameworks.

Subsequently, I turn to the Foucauldian concepts of governmentality and biopolitics to explore how they can assist in painting a more nuanced picture of how experiences of *konran* emerge and are managed within society's power structures. I find that both concepts are valuable in exemplifying the interplay between people and ruling elites following a nuclear disaster—biopolitics in particular being useful in connecting the experiences of suffering people to the *dispositifs* (apparatuses) deployed to manage the post-disaster social milieu. While I find great merit in both approaches, I ultimately agree that they confine research participants to act within constrained conceptualizations of the social milieu which leaves little room for studying the experiences of *konran* as emergent and contingent, imbued simultaneously with precariousness and possibility.

For the remainder of the chapter, I explore the concept of 'ontological politics' (Mol, 1999; 2002) which turns my attention to the field of material semiotics. I explore how material-semiotic sensibilities attune researchers to studying the experiences of *konran*, not as one-off events, but as "happening"¹⁸ that emerges from heterogeneous bundles of

¹⁸ I borrow Tsing's (2015: 23) use of the term "happenings," which she uses to refer to gatherings of humans and more-than-humans which sometimes become "greater than the sum

sociomaterial relations. I ultimately agree with scholars in the field of material semiotics that alternative ontologies that take seriously human embeddedness within heterogeneous assemblages of human and more-than-human actors is a necessary prerequisite for critically engaging with precarious realities and experiences, such as my participants' experiences of *konran*.

2.2 Are we living in a risk society?

I began my literature review where many sociologists studying nuclear issues do: with the writings of German sociologist Ulrich Beck. The 1986 Chernobyl nuclear disaster was the only other nuclear disaster prior to 2011 that was designated a 'Level 7' on the International Nuclear and Radiological Event Scale (INES).¹⁹ It was in that same year that Beck (1992: 22-3) published his German version of the book *Risk Society: Towards a New Modernity* where he argued that nuclear disasters are both propagators of the unintended side effects of industrial society—what Beck calls “new risks”—and thus also symbols of society's transition to the *risk society*. Beck (1992: 22-3, original emphasis) describes the term *new risks* as referring to:

above all radioactivity, which completely evades human perceptive abilities, but also toxins and pollutants in the air, the water and foodstuffs, together with the accompanying short- and long-term effects on plants, animals and people. They induce systematic and often *irreversible* harm, generally remain *invisible*, are based on *causal interpretations*, and thus initially only exist in terms of the (scientific or anti-scientific) *knowledge* about them.

The theory of risk society emerged out of theoretical debates about modernization taking place in the 1970s and 1980s.²⁰ Although Beck's conceptualizations of risks and

of their parts.” She points to ‘contamination’ as one way gatherings are transformed into ‘happenings’ (Tsing, 2015: 27-34). Also see Section 2.6.4.

¹⁹ See Kermisch (2011) for a discussion on the limits of the INES scale.

²⁰ In fact, this theory could be seen as a response to Yair Aharoni's 1981 book *The No-Risk Society* which outlines modern society's focus on creating a sense of security among people living in industrial societies. That is, modern society must focus on employing technologies, such as insurance, to provide a sense of security against the calculated risks (or side effects) of industrial production (see Aharoni, 1981; Sørensen & Christiansen, 2012).

hazards are similar in some ways to other sociologists such as Niklas Luhmann²¹ and Anthony Giddens,²² he emphasizes what he sees as a similarity between hazards and *new risks*: both occur at unforeseeable times and pose a threat to humanity. To clarify his definition of risk, Beck explains it within the context of three epochs, each with its own characteristic types of hazards and ways of managing uncertainties: pre-modern society, early industrial society and risk society. The hazards in pre-modern society are portrayed as being naturally or supra-naturally produced by non-human forces which affect human society, but for which no human could take responsibility or could prevent. These hazards (for example, epidemics and natural disasters) instilled a sense of uncertainty in people, but were unavoidable and, therefore, not politicized (Zinn, 2008).

Beck (1995) explains that with the dawn of early industrial society, the uncertainties of pre-modernity were transformed into calculable risks which were seen as controllable and containable, and could be regulated and compensated for through the technology of insurance.²³ Thus, while anthropological hazards existed in society, they were believed to be transparently known through scientific enquiry, and people could not only avoid these calculated risks, but could insure themselves against them.²⁴

As society enters the risk society, Beck (1995) argues, a feeling of uncertainty returns once again to human civilization though the form of *new risks*. However, unlike

²¹ Luhmann (1993) highlights clear differences between risks and hazards. He views risks as uncertainties that are predictable and insurable through statistical calculation which require a decision on whether or not to engage in the risky activity. He distinguishes them from hazards which he sees as resulting from external causes out of one's control, which originate in nature or result from the decisions of others.

²² Giddens (2000: 22) focuses on risk as a category necessary to the design and maintenance of a future-oriented modern society. He explains: "Traditional cultures didn't have a concept of risk because they didn't need one. Risk isn't the same as hazard or danger. Risk refers to hazards that are actively assessed in relation to future possibilities. It comes into wide usage only in a society that is future oriented – which sees the future precisely as a territory to be conquered or colonized. Risk presumes a society that actively tries to break away from its past—the prime characteristic, indeed, of modern industrial civilization."

²³ Francois Ewald (1991) argues that a defining feature of modern society is the use of insurance as the basis for creating a sense of security and to ensure a social contract.

²⁴ Beck (1995: 78, original emphasis) argued that risks were calculated and therefore limited to "only specific demographic *groups of people* in specific *places* at specific *times*."

previous forms of uncertainty which were seen as being beyond human control, *new risks* reveal themselves in a time where risks are assumed to be manageable, controllable and insurable. As Beck (2009) focuses on the materiality of hazards and their variability throughout the three epochs—arguing they are both materially novel and socially constructed²⁵—he distinguishes himself from scholars following a purely constructivist approach to hazards and risks.²⁶

What's more, Beck does not believe that the risks and hazards that define each of the three epochs disappear in the transition to the risk society. Instead, he argues that humans are still vulnerable to traditional hazards such as tsunamis, earthquakes and epidemics, but in the risk society these seemingly natural disasters can be compounded with anthropogenic hazards that have escaped into the wider environment. Beck elucidated this argument in a 2011 interview with *The Asahi News* following TEPCO's nuclear disaster:

I think industries try to define it as something which has been done by nature. But they don't realize that we are living in an age where the decision making is the primary background for these kinds of catastrophes. I think it's very important to realize this because modernity, or even what you could say is the victory of modernity, produces more and more uncontrollable consequences. [...] We have a system of organized irresponsibility, and this system has to be changed. (Ohno, 2011)

This 'organized irresponsibility' can be understood as what Wynne (1996: 49) describes as "systematic denial of responsibility for creating modern risks." That is, experts and institutions responsible for the release of *new risks* obscure their own role or agency in producing them. This leaves everyday people in a strange predicament: the

²⁵ Environmental sociologists have distinguished between 'realists' who question the materiality or "material truth" of environmental pollution and 'constructionists' who focus on the creation of meaning (for example the meaning of 'risk' or 'environmental problem') which emerges through social processes (see Bell, 2012: 4). Thus, Beck's theory of risk society can be seen as combining both 'realist' and 'constructionist' thinking.

²⁶ For example, Mary Douglas and Aarond Wildavsky (1982) advocate a cultural theory of risk, arguing that hazards remain the same throughout history, only society's interpretation of them have changed.

experts and institutions with the responsibility for protecting them from *new risks* not only produce information necessary to understand the risks (and thus have a role in shaping the social construction of that risk), but also simultaneously deny any responsibility of their own role in sociotechnical controversies.

2.2.1 *The limits of rational risk models*

In Beck's (1999) view, *new risks* (such as nuclear fallout and global warming) not only evade human senses and pose a threat to future generations, but are no longer easily calculated through existing rational risk models and are, therefore, not readily compensated through insurance and the welfare state.²⁷ To Beck (1999), this gestures to a great irony of modernity: it was modern society's own attempt to overcome uncertainty through scientific rationality and the control of nature that led to the creation of the unintended consequences which are no longer easily insured or understood through rational risk assessments.

2.2.2 *Dependency on experts and technology*

According to Beck (1992), although people with accumulated material wealth may have more resources to deal with the consequences of *new risks*, they are not immune to their effects. However, even if people with higher education and monetary wealth do have the resources to gather information on the risks they face, they also find themselves in the predicament of being "*dependent on external knowledge*" and are, thus, "becoming *incompetent* in matters of their own affliction" (Beck, 1992: 53, original emphasis). To illustrate this point, Beck turns to an example of toxic food, highlighting how the imperceptible nature of many pollutants make it impossible for people to identify their presence or conceptualize possible negative effects of consuming them within their everyday lives. He writes:

People who find out that their daily tea contains DDT and their newly bought cake formaldehyde, are in a quite different situation [from

²⁷ In Beck's (1999: 76-7, original emphasis) words, society enters into the risk society "when the hazards which are now decided and consequently produced by society *undermine and/or cancel the established safety systems of the welfare state's existing risk calculations*. In contrast to early industrial risks, nuclear, chemical, ecological and genetic engineering risks (a) can be limited in terms of neither time nor place, (b) are not accountable according to the established rules of causality, blame and liability, and (c) cannot be compensated for or insured against."

someone who is at the risk of losing his job]. Their victimization is *non determinable* by their own cognitive means and potential experiences. Whether DDT is contained in the tea or formaldehyde in the cake, and in what dose, remains outside the reach of their own knowledge just as much as does the question of whether and in what concentrations these substances have a long- or short-term deleterious effect. (Beck, 1992: 53, original emphasis)

Thus, while the wealthy may have more access to knowledge, Beck (1992) argues they often cannot access enough to feel at ease. As a result, all members of society may be equally plagued with anxiety due to their inability to gather adequate information on how to protect themselves and their families from the potential dangers posed by *new risks*.

2.2.3 *Side effects and the 'side effects of side effects'*

Finally, in Beck's (1992) view, the project of industrialization was undertaken with the virtuous ambitions of getting people out of poverty and providing a way for them to meet their own material needs. However, the project of industrialization did not come without unintended side effects; it has created *new risks* which threaten human existence. Beck (1992: 23) argues these 'side effects' not only threaten people's health, but also create a cascade of additional consequences relating to economic profit, private property, and the legitimization of positions of power, among others. These secondary side effects are also referred to as "the side effects of side effects" (Beck, 2009: 38). This ability for *new risks* to travel and affect the everyday lives of people around the globe is why Beck (1992; 1999; 2009) refers to the risk society as being a *world risk society*.

2.2.4 *Risk society and konran*

In a 2007 article, Boudia and Jas (2007: 5) translated Bruno Latour's (2003a) preface to the second French edition of *Risk Society (La Société du Risque)*: "when Risk Society first appeared, the cloud from Chernobyl was spreading over Europe; when this French translation appeared, catastrophe had just struck in Toulouse and in New York. Who still needs proof that we have well and truly entered the risk society?" I agree with Latour that it is difficult to deny that we are in fact living in very precarious times.

Thus, a number of questions arise: What is useful and what is potentially less-helpful about Beck's theorization of the risk society? How can it be used in understanding experiences of *konran* following TEPCO's nuclear disaster?

I would argue that the risk society thesis provides a useful starting point to begin reflecting upon *konran* as a side-effect of a nuclear disaster. Through his theorization, Beck created a language for discussing and grappling with what happens when pollutants spill out of industrial processes and into people's everyday lives. He importantly points to the imperceptible and persistent nature of these pollutants—what Carolan (2006: 234) refers to as “epistemologically distant objects”—which make it difficult for people to understand or identify these materials without scientific tools and expertise. The inability to act based on one's own senses can cause turbulence, not only in the performance of everyday life, but in how one understands and enacts reality. For instance, the realization of the existence of radionuclides—especially their possible presence in materials that humans put into their bodies—may cause people to question their own ontological groundings and the trajectory of society as a whole.

Additionally, Beck's theory of the risk society importantly highlights the limits of rational risk assessments in dealing with the complex aftermath of nuclear disasters. Rational risk assessments are based on rational choice theory which classifies people as individual, liberal, autonomous actors who make rational decisions based on what is in their best interest. Bell (2012: 231, original emphasis) explains how “the rational assessment perspective believes not only that risks *can* be evaluated independent of political, social, or cultural context, but that they *should* be.” He goes on to describe that because the findings of risk assessments provide simple answers based on precepts of scientific rationality, they are often used to inform policy.²⁸

Following TEPCO's nuclear disaster, there have been a number of studies published on risk perceptions, risk assessments and risk communication that relate, in some way, to the disaster (for example, Ito & Kuriyama, 2016; N. H. Kim et al., 2015; Murakami,

²⁸ Carlo Jaeger (2001) also offers interesting insights into the limits and social construction of the modernist rational actor paradigm, which is foundational to the rational risk assessment approach.

Nakatani, & Oki, 2016; Orita et al., 2015; Perko, 2016; Sawada, Aizaki, & Sato, 2014; Svendsen, Yamaguchi, Tsuda, Guimaraes, & Tondel, 2016). While most studies do not discuss the ontological positioning of the rational risk paradigm, Haggmann (2012: 812) provides an overview of the limits to rational risk assessments following TEPCO's nuclear disaster, arguing such assessments "are quite limited in their analytical orientation, their empirical circumscription, and the truth claims that they empower." He instead calls for a more democratic discussion which allows for questioning current government protocols of managing all uncertainty using this single, narrow approach. Using a feminist political ecology perspective to study the experiences of organic farmers in Fukushima following TEPCO's nuclear disaster, Kimura (2015) also discusses how risk perception research often neglects the complex and pertinent role gender plays in the disaster and its aftermath. Here and in her other work on TEPCO's nuclear disaster, Kimura and colleagues explicitly argues there is a need to interrogate the official tendency to denounce and chastise people's concerns about food safety as being 'emotional' and 'irrational,' an inherently feminine disorder of 'hysterical' women (Kimura, 2016a; 2016b; Kimura & Katano, 2014).²⁹ In fact, my own masters research on people's perceptions and behaviors regarding food safety following TEPCO's nuclear disaster was conducted within this theoretical context (Burch, 2012). While the study's intention was to grasp the multidimensionality of people's experiences and challenge the assumptions of the information deficit model,³⁰ the structured nature of survey research meant I was only able to brush the surface in understanding the complexity of my participants' experiences.

The information deficit model of risk communication also stems from the rational risk approach pointing to a belief that the uncertainty people experience following a sociotechnical disaster is due to their lack of adequate rational and scientific knowledge on the subject. An understanding of this model, and the rational risk assessment model in general, helps with understanding why it is often the case that scientific experts explain people's concerns following sociotechnical disasters as "excessive, or unwarranted, or irrational" (Hansen et al., 2003: 111). Within the rational risk model,

²⁹ Also see Seager (1996) for a discussion on 'hysteria' and the gender dimension of environmental protest.

³⁰ This model is also referred to as the 'knowledge deficit model' (see Bidwell, 2016; Hansen et al., 2003).

risk communication becomes the strategy used to transfer ‘correct’ scientific understanding of the risks involved in sociotechnical disasters from ‘rational-minded and knowledgeable’ experts to an ‘irrational and ignorant’ public. As an example, one study on risk communication following TEPCO’s nuclear disaster went as far as to call the public’s risk perceptions “bipolar” (Orita et al., 2015), while another purports sales in *wakame* seaweed declined due to “irrational reputation damage” (Miyata & Wakamatsu, 2015). Additionally, studies within this rational risk paradigm have tried to explain the emergence of people’s concerns through connecting them to hazard characteristics assigned to specific risks—for example, explaining that nuclear disasters are usually related to characteristics of severity of possible health effects, low controllability and unfamiliarity (Slovic, 1987).

Rational risk assessment is deeply guided by modernist ontologies, including adherence to a nature/society divide, the authority of scientific rationality, and a belief in an autonomous liberal subjectivity. It is a perspective that not only removes humans from their embeddedness in a natural, messy, material environment—referred to as ‘human exemptionalism’ (Murdoch, 2001)—but completely removes the concept of the social construction of risk from the discussion. I follow Bell (2012: 233) in arguing that one of this perspective’s major blind spots is the way it ignores the “inherently social character of risk.” Rational-choice models are often applied to society, where people’s experiences such as *konran* can be explained away as the ‘lay public’s’ irrational misunderstanding of fact-based science—a method that completely disregards the knowledge people use to conduct their everyday lives (see Wynne, 1996). It leaves people experiencing *konran* trapped within an ontological framing that is unable to recognize their experiences as anything other than ‘irrational.’

While there are many good things to be said about the risk society thesis, there are also some aspects that must be challenged. The first pertains to language. Some have argued that the term ‘risk society’ does not encapsulate the current era, and that terms such as ‘hazard society’ or ‘self-jeopardy society’ (Sørensen & Christiansen, 2012: 14) may be more effective in grasping Beck’s (1995: 77) point that *new risks* are no longer “determinable, calculable uncertainties.” In addition, Fressoz (2007) warns of the danger of referring to the experiences of people in the risk society as being novel. In his article, Fressoz provides a genealogy of risk society where he points to the precarious

situations faced by people in the 19th century who were forced to negotiate and understand their new relationship with polluting technologies and their effluents. He makes the important observation that it was the activity of people voicing their concerns about technologies that led to the construction of much ‘safer technologies’ than what had previously existed. To Fressoz, the significance of these activities falls out of sight and out of historical imagining in the theorization of the risk society; he instead encourages the uncovering of richer historical accounts that include interactions among heterogeneous actors, human and more-than-human.

Other critics warn that Beck’s (1992) argument regarding the equalizing nature of risks—that people will be more interested in avoiding ‘bads’ over accumulating material ‘goods’—is dangerous in that it allows one to overlook the very real inequalities that exist in society (for example, Bell & Mayerfeld, 1998). Bell and Mayerfeld (1998: 2) also point out their concern with “the language of risk” and its power to thwart democratic processes. They point out that the word ‘risk’ itself is a concept used to discuss uncertainty through very rationalistic means and explain that such “rationalism is problematic because it can easily become rationalization. Risk explains uncertainty, and it also explains it away. It gives control and it takes control, and therefore we often feel trapped in an iron cage of risk” (Bell & Mayerfeld, 1998: 1). Instead of using risk as the center of a conceptual argument, the authors encourage scholars to continue problematizing it and continue engaging with it as “a tool and not a smoke screen [...] for dealing with the unknown” (Bell & Mayerfeld, 1998: 11). I agree with Bell and Mayerfeld that an uncritical use of the word ‘risk’ has the potential to cover up or ignore the everyday realities embedded within the sociotechnical material matrix mentioned by Fressoz (2007), of which *new risks*—in this case TEPCO’s radionuclides—become an additional actor. If misused, the word itself may become an abstract, universal blanket statement that could be easily borrowed by elites to deter democratic discussion—as may be the case when governing through rational risk assessments. In short, while the theory of risk society may point to a hope that the realization of *new risks* will inspire new ways of thinking, acting and political engagement, the language of risk may itself be a tool to impede democratic debate.

What options are there for getting out of the “iron cage of risk”? Boudia and Jas (2007: 4) recommend a “historization and a denaturalization of risk” as a way to understand

the concept as a tool and not a universal. According to Giddens, the concept of risk is an essential feature of capitalism. He explains how the term first came to be used in the 16th century by Portuguese or Spanish explorers “where it was used to refer to sailing into uncharted waters” (Giddens, 1999). Seafaring was also a space where insurance was used as a way to provide security for the sailors and their cargo. In this case, risk served as “a way of regulating the future, of normalising it and bringing it under our dominion” (Giddens, 1999). Giddens (1999) goes on to describe how this concept of stabilizing the future became an essential feature of modern capitalism which “embeds itself into the future by calculating future profit and loss, and therefore risk, as a continuous process.” I agree that understanding ‘risk’ as a historical tool for managing uncertainty—as opposed to the name describing the current epoch or a group of polluting materials—can open up different ways of thinking about the particular role the term plays in the aftermath of sociotechnical disasters. The same is true for other rational-risk-paradigm-related terms such as ‘safety’ or ‘control.’

Another major drawback to using the risk society thesis as a guiding framework for this thesis is its master narrative style of theorization. Latour (2003b: 40), whose own scholarship was greatly influenced by ethnomethodology and its focus on situated, empirical research, describes Beck “as an unreconstructed social theorist, roaming freely through the ‘whole’ of society without showing the least interest in the practical and local conditions making this ‘whole’ visible.” Therefore, while the risk society thesis offers many insights into how to conceptualize the aftermath of a nuclear disaster, its grand narrative style of explaining reality is expected to be of little help in understanding the situated, emergent qualities that make up the multiple experiences of *konran* that are the focus of this thesis.

In fact, Beck (1994: 9) himself questions the limits of thinking only through the concept of risk, explaining how “[s]omeone who depicts the world as risk will ultimately become incapable of action.” To release people from the confinement within the ‘iron cage of risk,’ he and others developed the theory of reflexive modernization to describe how *new risks* might “become the motor of the *self-politicization* of modernity in industrial society” (Beck, 1992: 183, original emphasis). The theory opens up the opportunity to trace emergent possibilities of sociotechnical disasters. That is, it is imbued with hope that the anxiety resulting from the awareness of *new risks* may be

transformed into a positive political movement where people work together to define and enact a better world—a task that will result in an “opening up [of] the political” (Beck, 1992: Chapter 8). In the next section, I will describe the theory of reflexive modernization and explore how it may be useful in understanding the *konran* experienced by my study’s participants.

2.3 Searching for signs of reflexive modernization

As with risk society, the theory of reflexive modernization is situated within larger debates on modernity that describes society’s transformation from a first (simple) modernity to a second (reflexive) modernity. The theory argues that we are not in modernity as it once was, nor has modernity ended completely.³¹ Instead, modernity is in transition: some aspects of it remain the same, while others disappear (see Beck & Lau, 2005). To Beck, first modernity is characterized as an industrial society, while second (reflexive) modernity is characterized as risk society. The risk society remains an industrial society, but one much different from classical industrialization of first modernity.³²

2.3.1 First modernity’s underlying premises

According to the theory, the historical period of first modernity dates back to the Enlightenment of the early 18th century whose ideological foundations are expected to have driven the uptake of industrialization in the 19th century. In a 2003 journal article, Beck and colleagues (2003) outline six ‘premises’³³ that characterize and provide the ontological, epistemological and structural foundations of first modernity.

³¹ See Beck and Lau (2005: 525-6) for a discussion of the authors’ dissatisfaction with the concept of post-modernity.

³² To express the transformation of modernity, Beck’s theory of reflexive modernization separates modernity into three periods of social change—pre-modernity, first (simple-linear) modernity, and second (reflexive) modernity—which are associated with the previously mentioned epochs—pre-modern society, early industrial society, and risk society (see Beck et al., 2003).

³³ The use of the word ‘premise’ points to the project of first modernity as a theoretical construct of 18th century Enlightenment, not a set of absolute truths. The authors define them as “foundations of [first modernity’s] self-description: the explicit or implicit assumptions expressed in the actions and self-understanding of citizens, the goals of politics and the routines of social institutions” (Beck et al., 2003: 4). The authors admit that six premises are an oversimplification, but are useful for discussion.

According to Beck and colleagues (2003), the premises of the Enlightenment are normalized into *basic principles*³⁴—its ontological and epistemological foundations—that guide people’s activities and provide the basis for institutional order in first modernity. The three premises behind these *basic principles* are: (1) a nature/society divide;³⁵ (2) the authority of scientific rationality and conceptualizations of progress (“*scientization*”);³⁶ and (3) the “*principle of functional differentiation*” (the use of classification, specialization and standardization to manage complexity)³⁷ (Beck et al., 2003: 4-5, original emphasis).

Similarly, *basic institutions* refer to the institutions created in first modernity that are designed to manage and organize society based on the basic principles (Beck & Lau, 2005). The premises that created the groundwork for the establishment of first modernity’s *basic institutions* include: (4) a “*nation-state*” society “defined by territorial boundaries;” (5) a society of “*programmatically individualization*” (that is, a society of atomized, individual liberal subjects);³⁸ and (6) a “*gainful employment*” society (or a full employment society for male members of society)³⁹ (Beck et al., 2003: 4, original emphasis).

³⁴ These *basic principles* as were later described as “cognitive–normative problems and minimum requirements of the ‘project of modernity’, which represent its ‘driving force’ and thereby keep its developmental dynamic going” (Beck & Lau, 2005: 532-3).

³⁵ Under the first premise, nature is considered a “neutral resource” to be exploited by humans and which “can and must be made available without limitation” (Beck et al., 2003: 4-5).

³⁶ The second premise puts an emphasis on human’s “instrumental control” over nature and belief that scientific progress as “a process of demystification that can continue without limits” where humans will eventually “perfect the control of nature” (Beck et al., 2003: 4-5).

³⁷ Under the third premise, specialization is encouraged and the complexity of reality is neatly organized into social subsystems (for example, politics, science, culture and economy) which create fractures in society’s understanding of the world (Beck et al., 2003: 4-5, original emphasis).

³⁸ Under the fifth premise, people are viewed as ‘individuals’ who are encouraged to be free, while simultaneously being bound to collective social structures (such as the nuclear family) similar to those in pre-modernity.

³⁹ The sixth premise points to one of the underlying promises of first modernity: that all (male) members of society could expect to participate in an economy with very low rates of unemployment in which “status, consumption and social security all flow from participation in the economy” (Beck et al., 2003: 4).

Beck's theory of reflexive modernization argues that while the basic principles of first modernity live on through second modernity, first modernity's basic institutions are forced to transform. This transformation of the basic institutions of first modernity is set off by complex, interwoven and destabilizing forces—including the forces of globalization.⁴⁰

2.3.2 *From self-confrontation to politicization*

To Beck (1994: 5-6, original emphasis), reflexive modernization is not so much a “self-reflection” as it is a “*self-confrontation*.” He argues that in an industrial society that cannot avoid producing *new risks*, people's awareness of these *new risks* will be unavoidable. *New risks*, therefore, play an important role in Beck's reflexive modernization: they awaken people to the incongruity of using modernist Enlightenment ontologies for understanding and dealing with the complex realities of the risk society.⁴¹ Food, in particular, plays a major role in pointing out the peculiarity of conceptualizing humans as being separate from nature. Pollutants enter not only environments, but human bodies, providing an embodied experience of the inseparability of nature and society.⁴² In short, Beck points out that regardless of how intensely institutions of modernity work toward normalizing and legitimizing the *basic principles* of first modernity, the growing societal awareness of the existence of new

⁴⁰ Beck and Lau (2005: 526, original emphasis) describe this process: “collective patterns of life, progress and controllability, full employment and exploitation of nature that were typical of this first modernity have now been undermined by certain interlinked processes: globalization, individualization, the gender revolution, underemployment and global risks (such as the ecological crisis, the crash of global financial markets and the threat of transnational terrorist attacks). The real theoretical and political challenge of second modernity is the fact that society must respond to all these challenges *simultaneously*.”

⁴¹ Both Beck and Giddens were exploring the concept of reflective modernization in the 1990s. While both theorists seemed to agree that reflexive modernization involves the ‘disembedding’ of people from traditional structures without a ‘reembedding,’ Beck does not view this as the only driving force behind the transformation to a reflexive modernity (see Beck, 1994; Beck & Beck-Gernsheim, 2002: xxi-ii). Instead he sees the public's awareness of *new risks* as propelling the transition to a more reflexive modernity.

⁴² In Beck's (1992: 81, original emphasis) words: “The industrially transformed ‘domestic nature’ of the cultural world must frankly be understood as an exemplary *non-environment*, as an *inner* environment, in the face of which all of our highly bred possibilities of distancing and excluding ourselves *fail*. At the end of the twentieth century nature *is* society and society is also ‘*nature*’. Anyone who continues to speak of nature as non-society is speaking in terms from a different century, which no longer capture our reality.”

globalized risks and their threats will remain a constant force injecting doubt into these efforts.

2.3.3 *Collective anxieties experienced individually*

According to Beck (1992: 183), people's awareness of *new risks* can provide an opportunity for the politicization of issues that were once considered non-political. Therefore, in a reflexive modernity, people are expected to be proactive, critically engaging democratically with questions of rationality, technology and science that define modernity (Beck, 1994). However, the transition to a reflexive modernity is not without its own internal contradictions: while people are embedded within relations of ruling that expect them to act individually, they in fact experience problems collectively (Beck & Beck-Gernsheim, 1995: 7; 2002: xxii).⁴³

2.3.4 *Sub-politics to destabilize modernist ontologies*

Finally, Beck's (1992: 135) concept of "sub-politics" seeks to offer a solution for people who want to create change "*from below*" (Beck, 1994: 22-3, original emphasis).⁴⁴ According to Beck (1994: 23) politicization of issues brought about by people's awareness of *new risks* starts to interfere with institutional processes, creating a space for new voices to enter democratic discussions about technology and science. While including more voices within political processes sounds promising, Beck (1994: 23) also points to the "back side of sub-political activation" which he describes as the eruption of conflict among many people and groups, resulting in a "relative paralysis." However, this very "congestion"—the "'instrument of power' in sub-politics"—is exactly what Beck (1994: 23) sees as necessary for reforming the rationalities and logic

⁴³ Beck and Beck-Gernsheim (2002: xxii, original emphasis) point out that there is an "institutionalized imbalance between the disembedded individual and global problems in a global risk society. The Western type of individualized society tells us *to seek biographical solutions to systemic contradictions*." In addition, the authors argue that people experience "pressure to conform to internalized demands, on the one hand being responsible for yourself and on the other being dependent on conditions which completely elude your grasp" (Beck and Beck-Gernsheim, 1995: 7).

⁴⁴ Beck (1994: 22-3, original emphasis) explains that *sub-politics* "means shaping society *from below*. [Sub-politicization] thus implies a decrease of the central rule approach; it means that processes which had heretofore always run friction-free fizzle out in the resistance of contradictory objectives."

that structure current institutional processes.⁴⁵ Thus, the very messiness of sub-political engagement should disrupt the activities of modern institutions.

2.3.5 *Reflexive modernization and konran*

The theory of reflexive modernization provides important insights for the ontological framing of debates about nuclear disasters, as well as for examining how premises of the modernist paradigm no longer adequately cope with complex experiences such as *konran* that emerge in the aftermath of a nuclear disaster. That is, modern ontologies and institutions are no longer able to account for the complex material and social realities brought to the forefront in the risk society. I appreciate the theory's focus on the processes of stabilization (through first modernity's premises), destabilization (due to the recognition of *new risks*) and an attempt at re-stabilization (both by first modernity's institutions and, as Beck hopes, through the political awakening of everyday people). In particular, the notion of food as a material participating in disrupting modernist principles—most notably the nature/society divide—provides a powerful insight for the overall narrative of this thesis.⁴⁶

Overall, reflexive modernization seems to provide a positive path forward for those who feel trapped within the risk society.⁴⁷ Not only has the theory been praised for its hopeful description of how people might collectively overcome the precarious existence faced in the risk society (see Blowers, 1999), but for turning our focus away from mainstream narratives “to the discrepancies, cracks, failures and side-effects” of the project of modernity (Latour, 2003b: 46). I agree with the praises of both Blowers and Latour while, like them, also being wary of some of the underlying assumptions of the theory.

⁴⁵ As Beck (1994: 23) puts it, “the very fizzling out of the implementation process of industrialization, which used to be so well lubricated by consensus, which now produces losers on all levels, can slow the process, and can be a precursor of an unregulated anarchic self-limitation and self-control. Perhaps ‘anything goes’ means ‘rien ne va plus’, nothing goes any more?”

⁴⁶ This will be discussed further in Section 2.6.

⁴⁷ That is, the insidious, imperceptible materials that imbue people with a sense of precariousness could play a positive role in triggering them to take political initiative to re-design society's institutions (Beck, 1994).

While the language of risk may impede democratic discussion, reflexive modernization seems to leave space for the hope that alternate ontologies might emerge. However, as with the risk society thesis, language has also been brought into question with the theory of reflexive modernization. In a paper discussing Beck's theory of reflexive modernization, Latour (2003b: 36) refuses to even use the word reflexive arguing:

‘reflexive’ does not signal an increase in mastery and consciousness, but only a heightened awareness that mastery is impossible and that control over actions is now seen as a complete modernist fiction. In second modernity, we become conscious that consciousness does not mean full control.

Latour (1993) is famous for arguing “we have never been modern,” pointing to how modern society's self-description as dominant and disentangled from ‘nature’ was, and remains, a fantasy never to be achieved. As a result, he prefers to use the term “re-modernization” in his argument. In a 2003 paper, Latour (2003b: 36, original emphasis) problematizes the meaning of the word ‘risk,’ arguing that it does not signal a novel form of hazard, but the realization that “we are now *entangled*.” Drawing on concepts and sensibilities from actor-network theory (discussed later in this chapter), Latour (2003b: 36, original emphasis) describes people's realization of their susceptibility to *new risks* as discovering:

a *network* [...] referring to whatever deviates from the straight path of reason and of control to trace a labyrinth, a maze of unexpected associations between heterogeneous elements, each of which acts as a mediator and no longer as a mere compliant intermediary.

Such thinking opens up opportunities to view the possible material presence of radionuclides in food not as an individual, isolated experience, but as linked to a complex network of diverse actors (human and more-than-human) and their relationality. Such realization does not come easily to members of a modern society built with the ultimate goals of disentangling humans from the grasp of complex uncertainty through the application of tools—such as risk assessments—which bring a sense of control over the future and over a perceived external ‘nature.’ Latour (2003b: 38, original emphasis) points out what he sees as the ultimate irony of modern thinking: “It is only if you are absolutely convinced that science and society do *not* mix that you

can mix them so thoroughly as to produce the mess in which we are stewing today.” He identifies first the atomic bomb and now climate change as most blatantly demonstrating this irony.

Both risk society and reflexive modernization highlight how attempts to stabilize uncertainty, for example through rational risk calculations, requires abstraction or externalization of certain elements considered to be irrelevant to the project at hand.⁴⁸ Latour (2003b: 37, original emphasis) points out that “second modernity is first modernity *plus* its externalities: everything that had been externalized as irrelevant or impossible to calculate is back in—with a vengeance.” That is, the perceived disentanglement of humans from their environment involves a great deal of ideological and calculative work that is undone in destabilizing events, such as a nuclear disaster. Therefore, while Beck’s *new risks* point to a symptom or side effect of modernity, Latour’s arguments opens up new ways for empirically illuminating and tracing the different relations that produce and manage the specific types of materials that Beck terms *new risks*.

Wynne’s (1996) research points to another concern with the theory of reflexive modernization: researchers using the theory expect a ‘concerned public’ to both identify and engage politically in order to overcome first-modernity’s premises and rebuild its failing institutions, while scholars themselves may not be reflecting on their own ontological grounding. According to Wynne (1996), research in reflexive modernization does not challenge, and in fact often reproduces, modernist premises.⁴⁹ He goes on to criticize the theory for being “unduly influenced by rational-choice models of the social” in expecting people to automatically and logically engage in the politics of reflexive modernization once they realize the existence of *new risks* (Wynne, 1996: 45). Wynne (1996) also argues that such thinking perpetuates the expert-lay knowledge divide, and tends to overlook the importance of non-expert knowledge in overcoming the troubles of the risk society. What’s more, while Beck (1994) speaks of

⁴⁸ See Callon (1998) for an interesting discussion on economic externalities and how “framing” projects work to contain “overflowing” heterogeneity.

⁴⁹ Wynne (1996: 44) argues that the thesis of reflexive modernization “implicitly reproduces just those fundamental dichotomies which are key parts of the problem of modernity: natural knowledge versus ‘social’ knowledge, nature versus society, expert versus lay knowledge.”

the potential for the politics of reflexive modernization to destabilize science's stronghold over many aspects of life in the risk society, Wynne (1996) argues that the theory does not explicitly recognize science itself as a social construction.⁵⁰ This leads to a situation in which locally situated, tacit knowledge becomes "systematically suppressed" (Wynne, 1996: 45).⁵¹ Wynne's (1992) empirical study on the experiences of Cumbrian sheep farmers following the Chernobyl nuclear disaster in 1986 demonstrated what happens when scientists are unreflexive in their views of knowledge and science: the situated knowledge sheep farmers had about raising sheep went ignored by scientific experts who unreflexively, and incorrectly, assumed they could control and predict the activity of radionuclides in the environment. His later work on genetically-modified organisms also points out that researchers need to understand that the alienation of those categorized as 'lay-people' and 'experts' is socially organized (Wynne, 2001). That is, researchers who do not reflexively engage with such questions may actually be enacting the very systems of power they critique in their own work.

Given Wynne's insights, I am inclined to argue that the reflexivity Beck and colleagues hope will be performed by an abstractly conceptualized 'society' or 'public' could also be usefully applied to researchers themselves. Surely questioning one's own ontological underpinnings should be a prerequisite for any researcher examining whether or not people actively entangled with toxic materials in their everyday lives have been able to break free of the ontological bindings of first modernity and creatively design society anew? I will go on to argue that institutional ethnography, one of my chosen methods of inquiry, is positioned to help researchers in trying to accomplish just this. In discussing the potential (and his critique) of institutional ethnography, Walby (2007: 1016) makes this point: "Reflexivity draws attention to the importance of researcher social location in interpreting participant accounts but also, more important, requires of us the examination of the ontological and epistemological assumptions of our frameworks for data analysis." Not only should researchers be more

⁵⁰ See Latour and Woolgar (1979) for a discussion on the social construction of science. Also see Law (2008: 634-5) for an insightful discussion on the difference between the concepts of 'social construction' and 'performativity.'

⁵¹ Wynne (1996: 45) explains: "alternative, more culturally rooted and legitimate forms of collective, public knowledge—and of corresponding public order—which could arise from the informal non-expert public domain are inadvertently but still systematically suppressed."

reflexive themselves, but if it is true that people in the risk society are experiencing problems collectively while being expected to act individually, could not researchers play a role in conducting research to support the people struggling to grapple with their embeddedness within complex hybrid entanglements?

As with the risk society thesis, another concern about the theory of reflexive modernization is its grand narrative style of theorization and lack of empirical grounding (Latour, 2003b). Such theorization sends researchers to look for traces of reflexive modernization, which may or may not be found, instead of being attuned to what else may be emerging beyond the confines of the theory. Howell (2012: 193) points out that while the risk society thesis may be useful in diagnosing problems that arise in socio-ecological disasters, he questions “the logic of reflexive modernization as a useful corrective, especially given the power disparities between anti-reflexive forces like government and utility institutions and the weaker ‘concerned public.’” Such a statement begs the question: if the theory of reflexive modernization overlooks power structures which enable and constrain activities of actors, can it really be considered the only possible way to overcome the problems resulting from a nuclear disaster? Such insights are similar to Wynne’s (1996: 46) concern that Beck’s “neglect of the cultural/hermeneutic character of modern knowledge, specifically of modern scientific knowledge itself, seriously constrains the imagination of new forms of order and of how their social legitimation may be better found.”

Ultimately, the theorization of reflexive modernization may not only ignore disparities in power relations, but its own embeddedness in modernist ways of thinking may prevent researchers from discovering different, emergent possibilities for overcoming problems of industrial pollution. I agree with Michael Bell (2011: 193) who explains the major drawback to grand narratives: “If you have all the answers, you don’t have all the questions.” Therefore, instead of asking whether or not reflexive modernization exists following TEPCO’s nuclear disaster, I instead turn to postmodern theories to see if they might assist in painting a more nuanced picture of my participants’ experiences of *konran* in a way that focuses less on structural-oriented questions of *what* is happening, and more on questions of *how*: How did my participants come to experience *konran*? And, how are these experiences managed within society’s complex power structures?

2.4 Governmentality, biopolitics and the social construction of reality

Postmodernism⁵² and poststructuralism grew out of debates about modernity dating back to the work of Frederich Nietzsche in the late 1800s (see Trifonas, 2004).

Postmodern theories question grand narratives and “the modernist belief in the possibility of describing the determinate rules and systems of reality” (Trifonas, 2004: 151). According to Donna Haraway (1991d: 140), unlike modernist theories which tend to offer rationalist, structural descriptions of reality, postmodern approaches view reality as “complex open fields of criss-crossing plays of domination, privilege, and difference.” That is, instead of society being structured by one master narrative, postmodern thinking recognizes heterogeneity and relationality, and works to uncover the complex ways in which power and knowledge structure social spaces to direct activity. Latour’s (2003b: 42) definition of postmodernism points to this form of organization: “Postmodernity has many definitions but it offers, at its core, a theory of the way time flows and how connections are established between heterogeneous phenomena.” When it comes to ‘risk,’ postmodernists have taken up the task of explaining not only how the concept of risk is socially constructed, but how the concept itself could be used to organize society (for example, Hardy & Maguire, 2015; Lim, 2012). In particular, the concepts of governmentality and biopolitics have been used to illustrate how awareness of ‘risks’ enter the political realm and are managed within society’s complex power structures.

2.4.1 *Managing heterogeneity through conducting conduct*

Governmentality is a concept developed by French philosopher Michel Foucault to describe a new type of government that first appeared in Western Europe in the sixteenth century (Dean, 1999: 209-10). The term can be defined generally as the ways in which “we think about governing others and ourselves in a wide variety of contexts” (Dean, 1999: 209). The notion helps to highlight how government, defined as the “conduct of conduct,” is accomplished (Foucault, 2007: 389). This definition of government generally refers to the deliberate direction of human behavior. More specifically, government can be defined as:

⁵² See Featherstone (2007) for a discussion on the many connotations of the term ‘postmodernism.’

any more or less calculated and rational activity, undertaken by a multiplicity of authorities and agencies, employing a variety of techniques and forms of knowledge, that seeks to shape conduct by working through our desires, aspirations, interests and beliefs, for definite but shifting ends and with a diverse set of relatively unpredictable consequences, effects and outcomes. (Dean, 1999: 11, emphasis removed)

According to this definition, people's conduct can be shaped by others or the self, and necessarily presupposes freedom to act by both the governing and the governed.

Foucault (2007: 108) himself defines governmentality as:

the ensemble formed by institutions, procedures, analyses and reflections, calculations, and tactics that allow the exercise of this very specific, albeit very complex, power that has the population as its target, political economy as its major form of knowledge, and apparatuses of security as its essential technical instrument.

This definition highlights some of the major characteristics that mark the “era of ‘governmentality’” (Foucault, 2006: 142). First, the object of the modern form of government is the ‘population,’ which is viewed as a resource “to be fostered, to be used and to be optimized” (Dean, 1999: 20). Optimizing the population involves taking into consideration the “health, welfare, prosperity and happiness” of members of society (Dean, 1999: 19). Successful government, therefore, implies ensuring a population's prosperity “through a particular register, that of the *economy*” (Dean, 1999: 19, original emphasis). Here Foucault points to the important role the economy plays in both organizing and providing for the wellbeing of the population, making unobstructed circulation of the economy a central feature of successful government. Foster et al. (2014: 233) point out how welfare narratives are used to target populations and “construct subjects who make effective workforces and consumers, while marginalising and excluding those who do not.” Thus, successful government involves providing (or at least providing narratives of) welfare for a population who will, then, be used as a resource for governments and institutions.

2.4.2 Conducting conduct through *dispositifs*

Another characteristic of governmentality is that it necessarily involves the establishment and maintenance of ‘apparatuses of security’ (or *dispositifs*) as a means of optimizing the welfare of a population (see Braun, 2014; Deleuze, 1992; Foucault, 2007). Foucault (1980: 194) describes what he means by the term *dispositif*:

What I’m trying to pick out with this term is, firstly, a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions—in short, the said as much as the unsaid. Such are the elements of the apparatus. The apparatus itself is the system of relations that can be established between these elements.

Dispositifs are not created anew, but deployed within the social milieu—the heterogeneous elements making up the social environment—as a way to direct activity. In fact, according to Foucault, *dispositifs* are historically specific formations that arise in “responding to an *urgent need*” (Foucault, 1980: 195, original emphasis). They are not planned, but an afterthought, strategically deployed as a reaction to events which may destabilize attempts of government. Explained by Foucault (2008: 260), within *dispositifs* “action is brought to bear on the rules of the game rather than the players.” Braun (2014: 51-2, original emphasis) also provides a convincing description of this phenomena:

apparatuses emerge in relation to a perceived problem; their elements have no common dimension other than the urgency to which they respond, and the network established between them. Thus, government not only exists as a shifting and uneven diagram of power [...]; it comes into being as a kind of afterthought. First and foremost *reactive* in the face of crises of various kinds, it seeks to take hold of relations of force that *already* exist, ‘manipulating’ and ‘intervening’ in them, ‘developing’ them in particular directions, ‘blocking’ them, ‘stabilizing’ them, and ‘utilizing’ them.

Gilles Deleuze (1992: 159, original emphasis) describes *dispositifs* not as a structured form of government where a single rationality guides ruling activity, but as “a tangle, a multilinear ensemble. It is composed of lines, each having a different nature. [...] Each line is broken and subject to *changes in direction*, bifurcating and forked, and subject to *drifting*.” While the complex tangles work to direct activity in some way, the agency of actors make exact prediction of outcomes difficult. It is, therefore, no surprise that *dispositifs* encompass “all the practices and institutions that ensure the optimal and proper functioning of the economic, vital and social processes that are found to exist within that population and would thus also include health, welfare and education systems” (Dean, 2010a: 29). In addition, because unobstructed circulation of the economy is a major goal of government, *dispositifs* are not often used for “establishing limits and frontiers, or fixing locations” but for “making possible, guaranteeing, and ensuring circulations: the circulation of people, merchandise, and air, etcetera” (Foucault, 2007: 29). In the era of governmentality, *dispositifs* can, thus, be understood as historically specific attempts to organize heterogeneous elements of the social milieu in ways that promote free circulation of the economy.

According to de Larrinaga and Doucet (2010: 100), the *dispositif* was a central concept used for “constituting the liberal order” in so far as it is organized by rationalities “to foster ‘good’ circulation by negating what are perceived to be its negative elements, and to do so within the context of a social order marked by freedom.” While many consider liberalism to represent a historical period, or the philosophical concepts describing a reality in which people are bestowed with freedom, liberty and inalienable rights, Foucault considers liberalism to be “more like an ethos of government” (Barry, Osborne, & Rose, 1996: 8). In other words, liberalism can be viewed as more of a practice, or a way of enacting reality rather than a philosophy. Within the era of governmentality “the market plays a privileged domain in testing the limits of government and the effects of its excesses” (Dean, 2010b: 41) where *dispositifs* “enable the circulations that define the personal and commercial ‘freedoms’ of liberal-democratic life” (Anderson, 2012: 34, original emphasis). Thus, liberalism could also be understood as a mentality or regime of practice used to protect against an over-powerful state.

2.4.3 *Biopolitics and biopower*

Ian Hacking (1990: 1) begins his book *The Taming of Chance* with an interesting observation: “The most decisive conceptual event of twentieth century physics has been the discovery that the world is not deterministic. [...] A space was cleared for chance.” From this insight, he points to a paradox he recognized within scientific disciplines: “the more indeterminism, the more control. [...] Quantum physics takes for granted that nature is at bottom irreducibly stochastic” (1990: 2). In the social realm he observed something similar: statistical data was being “developed for purposes of social control” which seemed to be based on “the notion that one can improve—control—a deviant subpopulation by enumeration and classification” (1990: 3-6). Hacking explains that through the process of taming populations, people were being “regarded as social atoms subject to social laws [which] turn out to be statistical in character” (1990: 15). What he is describing here is what Foucault has termed ‘biopolitics.’

Biopolitics, according to Foucault (2008: 317), is “the attempt, starting from the eighteenth century, to rationalize problems posed to governmental practice by phenomena characteristic of a set of living beings forming a population: health, hygiene, birthrate, life expectancy, race.” Thus, it involves the management of life and social relations within the social milieu. Foucault (2003: 245) also describes biopolitics as referring to:

control over relations between the human race, or human beings insofar as they are a species, insofar as they are living beings, and their environment, the milieu in which they live. This includes the direct effects of the geographical, climatic, or hydrographic environment: the problem, for instance, of swamps, and of epidemics linked to the existence of swamps throughout the first half of the nineteenth century. And also the problem of the environment to the extent that it is not a natural environment, that it has been created by the population and therefore has effects on that population.

In this definition, the social milieu is expanded to refer not only to humans, but all living things and their environments. Biopolitics, then, entails not only managing relations among humans, but the relations humans have with other living beings and with both the built and the biophysical environment.

Though the term biopolitics refers to administration over the lives and relations of political subjects, biopower (sometimes used interchangeably) tends to refer to the use of biopolitics and disciplinary techniques to master individual bodies (Mills, 2013: 85).⁵³ Foucault (2007: 1) describes biopower as:

the set of mechanisms through which the basic biological features of the human species became the object of a political strategy, of a general strategy of power, or, in other words, how, starting from the eighteenth century, modern western societies took on board the fundamental biological fact that human beings are a species.

Biopower, then, is a “new regime of power” (Mills, 2013: 86) which uses the technique of “normalization” (Foucault, 2007: 63) to manage and optimize human bodies through discipline and self-discipline.⁵⁴ With this understanding, biopolitics might be understood as the artful application of biopower to administer life.

2.4.4 *The role of statistics and norms to manage a population*

What is meant by ‘the technique of normalization’? Turning back to Hacking (1990: 5), we hear a story about how “the world itself became numerical” which in turn led to the uptake and subsequent hegemony of positivist science and the “imperialism of probabilities.” Statistics became a tool not only to explain the tendencies of a ‘human

⁵³ Prior to his work on governmentality, Foucault focused his attention on two other forms of power which remain relevant within modern governmentality: *sovereign power* and *disciplinary power*. First, *sovereign power* is “characterized as theory and practice of royal administrative rule beginning with the actuality of feudal monarchy, as an element in the contests over the limits and strength of royal power, and as later providing an alternative model of parliamentary democracy;” its “characteristic mechanisms are constitutions, laws and parliaments” and it is “exercised through the juridical and executive arms of the state. It is exercised over subjects” (Dean, 2010a: 29). Discipline, on the other hand, “concerns the exercise of power over and through the individual, the body and its forces and capacities, and the composition of aggregates of human individuals (school classes, armies, etc.). The expansion and intensification of regimes of discipline in the seventeenth and eighteenth centuries, in schools, hospitals, workhouses, manufactories, armies and so on, is roughly correlative with the development of the bureaucratic and the administrative apparatus of the state” (Dean, 2010a: 29).

⁵⁴ Put another way, while discipline and self-discipline can be seen as forms of power used to create an efficient workforce, biopower is used to maintain a workforce, or at least a large percentage of the workforce, that is healthy (enough) to work productively and maintain the smooth circulation of the economy (see Foucault, 2003: 239-64).

population,' but the probability of future happenings, both enjoyable and terrifying. Hacking (1990: 4-5) describes how probabilities are used to explain “chances of meltdowns, cancers, muggings, earthquakes, nuclear winters, AIDS, global greenhouses, what next? There is nothing to fear (it may seem) but the probabilities themselves.” He goes on to detail that “the professional lust for precision and measurement” not only made the standardization of industrial processes possible, but created the concept of “a norm” or standard (Hacking, 1990: 5).⁵⁵ Eventually, in the ways that average work day, lunch break, salary, or pocket size were used as norms to standardize factory work, norms for living and conducting one’s life were used to describe, optimize and manage the lives of people in a population.

It is important to reemphasize that having a population as the target of government is a central aspect of the project of biopolitics: it involves the governing of a population of living people whose idiosyncrasies and heterogeneity is represented statistically through objective, often numerical, values. Dean (1999: 107) describes how what we have come to know as ‘a population’ was a social construction developed over time through statistics, epidemiological studies, and the systematic collection of demographic and census data. That is, the ‘population’ of a state is made knowable to ruling elites through abstract descriptions based on objectifying statistical data. Essentially, almost any aspects of the social milieu could be the object of government manipulation; statistics and probabilities are essential to the task of creating, optimizing and attempting to stabilize the future and the entities of the social milieu (Dean, 1999: 99).⁵⁶

It is also important to understand that while probability statistics are used to optimize wellbeing, they can never guarantee it. Instead, optimization will always result in there being some winners and some losers, some healthy and some suffering (see Foucault, 2007; 2008). That is, the use of statistical norms in biopolitics bestows ruling elites

⁵⁵ See Busch (2011) for more on standards.

⁵⁶ Dean (1999: 99) describes how biopolitics concerns, “the social, cultural, environmental, economic and geographic conditions under which humans live, procreate, become ill, maintain health or become healthy, and die. From this perspective bio-politics is concerned with the family, with housing, living and working conditions, with what we call ‘lifestyle’, with public health issues, patterns of migration, levels of economic growth and the standards of living. It is also concerned with the bio-sphere in which humans dwell.”

with “a power to *foster* life or *disallow* it to the point of death” (Foucault, 1978: 138, original emphasis).⁵⁷ What is ‘normal’ for a population becomes ‘normal’ for its members. But what is one to do if they do not want to follow the norm?

Foucault (2007: 202) describes people’s freedom to conduct themselves in ways different from government through engaging in “counter-conducts.” That is, people may act in ways to strive for a “different form of conduct” or to be “conducted differently” (Foucault, 2007: 194).⁵⁸ While acting through counter-conducts may be useful in opposing disciplinary power, trying to subvert biopower’s administration may be much more challenging given its reach into the most intimate and mundane aspects of life.

Foucault (2007: 63) explains that both biopolitics and *dispositifs* are essential for setting norms.⁵⁹ Experts also play a key role as actors who shape how people should conduct their everyday lives and maintain their health in line with the calculated norm. Rose (1999: 74-5) elucidates:

it is experts—first doctors but later a host of others—who can specify ways of conducting one’s private affairs that are desirable, not because they are required by a moral code dictated by God or the Prince, but because they are rational and true. [...] The notion of normality, the invention of the norm, is the linchpin of this mechanism.

⁵⁷ Foucault (2007: 62) also describes the process of how “normal” death rates are established: “It takes all who are sick and all who are not as a whole, that is to say, in short, the population, and it identifies the coefficient of probable morbidity, or probable mortality, in this population, that is to say the normal expectation in the population of being affected by the disease and death linked to the disease.”

⁵⁸ As Dean (2010a: 21) explains, this type of protest fundamentally differs from “revolts against state sovereignty and economic exploitation however much they are at work in them” and instead include “[c]oncerns like opposition to war or the eating of animal products [that] are aligned with counter-conducts of conscientious objection and vegetarianism.”

⁵⁹ In Foucault’s (2007: 63) words: “plotting of the normal and the abnormal, of different curves of normality, and the operation of normalization consists in establishing an interplay between these different distributions of normality and [in] acting to bring the most unfavorable into line with the most favorable.”

Thus, scientist and expert derived ‘truths’ play a critical political role in government. ‘Rational’—and thus ‘truthful’ and ‘trustworthy’—expert-calculated statistical norms about human health and behavior are distributed to members of the population in a way that delineates the difference between what, and who, is normal or abnormal.

2.4.5 *Neoliberalism and the prospects of uncertainty*

To reiterate, governmentality is a “historically specific version” of governing (Dean, 1999: 16) which “focuses on the rationality of rule, not in terms of a transcendental reason but in those of specific forms of reasoning around which the exercise of power is articulated” (Pellizzoni & Ylonen, 2012: 50). For government directed by liberal forms of rationality, its object is the liberal subject—a subjectivity often referred to as *homo economicus* based on the assumption that people are calculative, rational and economically-minded beings.⁶⁰ These liberal subjects are considered to be free to act within the economic sphere, and their “rationality and responsibility entails a future neither totally fixed nor totally random” (Pellizzoni & Ylonen, 2012: 51). Similar to the observations of Hacking (1990), Pellizzoni and Ylonen (2012: 51) describe the interplay between calculable and non-calculable phenomena in a liberal society: while calculations of risk and probability were essential tools to help liberal subjects plan their activities, uncertainty (or the incalculable) freed subjects from a life of determinacy.

Neoliberalism is the term used to describe the historically specific form of government rationality that has been on the rise in some societies since the 1980s.⁶¹ It has been described as a “social ontology and epistemology” (Winnubst, 2012: 83) or the now

⁶⁰ See Read (2009) for a discussion of the term *homo economicus*. Also see Brown (2015), especially Chapter 3.

⁶¹ The term neoliberalism is critiqued in the literature as being “omnipresent” and “promiscuous” (J. Clarke, 2008: 135) and for being abused by scholars who employ it as used as “contextual wallpaper” (Venugopal, 2015: 169) or a “constant master category that can be used both to understand and to explain all manner of political programs across a wide variety of settings” (N. Rose, O'Malley, & Valverde, 2006: 97). Also see Ferguson (2010) and Venugopal (2015) for a discussion of the different uses of the term. While I agree with many of these critiques, in this section I am merely trying to explain how the term fits into the conceptualization of governmentality and how other scholars may be using it to understand current forms of government.

“commonsense way many of us interpret, live in, and understand the world” (Harvey, 2007: 23). Lemke (2001: 203) defines neoliberalism as:

a political rationality that tries to render the social domain economic and to link a reduction in (welfare) state services and security systems to the increasing call for ‘personal responsibility’ and ‘self-care’.

Differing from liberal subjects who were slowly molded and conducted over time through government manipulation of the social milieu, the neoliberal *homo economicus* has been described by Foucault (2008: 270) as someone who “accepts reality or who responds systematically to modifications in the variables in the environment” and therefore “appears precisely as someone manageable, someone who responds systematically to systematic modifications artificially introduced into the environment.”

Similar to Beck’s (1994; 1999) observation of the decline of the welfare state and the rise of individualization,⁶² neoliberalism describes an era where collective forms of welfare slip away. As economic rationality expands from markets to permeate all aspects of life, responsibility for managing risk transfers from the state to neoliberal subjects.⁶³ Under the rationality of neoliberalism, instead of the government being responsible for protecting the public from risks through welfare and insurance, “[r]isk-centered arrangements are merely tools for governing the incidental and collateral harms (such as industrial accidents, consumer injuries or exposure to crime) generated by the *core* enterprising activities” (O’Malley, 2004: 5, original emphasis). At the same time, uncertainty becomes opportunity or, in O’Malley’s (2004: 4-5) terms, “the technique of entrepreneurial creativity [...] the fluid art of the possible.” While Beck

⁶² Beck (1994: 14) describes ‘individualization’ as “a compulsion, but a compulsion for the manufacture, self-design and self-staging of not just one’s own biography but also its commitments and networks as preferences and life phases change, but, of course, under the overall conditions and models of the welfare state, such as the educational system (acquiring certificates), the labour market, labour and social law, the housing market and so on. Even the traditions of marriage and family are becoming dependent on decision-making, and with all their contradictions must be experienced as personal risks.”

⁶³ Pellizzoni and Ylonen (2012: 51) explain how under neoliberal rationalities “government operates more on interests, desires, and aspirations than through rights and obligations. [...] People are oriented in an increasingly indirect and pervasive way towards their self-fulfillment or enhancement.”

(1992) sees risk and uncertainty as a destabilizing force, he does observe that attending to secondary side effects can be potentially more profitable than attending to primary sources of pollution. This observation fits well with O'Malley's description of how neoliberal governance turns uncertainty into something positive: the prospect of accumulating capital in unexpected ways.

2.4.6 Governmentality, biopolitics and *konran*

This idea of governmentality is very useful, and points to the ways in which government is currently performed and can help in understanding how the consequences of a nuclear disaster, including emergent experiences of *konran*, are managed within the social milieu. Though the concept's theoretical roots are based upon European experiences, it has also been successfully used in a Japanese context to explore the governing of food security (Barclay & Epstein, 2013), food reforms (Kimura, 2011), the phenomenon of *karoshi* (death from overwork) (Y. Shibata, 2012), and government planning strategies (K. Shibata, 2008), to name a few. Of particular interest is Mori's (2008) use of biopower to describe the aftermath of a historical case of extreme environmental pollution in Yokkaichi City beginning in the 1950s. In that paper, Mori describes how the onset of a number of environmental pollution cases signaled a change in how the Japanese government conducted biopolitics: transitioning from a more historical focus on managing hygiene (*eisei*)—a problem that needed to be addressed in early industrial times—to managing the environment (*kankyo*) which became officially recognized as a major source of disease in the 1960s.

When it comes to nuclear disasters, some scholars have used the concept of biopower to understand the governing and suffering of victims exposed to radiation (for example, Petryna, 2002; Piotukh, 2015). In her book on the aftermath of the Chernobyl nuclear disaster, Petryna (2002) provides a noteworthy ethnographic account of the diverse ways biopower was disseminated to manage the lives and livelihoods of people, or as the title of her book terms “biological citizens,” exposed to radioactive pollution. In her depiction, she reveals the multilayered ways biopolitics and neoliberal forms of governmentality are at work: not only do people suffer from exposure to radiation, but industries providing service to the unwell are able to profit off the disaster, while people able to gain access to government support could possibly gain some financial security (though proving one's exposure is not always easy). Petryna's description

paints a picture in which it is not always the actual radioactive contamination and exposure to radionuclides that matters, but how these issues are negotiated among human actors within the social milieu that counts.

Following TEPCO's nuclear disaster, there have been a number of scholars examining the role of neoliberal rationality in post-disaster governing (for example, Kimura, 2016a; Nadesan, 2013). The concept of biopolitics has also been used by those trying to connect the suffering of people exposed to radionuclides to greater social organization. Davis and Hayes-Conroy (2017) provide a particularly useful analysis that offers an empirical investigation into the disjuncture between government policies and people's actual experiences and needs following TEPCO's nuclear disaster. The authors combine Steinberg and Peters' (2015) concept of "wet ontologies"—highlighting the biophysical presence of unstable and fluid-moving radionuclides as being part of the social milieu—with the concepts of governmentality and biopolitics to explore post-disaster governing in contaminated spaces. Through an empirical inquiry into the experiences of people living in Fukushima Prefecture, the authors trace the *dispositifs* deployed after the disaster to organize the social milieu in ways which reestablish government control and promote smooth circulation of the economy. The neoliberal-rationality-infused *dispositifs* create a situation where risks are individualized and people's concerns about future consequences to health and reproduction "are often pitted against economic concerns" (Davis & Hayes-Conroy, 2017: 16). Reemphasizing points made by both Kimura (2016a) and Slater et al. (2014), the authors highlight the very gendered dimension to the aftermath of the disaster: "Through state policies and masculine imperatives that focus on economic factors, the concerns of women and others who would like to advocate for a more extensive clean-up are ignored, constrained, and even pathologized as hysteria" (Davis & Hayes-Conroy, 2017: 18). Thus, people become trapped within post-disaster *dispositifs* where it becomes easier, and more profitable, to follow mainstream forms of adaptation in line with neoliberal economic logic than it is to challenge these forces (see Grove, 2014: 252).

Davis and Hayes-Conroy's (2017: 17-8, original emphasis) analysis additionally uncovers "an acceptable 'bandwidth' of tolerable⁶⁴ suffering" describing how "the suffering of individuals is an *expected* consequence of modern governance, not an anomaly." The suffering of victims of environmental pollution has also been a major focus of Japanese environmental sociologists (Funabashi, 2006; Iijima, 1992). Similar to Beck and Lau's (2005) description of anti-reflexive forces that sweep in to maintain modern institutions,⁶⁵ *dispositifs* deployed after TEPCO's nuclear disaster try to conduct government subjects in a way to keep the status quo moving forward, regardless of the presence of TEPCO's radionuclides in the social milieu. Given the results of their analysis, Davis and Hayes-Conroy (2017: 18) conclude by arguing: "contemporary forms of governance are ill-equipped to handle the consequences of an accident without sacrificing people, families, and communities."

The concepts of governmentality and biopolitics are useful in their ability to describe the interplay between government and its subjects, illustrating how government works to stabilize post-disaster social milieu and how government subjects position themselves and navigate within these often complex *dispositifs* of knowledge and power. Such an analysis might depict the experience of *konran* as stemming from an incompatibility of rationalities and experiences as the logic of post-disaster *dispositifs* may not match the logics people have been using to conduct their lives until that point. Thinking with governmentality could also help in analyzing the government's increasing of the allowable limit of radionuclides in food as a *dispositif* for managing the social milieu. It would present a story of how the government sets the rules of the game and how people negotiate, and sometimes disrupt government attempts, within the social milieu. But would this be enough to critically study the experiences of *konran* I heard from my study's participants? Or would such an analysis confine my

⁶⁴ In *Risk Society*, Beck (1992: 19) also ponders the concept of 'tolerable' limits to the side effects of *new risks*: "Where [new risks] do finally see the light of day in the shape of 'latent side effects', how can they be limited and distributed away so that they neither hamper the modernization process nor exceed the limits of that which is 'tolerable'—ecologically, medically, psychologically and socially?"

⁶⁵ According to Beck and Lau (2005: 532-33), the transition to a reflexive modernity does not come without resistance: "the basic principles of modernity do not lose any of their normative validity; on the contrary, their claim to validity becomes greater in the course of reflexive modernization."

participants and their experiences within a conceptualization of the social milieu unable to grapple with the materiality of TEPCO's radionuclides?

In his paper problematizing the use of the term 'neoliberalism,' Ferguson (2010) writes:

In thinking about the rapidly expanding literature on neoliberalism, I am struck by how much of the critical scholarship on [the] topic arrives in the end at the very same conclusion—a conclusion that might be expressed in its simplest form as: “neoliberalism is bad for poor and working people, therefore we must oppose it.” It is not that I disagree with this conclusion. On the contrary. But I sometimes wonder why I should bother to read one after another extended scholarly analysis only to reach, again and again, such an unsurprising conclusion.

I would add that much of the literature on biopolitics leaves me with a similar feeling, possibly expressed as: 'though people have some agency, they are ultimately trapped within the government-managed social milieu which will determine their fate; this is unfortunate.' I find myself in agreement with sociologist and feminist scholar Dorothy E. Smith (1999: 98) who praises postmodern theories for challenging sociology's tradition of grand narrative theorization—something Beck himself is guilty of—while also questioning the ways in which their analysis confines research subjects “to a phenomenal world in which nothing ever happens.” She explains: “post-structuralism/postmodernism transfers the function of the subject to language or discourse, reinforcing the traditional separation of the bases of consciousness from the local historical activities of people's everyday lives. Once this step has been taken, the inquirer cannot find her way back to a world in which people are active and in which we are constantly bringing what we do into relation to others” (D. E. Smith, 1999: 98).⁶⁶ Smith designed institutional ethnography as a way out of this predicament.

⁶⁶ Law (2004: 163) also describes how poststructural approaches tend to limit the agency of subjects: “particular enacted versions of reality set limits to what they are able to know or create. Terms such as ‘discourse,’ ‘deferral’ or ‘episteme’ point to such limits.” See Campbell (2003) for more on Smith's critique of postmodern theories.

In a paper comparing institutional ethnography and governmentality, Katherine Teghtsoonian (2015) explains that while both approaches are used to uncover ruling relations of people's everyday lives, they have very different ways of engaging with the research setting. That is, institutional ethnography has very practical, process-oriented, performative and pragmatist⁶⁷ orientation based on a strong commitment to social justice where researchers play a role in creating "knowledge for action" (Teghtsoonian, 2015: 10). Therefore, unlike in the theory of reflexive modernization where everyday people are expected rebuild modern institutions, in institutional ethnography research is conducted with the goal of helping people understand their own embeddedness within ruling relations. That is, research is designed from participants' own experiences and any results are given back to them so that they can understand more about how their everyday lives are being organized—information which may help them in "making change from below" (D. E. Smith, 2007). The goal of an institutional ethnographer is to identify "how power is inserted into (enacted in, actually) the experiential setting, often in silent and mysterious ways" (M. L. Campbell, 2003: 13). The focus, then, is not only on discourse, but on everyday practice.⁶⁸ Instead, she advocates for an empirical inquiry into everyday practice where she was able to discover something different: a 'logic of care' being enacted by people in local settings. Scholarship using the governmentality approach, Teghtsoonian goes on to argue, does not tend to have the same commitment to social justice as institutional ethnography, nor does it focus much on practices of resistance.⁶⁹

Latour (2003b: 44) points out that, like the theories of risk society and reflexive modernization, postmodernism is "above all a different way of recording the succession

⁶⁷ See Seigfried (1996) for a discussion of pragmatism and the pragmatist nature of institutional ethnography.

⁶⁸ A similar critique of governmentality comes from Annemarie Mol (2008b) who sees the limits of focusing one's analysis on describing 'patient choice' as a product of neoliberal discourse.

⁶⁹ Teghtsoonian (2015: 114) explains: "precisely because the analysis highlights the discursive practices through which extra-local interests and goals subordinate those of individuals in local sites, it arguably results in a depiction of ruling as secure, solidified and effective, rather than vulnerable. This may make it more difficult for the researcher to convey a sense that real possibilities for change exist [...] with the unintended effect of reinforcing the durability of things-as-they-are, rather than opening them up for change as institutional ethnography intends."

of epochs.” With this in mind, both he and the sociologist John Law question whether or not postmodern approaches have actually freed themselves from the constraint of modernist ontologies. Law (2008: 636) explains:

for all his radicalism, Foucault proposed that the modern episteme started spreading through and organising practices, realities and knowledges in the eighteenth century, and that we are still utterly in its productive grip. [...] Foucault is telling us that we’re all playing from more or less the same modern score. So the standard answer is that heterotopic spaces are far distant.

Heterotopic spaces refer to those places in the margins, where hegemonic forms of ordering are absent.⁷⁰ While Foucault argues that heterotopic spaces tend to be marginalized or distant from the rest of society, Law (2008) points out how the work of scholars following a material-semiotic approach, explored in more detail later in this chapter, dispute such a claim as the approach attunes researchers to see heterotopic spaces as existing in the everyday.

Given that this thesis aspires to study experiences of post-nuclear disaster *konran* as emergent, the governmentality approach and its tendency to confine research subjects does not seem fit for purpose. However, it appears that the work of unshackling the subjects, and scholars, of governmentality from the grips of modernist ontologies might be accomplished by revising the concept of the social milieu. Davis and Hayes-Conroy (2017) took an important move in this direction by incorporating radionuclides into the social milieu through the concept of ‘wet ontologies.’ This may also be accomplished by taking Foucault’s (1984: 50) own advice in calling for a “critical ontology of ourselves.” That is, scholars must examine their own ontological groundings in order to

⁷⁰ The concept was developed by Foucault—translated by Miskowiec—(1986: 25) who refers to both “heterotopias of crisis” and “heterotopias of deviations.” ‘Heterotopias of crisis’ refer to “privileged or sacred or forbidden places, reserved for individuals who are, in relation to society and to the human environment in which they live, in a state of crisis: adolescents, menstruating women, pregnant women, the elderly, etc.” He argues that, in modern societies, the crisis forms are being replaced by ‘heterotopias of deviation,’ defined as spaces “in which individuals whose behavior is deviant in relation to the required mean or norm are placed [such as] rest homes and psychiatric hospitals, and of course prisons” (Foucault & Miskowiec, 1986: 24-5).

prevent replicating the social constructs they critique. In the next section I will describe some useful ontological discussions that can aid in disrupting common ways of performing scholarship, a process which may open up the possibility of thinking differently about social organization and the complex experiences of *konran* at focus in this thesis.

2.5 Ontological politics

Feminist and science studies scholar and philosopher Annemarie Mol (2002: 183) ends the sub-text of her book *The Body Multiple* with an intriguing quote from Foucault (1984: 50):

The critical ontology of ourselves has to be considered not, certainly, as a theory, a doctrine, nor even as a permanent body of knowledge that is accumulating; it has to be conceived as an attitude, an ethos, a philosophical life in which the critique of what we are is at one and the same the historical analysis of the limits that are imposed on us and an experiment with the possibility of going beyond them.

Foucault's call for a 'critical ontology of ourselves' sparked my attention. What were these 'limits that are imposed upon us' and what were the ways of experimenting 'with the possibility of going beyond them'? Mol's (2002) clever engagement with the literature helped to clarify this. Though she ended her book with a quote from Foucault, throughout the sub-text she explains her reason for borrowing from, but ultimately abandoning him. She tells us how Foucault helped her to understand 'medicine' as not only an encounter between a patient and a doctor, but as a social construct. That is, Foucault taught her how to explore 'medicine' as an enactment of myriad social processes, and to view it as a form of knowledge and practice which takes on material form as a discourse capable of organizing society. Her abandonment of Foucault comes in her search for ways of understanding the complex multiplicity of experiences wrapped up in the disease termed 'atherosclerosis.' Describing her study as "empirical philosophy," Mol (2002: vii-1) argues that choosing to focus on "enactment rather than knowledge has an important effect: what we think of as a single object may appear to be more than one." Mol (2002: viii, original emphasis) makes clear that the purpose of her book is not to place judgement on medicine, but to open up what we have come to know as 'medicine' by contributing to the theorization of its "*ontological politics*"

which, in the case of medicine, refers to “a politics that has to do with the way in which problems are framed, bodies are shaped, and lives are pushed and pulled into one shape or another.” She describes the concept in more detail:

Ontological politics is a composite term. It talks of *ontology*—which in standard philosophical parlance defines what belongs to the real, the conditions of possibility we live with. If the term 'ontology' is combined with that of 'politics' then this suggests that the conditions of possibility are not given. That reality does not precede the mundane practices in which we interact with it, but is rather shaped within these practices. So the term *politics* works to underline this active mode, this process of shaping, and the fact that its character is both open and contested. (Mol, 1999: 74-5, original emphasis)

Mol (2002: 182, original emphasis) discusses how her act of studying ontology through a localized empirical study went against the normal philosophical theories which are traditionally “*universal*: valid everywhere—and rooted nowhere in particular [...] What was right in theory was supposed to be transportable anywhere—so easily that no attention was paid to what it might mean to transport ‘rightness.’” Empirical investigations destabilize such notions of wholesale universality.⁷¹

Mol’s call for empirical inquiry is reminiscent of Marx and Engels’ (Marx & Engels, 1998: 36-7) argument for beginning sociological inquiries empirically through focusing on people’s everyday activities. In *The German Ideology* they write:

The premises from which we begin are not arbitrary ones, not dogmas, but real premises from which abstraction can only be made in the imagination. They are the real individuals, their activity and the material conditions of their life, both those which they find already existing and those produced by their activity. These premises can thus be verified in a purely empirical way.

Marx and Engels’ distinction between people’s everyday activities and the ideologies extracted from them and used to categorize and explain these experiences was also one

⁷¹ See Law (2015) and Tsing (2005) for critical discussions of universals.

of the inspirations⁷² that led Dorothy E. Smith (1987; 1990a; 1990b; 1999) to design institutional ethnography as a method of inquiry that strives to avoid the objectification⁷³ of people's lived experiences. To overcome what she has termed "the dominance of theory," Smith proposes an "ontology of the social" based on the premise that all knowledge in society is socially organized, and argues that an understanding of this organization can only be grasped through empirical investigations into people's everyday experiences (D. E. Smith, 2005: 49-52). Instead of subscribing to grand narratives where 'facts' are gathered and fit into pre-formed categories, Smith recommends researchers instead follow a "botanizing ideology" where scholars first go to local settings and see what is happening; there they may find specimens of interest (in material, not ideological form) which can be brought back with them to be analyzed (see Eastwood, 2005: 59-61).

In line with Mol's concept of ontological politics, speculative feminist, speculative fabulator, humusities scholar and compostist⁷⁴ Donna Haraway (2014) relays a lesson she learned from Marilyn Strathern and others concerning the importance of reflecting upon, playing with and disrupting one's own ontological stance.⁷⁵ She shares:

that it matters what stories tell stories, it matters what thoughts think thoughts, it matters what worlds world worlds. That we need to take seriously the acquisition of that kind of skill, emotional, intellectual, material skill, to destabilize our own stories, to retell them with other stories, and vice versa. A kind of serious denormalization of that

⁷² Smith (1990b: 36) notes both the benefits and limits to Marx's work: "His theory [...] fails to embrace patriarchal forms of oppression. Nonetheless, his ontology offers us a radical break with the types of social and sociological theory that begin with assumptions about human nature assigning agency, reason, creativity, and the recognition of rights to men and subordination, passivity, and a being ruled by body and feeling to women."

⁷³ Mueller (1995: 100) explains this process of objectification by researchers as 'transposition'—specifically, she refers to the process of "transposing the actualities of people's living into policy categories which activate further bureaucratic procedures." Eastwood (2005: 55) describes this as "a process through which the actual experiences of identifiable individuals are rendered invisible for their particularities, yet sociologically visible in the form of categories, facts, or statistics." Also see Kristeva (1986: 111) for a discussion on transposition, intertextuality, multiplicity and plurality—referred to as "semiotic polyvalence."

⁷⁴ These are all Haraway's neologisms. See Haraway (2016: 31-2; 2017: M45).

⁷⁵ Also see Haraway (2016: 35).

which is normally held still, in order to do that which one thinks one is doing. It matters to destabilize worlds of thinking with other worlds of thinking.

Similar to Mol, Haraway (1991a; 2006) argues that reality is not singular: multiple and messy realities are enacted by human and more-than-humans alike. The difference is that some realities are esteemed more highly and given more prominence than others.

For many years, feminist scholars have been criticizing academics who do not reflect on their own standpoint and positionality in the field and, as a result, end up reproducing the power structures they set out to critique (Harding, 1986; H. Rose, 1983; D. E. Smith, 1992; 1997). Even scholars in the critical field of social studies of science and technology (STS)—where it is acknowledged that science “is just politics by other means” (Latour, 1988: 229)—have been accused of unreflexively ignoring their own political position in the research process (Haraway, 1992). Hilary Rose (1996: 72) describes the difficulty some scholars find in seeing the inequalities in social relations as “quite an achievement.” That is, learning to ignore such structures of inequality is a form of ideological work that has been accomplished through practice over time.

As Haraway’s abovementioned quote illustrates, recognizing one’s political position and ideological strongholds requires ontological destabilization. Through her work, Haraway (1991b; 2008) poses questions on the ethics of research and human and more-than-human relations, proposing categories, such as ‘companion species’ or ‘cyborgs,’⁷⁶ to help in thinking through incoherent, hybrid⁷⁷ relations and realities. Such hybrid thinking exposes entanglements among and within a multitude of human and more-than-human actors, and allows us to see interconnectivity and incoherence usually obscured by dominant, simplified ways of seeing.

⁷⁶ Haraway (1991a: 149) describes a cyborg as “a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction.” The cyborg provides a metaphor for thinking of the hybrid nature of reality and relations; disparate realities come together in practice and are all performed simultaneously in enacting the cyborg.

⁷⁷ See Latour (1993) for discussions of hybrids in the context of actor-network theory.

Another scholar interested in disrupting ontological strongholds is anthropologist Anna Lowenhaupt Tsing. However, instead of using the term ‘ontology,’ Tsing (2015: 21) refers to the process of “world making.” Tsing (2015) puts the concept of ‘world making’ to use in her book *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*, where she conducts ethnographic research to examine global commodity chains—and the heterotopic, self-organized spaces within them—from the perspective of the *matsutake* mushroom. She explains that world making may share with alternative ontologies an interest in “interrupting common sense [...and revealing] that other words are possible” (Tsing, 2015: 292, n7).

The concept focuses scholars away from universal grand narratives, to everyday activities and encounters. Whereas many ontological debates focus on how humans conceive of the rest of the (non-human) world, ‘world making’ points to the idea that nonhumans also have their own ontologies. Additionally, Tsing (2015: 292, n7) points out how “world-making projects overlap. [...] While most scholars use ontology to segregate perspectives, one at a time, thinking through world making allows layering and historically consequential friction.” *Friction* is the title of Tsing’s 2005 book where she uses the concept as a metaphor for exploring how the abstract, universal concept of ‘globalization’ does not exist as an entity onto itself, but is enacted through everyday activities. For Tsing (2005: 13), friction is “the awkward, unequal, unstable, and creative qualities of interconnection across difference.” She explains its role in fostering ontological destabilization and play: “[a]s a metaphorical image, friction reminds us that heterogeneous and unequal encounters can lead to new arrangements of culture and power” (Tsing, 2005: 19). Tsing’s work and ontological grounding makes her attuned to discovering messy, unorganized, heterogeneous, and heterotopic spaces from which new possibilities might emerge. Her research is able to capture such possibilities through empirical investigations into local, embodied practices.

In discussing ontological politics, John Law (2008: 673) outlines what he sees as the call to action put forward by both Mol and Haraway (and I would argue Smith and Tsing): “To deal with the materialities of specific practices. To discover difference. And then to intervene in ways that might make a difference to those differences.” Put another way, instead of trying to understand the world through master narratives, practicing ontological politics requires researchers to accept that reality is neither

singular nor given. Instead it must be understood as heterogeneous, multiple and produced through everyday practice. It requires taking to heart the idea that the present does not dictate the future. Or, as Law (1991: 6, original emphasis) puts it, practicing ontological politics requires scholars to maintain a “sense that what is seemingly so ‘natural’ *could have been otherwise*.” That is, happenings, such as experiences of *konran*, do not begin and end in an instant, but emerge from heterogeneous relations among myriad actors, human and more-than-human. In the next section I will discuss some of the insights that have emerged from the field of material semiotics (or relational materiality) which help in attuning my research to grasp the heterogeneous sociomaterial relations that participated in enacting my participants’ multiple experiences of *konran*.

2.6 Material-semiotic sensibilities for studying messy, emergent realities

Mol’s work on multiplicity and ontological politics emerged through her engagement with STS and actor-network theory. Materialized through the work of scholars including Michel Callon, Bruno Latour and John Law, actor-network theory has evolved through the critique and contributions of myriad scholars including Haraway and Mol. The ‘theory’ has evolved greatly over time.⁷⁸ Thus, I take the advice of Law (2009: 142) who recommends talking about material semiotics, rather than focusing purely only on actor-network theory, as it “better catches the openness, uncertainty, revisability, and diversity of the most interesting work” in the field. In this section, I will discuss some of the major theoretical insights from this field of scholarship that can be useful in understanding the multiple experiences of *konran* at focus in this thesis.

2.6.1 Actor network theory and relational materiality

Though actor-network theory has been labeled a ‘theory,’ it offers no overarching theoretical framework (Mol, 2010a: 261). It is therefore more useful to think of it as a “sensibility” or method for exploring heterogeneous, material-semiotic networks of relations (Law, 2009: 142). As put by Mol (2010a: 262), actor-network theory “helps to

⁷⁸ See Law (2009) for an overview of some of actor-network theory’s origins and transformations.

train researchers' perceptions and perceptiveness, senses and sensitivity." Law (2009: 141) defines the material-semiotic version of actor-network theory as:

a disparate family of material-semiotic tools, sensibilities, and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations. Its studies explore and characterize the webs and the practices that carry them. Like other material-semiotic approaches, the actor network approach thus describes the enactment of materially and discursively heterogeneous relations that produce and reshuffle all kinds of actors including objects, subjects, human beings, machines, animals, 'nature,' ideas, organizations, inequalities, scale and sizes, and geographical arrangements.

As the definition suggests, instead of being a theory explaining why things happen, actor-network theory is better seen as a set of tools or sensibilities for telling interesting stories about how heterogeneous relations lead to enactments or happenings. As Law (2009: 151, original emphasis) describes, actor-network theory is not about studying stable social constructions, but "*enactment or performance.*" Thus, instead of social 'construction,' actor-network theory helps researchers to explore social 'enactment' or 'emergence.'⁷⁹ Law (2009: 151) explains how researchers engaging with actor-network theory deal with a number of heterogeneous elements that "assemble and together enact a set of practices that make a more or less precarious reality." Expanding governmentality's conceptualization of the social milieu, actor-network theory allows for the existence of all possible actors whether they be human and more-than human—animal, material or otherwise. The method is based on a belief that though heterogeneous networks have always existed, we as humans and researchers have been trained over time to ignore them.

One of the first recognized contributions to actor-network theory was Callon's (1980) attempt to describe the heterogeneous network from which electric vehicles were being

⁷⁹ See Law (2008: 634-5) for a discussion on social construction versus performativity.

engineered and (unsuccessfully) deployed. Latour and Woolgar's (1979) ethnographic inquiry into the production of scientific knowledge within a laboratory setting also contributed to the development of actor-network theory. As mentioned in the review of risk society, Latour (1993) argues that modernity is a mode of thinking—not an accomplishment as argued by Beck—based on dualisms that conceal the heterogeneous entanglements through which reality is enacted.⁸⁰ He points out that the nature/society divide in particular creates cognitive distinctions between active, human agents and what are imagined to be passive, natural objects. These distinct categories of nature and society became mixed and boundaries blurred following destabilizing events—including nuclear disasters or other hybrid enactments such as global warming or clouds of acid rain (Latour, 1993). According to actor-network theory, hybrid enactments are the result of a complex mix of relations among humans and more-than-humans. However, modernist ontologies have trained us over time to overlook the heterogeneity and view the world in dualisms and binaries. Thus, acknowledging heterogeneity requires attunement; noticing hybrid entanglements requires material-semiotic sensibilities. Law (2009: 154) describes the situation: “Goods (or bads), knowledges, and realities, all are being enacted together: this is one of the ways the material-semiotic sensibility leads us into the diaspora.” Thinking of material-semiotic approaches not as theories, but ‘sensibilities’ or “arts of noticing” (Tsing, 2015: 17) helps scholars to recognize the contingent nature of reality and reminds “us that we live in a world that is *materially diverse* and *heterogeneous*” (Law & Singleton, 2014: 382, original emphasis).⁸¹

So what exactly are the ‘material-semiotic sensibilities’ that attune researchers to the heterogeneity, the diaspora, the obscure networks from which Beck's *new risks* emerge? Semiotics has been defined as “the dimension of meaning. It studies the structure of symbols and signs and their associated meanings” (Mazzola et al., 2016: 59). Material semiotics adds materials into the equation, helping to attune researchers to the heterogeneous relations at the focus of actor-network theory. Mol (2010a: 257) compares de Saussure's version of semiotics to that of actor-network theory: according

⁸⁰ Latour (2003b) explains that his early work was inspired by blending Griemas's view of non-humans and Garfinkel's ethnomethodology for humans. See Latour (2003b: 40) for a discussion on his early theoretical and methodological inspirations.

⁸¹ Also see Mol (2010a).

to the field of semiotics “words do not point directly to a referent, but form part of a network of words. [...] In [actor-network theory] this semiotic understanding of relatedness has been shifted on from language to the rest of reality.” In an example using fish (both in their symbolic linguistic and material representations), Mol explains that semiotics reveals how the word fish gains meaning through its relation with other words—its contrast with the word ‘meat,’ the way it associates with the word ‘scales,’ or the way it evokes other words such as ‘water.’ Likewise, material semiotics views the fish itself as being the product of a set of heterogeneous relations. Mol (2010a: 258) explains how a “fish depends on, is constituted by, the water it swims in, the plankton or little fish that it eats, the right temperature and pH, and so on. Fish relate to meat as well—if only because they compete in food markets.” While these relations may appear to be causal, she explains how material-semiotic sensibilities reveal the fish itself to be an actor which not only participates in enacting reality, but is itself enacted through relations it is embedded within.⁸² Law’s (1994) appeal for “a pragmatic and relationally materialist sociology” may help in understanding what material semiotics has to offer.

Poststructuralism also shares an interest in material semiotics, highlighting the heterogeneous nature of the social milieu. In fact, Law (2009: 146) has described actor-network theory “as a particular empirical translation of poststructuralism.” However, as previously mentioned, to poststructuralists agency does not tend to be extended as widely as it does in actor-network theory. In addition, actor-network theory provides historical, empirically based accounts of the emergent effects of heterogeneous relations, while poststructural approaches—such as governmentality—tend to explain activity based on epistemological constraints of a historical moment. Or as Law (2009: 147) describes, actor-network theory offers “an historical account of particular translations through time rather than a diagnosis of an epochal epistemic syntax.”

2.6.2 *Thinking through messiness with the assemblage approach*

Similar to actor-network theory, the assemblage approach emerged from the field of material semiotics as a conceptual and methodological tool for tracing procedures and practices, unified across difference, that emerge as happenings in the world. The understanding of assemblage I find of most interest descends from Deleuze and

⁸² Also see Law and Mol (2008) for a creative discussion on acting and enactment.

Guattari's translation of the French term *agencement* which Law (2004: 41-2) translates as "an uncertain and unfolding process [...] a tentative and hesitant unfolding, that is at most only very partially under any form of deliberate control. It needs to be understood as a verb as well as a noun." While some scholars understand assemblage to resemble Foucauldian *dispositifs*, the meaning stemming from *agencement* differs in its conceptualization of agents, agency and determinism of activity. As Tsing (2015: 292-3, n8) describes, Foucauldian "'assemblages' expand across space and conquer place; they are not constituted through indeterminacy." While there are not great differences between the theoretical underpinnings of *agencement* and 'actor-network' (see Law, 2004; 2009), there are some important distinction in each concept's ability to manage messiness. Tsing (2015: 292-3) clarifies what she sees as the difference between her use of the term 'assemblage' and the concept of 'network' in actor-network theory: "A network is a chain of associations that structures further associations; my assemblages gather ways of being without assuming that interactional structure." That is, while the term 'network' might connote forms of association and interaction among various human and more-than-human actors, 'assemblage' denotes a sense of fluidity, open-endedness and 'intra-action.'⁸³

Tsing's description of networks might fit with Law's own critiques of actor-network theory—noted in a paper within which he and Singleton attempted to map the network and trajectory of relations that results in the experience of alcoholic liver disease (Law & Singleton, 2005). Their findings show actor-network theory's limitations, being more poised to describe existing networks, but not being able to grapple much with the messiness—in their case otherness or shifts between presence and absence—that appear within the network. Tsing's distinction may, therefore, be useful in pointing out the promise of assemblage thinking: while actor-network theory and the assemblage approach (or "method assemblage") (Law, 2004: 13) both explore the precarious relations among myriad heterogeneous actors, assemblage thinking allows for conceptualization of messier, overlapping, "absent presence" (Law & Singleton, 2005:

⁸³ Barad (2007: 33, original emphasis) describes intra-activity as signifying "*the mutual constitution of entangled agencies*. That is, in contrast to the usual 'interaction,' which assumes that there are separate individual agencies that precede their interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action." Also see Barad (Barad, 2017: G111).

343-4) and multiple processes of engagement and entanglements that emerge in local settings.

Tsing (2015: 23) characterizes her conceptualization of assemblages as “open-ended gatherings. They allow us to ask about communal effects without assuming them. They show us potential histories in the making.” Human geographers McFarlane and Anderson (2011: 162) describe assemblages as both a concept and “an ethos of engagement attuned to the possibilities of socio-spatial formations to be otherwise within various constraints and historical trajectories.” Both of these portrayals point to the potential of engaging with assemblage thinking: it provides a method for conceptualizing and tracing how seemingly-stable bundles of relations among heterogeneous and often disparate actors are precariously held together. The recognition of the precarious stability of these bundles of relations can attune researchers to unexpected, emergent happenings, while also helping them to trace unexpected happenings to their precarious beginnings. Thus, assemblages can be seen as coexisting bundles of relations that are always in tension (Mol, 2010a). Put differently, an important aspect of assemblage thinking is its ability to recognize both emergent possibilities and precariousness as being simultaneously present within an assemblage.

2.6.3 *Attempts at ordering and coordinating the social*

If reality is a precarious mess of heterogeneous relations, how is it that we have come to think of anything as being stable? Law (1994: 101, original emphasis) explains how actor-network theory “treats the social world as a set of more or less related bits and pieces. There is no social order. Rather, there are endless attempts at ordering.” The focus on the unfinished process of social ordering or social ‘co-ordination’⁸⁴ creates an image of ‘the social’ not as a static, steady, knowable entity (as is portrayed in statistical data), but “the recursive but incomplete performance of an unknowable number of intertwined orderings” (Law, 1994: 101). Actor-network and assemblage scholars see attempts at social co-ordination as emerging through the process of *translation*. Law (1994: 103) explains:

⁸⁴ Mol (2010a: 264) prefers to use the term ‘co-ordination’ as it “suggests continuing effort. Tensions live on and gaps must be bridged, hence the need for ‘co-ordination.’”

Translation, then, is to do with verbs, but one could say that its object is to try to convert verbs into nouns. Of course, this is impossible. Verbs are verbs are verbs. To think otherwise is to cleave to the modernist dream of pure order. Nevertheless, some verbs may end up acting for longer than others. Some may even look like nouns for a while. So translation is a play to achieve relative durability, to make verbs behave as if they were nouns. This is where relational materialism comes into the picture.

According to Law and other scholars in the field of material semiotics, translations, and any orderings they may invoke, are necessarily contingent. Material-semiotic attuned approaches illuminate how materials play an important role in attempts to coordinate and stabilize social relations. Or, as Mol (2010a: 263) clearly explains: “[t]hings are crucial to the ordering work at hand.” According to these approaches, any ‘thing’—from a discourse, to a text, to a nuclear power plant—are translations. One of the main differences among ‘things’ rests in their durability: while a spoken word may disappear after it is enunciated, the textual representation of those words can be made into replicable copies and distributed to coordinate activities across far distances (Law, 1994: 102). That is, a sense of stability is achieved because “some materials last better than others. And some travel better than others” (Law, 1994: 102). Materials that can travel from site to site without losing their shape are what Latour (1986: 8) has termed “immutable mobiles.”

The process of translation can be found in the production of immutable mobiles, but also in encounters actors have when relating to these materials. The process of translation that produces an immutable mobile is sometimes referred to as inscription. Law (1994: 103) points out it is “sociotechnical innovations that generate new forms of immutable mobiles: writing; print; paper; money; a postal system; cartography; navigation; ocean-going vessels; cannons; gunpowder; telephony.” Immutable mobiles do not create situations of technical determinism, but are sociotechnical in the sense that they are formed through and interact within heterogeneous relational materiality.⁸⁵

⁸⁵ Law (2009: 147-8, original emphasis) explains: “We have seen that the *social* and the *technical* are embedded in each other. This means that it simply isn’t possible to explore the social without at the same time studying the hows of relational materiality.”

Put differently, they represent material forms that emerge from a specific set of intentions and relations, and are deployed as actors in an attempt to order further relations—though the participation of other humans and more-than-humans means the result of ordering attempts are never predictable.

Callon (1991) provides an example. In discussing the functioning of techno-economic networks, Callon distinguishes between actors and intermediaries that interact within an actor-network. Texts, food products, technical instruments, forms of knowledge or skills known by a human or machine, and currency are all examples of intermediaries. Intermediaries are produced through the process of inscription. Therefore, though they are exchanged through external networks, each intermediary has its own network from which it emerges, each imbued with its own political and economic values. Thus intermediaries may be created with the potential to replicate the values of the network from which it emerges. This replication, however, is never guaranteed as the relationship among actors and intermediaries is always contingent, never determinable.⁸⁶ Callon (1991) also describes how intermediaries define the relationships among actors who exchange them, for example networks designed to circulate food are defined as ‘food systems.’ Because intermediaries are not confined to one network, they are able to travel to numerous other networks to be exchanged by actors there. Intermediaries, therefore, also play the role of actor when involved in coordinating or instigating activity among other actors in a techno-economic network, though the character of these interactions are not always predictable. Callon (1991: 141-2) uses an example of nuclear power plants as both intermediary and actor to describe this point:

The plant is often seen as a simple link in a chain which extends from the user to the generating company, and perhaps beyond to the terrible nucleocrats who conceived and planned it. In this case the actors are taken to pass through the plant without stopping. [...] Others treat it as a dignified actor that may introduce unexpected and unprogrammed sequences and associations. [...] When the clouds from Chernobyl spread over Europe to contaminate Lapp reindeer

⁸⁶ See Legun (2015) for an intriguing empirical example of apple dwarfing technologies as assemblage intermediaries and actors.

and Welsh sheep, the plant became an actor rather than an intermediary.

Attuning to messy, heterogeneous sociomaterial entanglements using material-semiotic sensibilities allows for practicing ontological politics, opening up opportunities to explore both intermediaries and actors as fluid in their identities.

Law's (1986; 2012) work on Portuguese imperial expansion and trade in the 15th and 16th centuries also points to the critical role immutable mobiles played in the country's long-distance and large-scale ordering projects. He illustrates some of the processes of translation used by the Portuguese empire in maintaining control over their ships: the knowledge of astronomers was inscribed into astronomical tables that were used by disciplined navigators to direct ships to far-off places of interest to the empire (Law, 1986). Law (1986: 234) ultimately argues that "long-distance control depends upon the creation of a network of passive agents (human and more-than-human) which makes it possible for emissaries to circulate from the centre to the periphery in a way that maintains their durability, forcefulness and fidelity." In this case, networks of passive agents including "documents, devices and drilled people"⁸⁷ were shaped and exploited by the Portuguese ruling elites to co-ordinate their imperialist projects (Law, 1986: 234).

In the same volume, Callon (1986) uses an empirical example with scallops to describe the creation of a network of passive agents. The study outlines a four-step process of translation used in establishing a network of actors—marine biologists, fishermen and scallops—who will work together to prevent devastating declines in scallop populations in the St. Brieuc Bay in Brittany, France. The study illustrates the contingent nature of translation and the precariousness of ordering projects since 'betrayals' of actors—in this case "silent mutinies of scallops and fishermen"—and identity-shifting controversies are always possible and have the power to disrupt and reconfigure seemingly-stable translations and coordinations (Callon, 1986: 219-21).

⁸⁷ Here Law borrows the concept of 'docile bodies' from Foucault (1977). Haraway (1994: 65) has also described how these voyagers are expected to "pronounce 'land ho!' and forever pose as the ventriloquist (representor) to the way the world really is."

Focusing on attempts at ordering through translation can help in pointing to the contingent nature of ordering projects, providing a constant reminder that “what is seemingly so ‘natural’ *could be otherwise*” (Law, 1991: 6, original emphasis; 1994)}. Or, in Haraway’s terms, “the established disorder isn’t necessary” (Gane, 2016: 136). Tsing’s (1997) work on translation also reveals how viewing historical transformations as open-ended, never complete processes of translation can sensitize researchers to glimpse the heterogeneous relations and encounters that have been left out of dominant Western histories, but nonetheless contribute to historical happenings.⁸⁸ Ultimately, material-semiotic sensibilities seem to be useful in training researchers to identify “the glue that holds the social world more or less precariously together” (Law, 1991: 7). Attempts at ordering or coordinating can, thus, be seen as continuous efforts, always imbued with tension, where there is no certainty as to how things will play out within particular sociomaterial assemblages.

2.6.4 *Conceptualizing the messiness of sociotechnical disasters: Overflow and contamination*

Callon and colleagues (2009: 28) use the term “overflow” to refer to instances where something ordinarily kept within a technical space (for example, radionuclides within a nuclear power plant) are released from their confinement into the “big world.” The technical space can be both physical (as in the release of radionuclides from within the containment of a nuclear power plant) or philosophical (as in the discovery of gaps in modernist ontologies). Here Latour’s (2003b: 36) aforementioned definition of risk helps explain the philosophical implications of the term ‘overflow’: it reveals people’s entanglements with myriad heterogeneous elements that they once thought were separate, or at least separable, from themselves. Callon et al. (2009: 28-36) refer to this realization as recognizing one is ‘concerned’ with the overflow.⁸⁹ That is, people realize they are somehow implicated in the outcome of the overflow. Such realizations

⁸⁸ Also see Satsuka (2015) for an interesting ethnographic account of how human knowledge of nature is produced through the process of translation.

⁸⁹ It is interesting to differentiate between being ‘concerned with’ and ‘concerned about’ an overflow. The first points to people who realize they are entangled with an overflow. ‘Concerned about’ connotes that people might be interested in taking action to negotiate the new relationships and entanglements they find themselves within. While people may be ‘concerned with’ a situation, it does not mean they are necessarily ‘concerned about’ it. That is, they could ignore their entanglements and/or allow others to manage the situation for them.

lead to controversy in the social sphere (or ‘socio-activity’), meaning overflows are neither purely social or technical, but sociotechnical (Callon et al., 2009: 109).

Callon et al. (2009: 48-70) go on to detail three stages of translation essential to the production and application of seemingly stabilized forms of scientific knowledge which can be disrupted by the controversy of an overflow. *Translation 1*—“from the macrocosm to the microcosm”—illustrates the process of reducing parts of the “big world” to be studied objectively within the isolated and controlled microcosm (or “small world”) of the laboratory. *Translation 2*—“the research collective at work”—is the process of discussing simplified, objective findings from the laboratory within a research collective of actors with shared language (terminology), knowledge and skills. Finally, *translation 3*—“return to the big world”—describes the process of how the knowledge produced in the laboratory and discussed within the research collective is transported and applied back to the complex real world from which it originated. As with the example of the scallops, however, the stabilization of these translations can also be difficult to maintain in the face of controversy, as they are open to interpretation from a variety of new actors who discover they are concerned with the controversy at hand.

Similar to Latour’s (1993) conceptualization of hybrids, Law and Singleton (2014: 383) describe how modernist divisions between nature and society become blurred in instances of controversy or overflow: “‘nature’ cannot be easily distinguished from ‘the social.’ Instead of being separate domains, they are all raveled up together. ‘Society’ and ‘nature’ are being generated—and then perhaps separated—in practice.” According to Callon et al. (2009: 99), the realization of one’s concern or entanglement leads to a state of uncertainty⁹⁰ as the knowledge necessary to control the technical materials

⁹⁰ Like Beck (Section 2.2), Callon et al. (2009: 19-21) and his colleagues distinguish between calculable risk and uncertainty. They define risk as “a well-identifiable danger associated with a perfectly describable event or series of events,” and uncertainty as situations where “we cannot anticipate the consequences of the decisions that are likely to be made; we do not have a sufficiently precise knowledge of the conceivable options, the description of the constitution of the possible worlds comes up against resistant cores of ignorance, and the behavior and interactions of the entities making them up remain enigmatic.”

within secluded spaces may not be fit for dealing with the materials once they escape into “the wild.”⁹¹

Another concept that emerges out of sociotechnical disasters is ‘contamination.’ While the term usually has a negative connotation, material-semiotic thinking helps to attend to contamination as an event that emerges from the heterogeneous relations among actors, human and more-than-human (see Mol, 2010a: 261). Tsing’s (2015: 28-9) description of contamination as “transformation through encounter” is useful for conceptualizing contamination as relations among heterogeneous elements, whose entanglements produce “diversity.”⁹²

Material-semiotic approaches allow researchers to view contamination not in terms of binaries—pure/contaminated, polluted/non-polluted, clean/dirty,⁹³ safe/unsafe—but as messy, historically situated sets of relations among humans and more-than-humans which cannot easily fit into simplified, designated categories. In a positive light, contamination produces diversity. More negatively, contamination can produce disorder, disease and death. However, as with assemblages, both possibility and precariousness are simultaneously present in the process of contamination, and material semiotics requires researchers to take all sides into consideration. Bell (2016: 193, original emphasis) voices his concern that agrifood scholars adopting material-semiotic approaches tend to focus on the positive possibilities offered by connections among heterogeneous actors, imploring them to instead “focus more on two other *con-* words: *consequence* and *context*.” He explains:

⁹¹ For an empirical example concerning the Chernobyl nuclear disaster and contaminated farmland see Wynne (1992) and Callon et al. (2009: 90-4).

⁹² Tsing (2015: 34) explains: “Contaminated diversity is not only particular and historical, ever changing, but also relational. It has no self-contained units; its units are encounter-based collaborations. Without self-contained units, it is impossible to compute costs and benefits, or functionality, to any ‘one’ involved. No self-contained individuals or groups assure their self-interests oblivious to the encounter. Without algorithms based on self-containment, scholars and policymakers might have to learn something about the cultural and natural histories at stake. That takes time, and too much time, perhaps, for those who dream of grasping the whole in an equation.”

⁹³ See Phillips (2002) for a fascinating ethnographic inquiry into how people living in Kyiv, Ukraine discussed contaminated food following the Chernobyl nuclear disaster, often using the word ‘dirty’ to refer to foods contaminated with radionuclides.

We should not confuse the importance of recognizing consequence with proclaiming metaphors of connection. [...] [C]onnections that you thought were there often weren't, just as disconnections you thought were there weren't. Help doesn't come and listeria gets into the food. So a large measure of humility and openness to the unexpected is always in order, and thus always in disorder. We open ourselves to a deeper appreciation of consequence when we start to think not in terms of the dream of universal fellow-feeling among non-hierarchical equals but in terms of context, with all its difference, dynamism, and disconnection—as well as connection. (Bell, 2016: 194)

Thus, contamination, connection, consequence and context are not simple, universal or singular in their form and logic, but must be understood as 'multilogics' (Bell & Goetting, 2011), forms of 'multiplicity' (Mol, 2002), or 'versions' of reality (Mol, 2012). Mol's (2010a: 260) multiple works on multiplicity point to how the enactment of what seems to be the same activity or object varies depending on the site (context) where it emerges. Similarly, she describes 'versions' as being:

neither physical nor social, but both at the same time. Stronger still: the particular substance of which they are made is not the issue. Versions of the body do not occupy a layer in a *spatial* pile. Rather, they are events in *time*. They emerge in different circumstances. They happen in different situations. Think of a play that is being staged in a theatre. Versions of the body are performed, orchestrated, enacted. They are done in practices. (Mol, 2012: 120-1, original emphasis)

Mol (2012: 120, original emphasis) goes on to explain how the concept of 'layering'—that is, “a physical layer *underlying* a social layer that is situated *on top* of it”—can be useful in understanding historical transformations and overlapping realities, while 'versions' help us to conceptualize the complex and multiple realities and experience that emerge at a specific point in time.

Alongside the concepts of multiplicity and versions fits the concept of fluidity and fluid technology. De Laet and Mol's (2000) work on the Zimbabwe bush pump provides an

empirical example of a fluid technology which, designed and assembled in Zimbabwe's capital city, acts and is enacted in multifarious local village settings around the country. The technology is fluid, as opposed to rigid, because it is translated differently within each local setting. It has many identities—"a hydraulic system [...] a health promoter and a nation-building apparatus"—(de Laet & Mol, 2000: 252). As Law (2009: 153) describes, the pump is a "mutable mobile," as opposed to an 'immutable mobile,' as it is malleable in its shape and success—its parts can be 'tinkered with'⁹⁴ and replaced, and while it sometimes produces healthful water, it can also produce water filled with health-threatening actors such as *E.coli*. The fluidity of the object means that the bush pump itself cannot be considered universally good or bad, but its identity is always fluid—shifting depending on the heterogeneous relations enacting it within a specific time and local setting.

2.6.5 *The ethics of situated knowledge*

Donna Haraway's work has been referred to as a form of 'feminist material semiotics' or 'political material semiotics,' political because of its overt enunciation of the role and standpoint of the researcher in the research process (see Law, 2009). Law (2004: 68, original emphasis) describes how taking Haraway's material-semiotic stance illuminated how:

We are caught up [...] in a dense *material-semiotic network*. That is, we are caught up in sets of relations that simultaneously have to do with meanings and with materials. We are entangled in our flesh, in our versions of vision, and in relations of power that pass through and are articulated by us. So detachment is impossible. At best a self-delusion, more often it is also a form of irresponsibility.

This description points out two important aspects of conducting research using a material-semiotic approach: first, researchers must learn to see the world as a heterogeneous mix of entangled relations among humans and more-than-humans; second, researchers must acknowledge that they themselves are embedded and active within these relations.

⁹⁴ Mol et al. (2010a: 13) argue that the verb "tinkering" best describes how realities emerge through practice, not through a form of verbal or cranial 'negotiation' of what is good or bad, but through trying things out in practice.

As mentioned, Haraway is one of a number of feminist scholars who has expressed the importance of not only recognizing, but articulating the particular standpoint and role of the researcher in the research process. She argues that most researchers are trained to conduct their research using the “god trick,” which involves a false pretention that one is able to see “everything from nowhere” (Haraway, 1991c: 189). Material semiotics points out the flaw, and danger, in such un-reflexive research practices: researchers are embodied beings who are, in fact, situated somewhere and their position influences how they conduct research and how they see the world. Haraway argues it is essential that scholars acknowledge the situated nature of knowledge and knowledge production. This includes the necessity of reflecting on their own embedded standpoints and positions of power which are created and recreated through their work.⁹⁵

Mol (2002) makes a similar observation about ethics in her book *The Body Multiple*. According to Mol (Mol, 2002: 177), once researchers recognize their own embeddedness, they are faced with the very political question of “what to do?” She explains: “The term *politics* resonates openness, indeterminacy. It helps to underline that the question ‘what to do’ can be closed neither by facts nor arguments. That it will forever come with tensions—or doubt” (Mol, 2002: 177, original emphasis). She goes on to explain how the answer to ‘what to do?’ cannot be determined through discourse or theory, but is performative, enacted only through the act of doing. Thus, researchers must confront their own role as embedded performers and enactors within local research settings and the contingent and limited nature of their findings.

Furthermore, Haraway (1991c) describes how understanding the situated nature of knowledge leads to another important observation: that knowledge from one, situated standpoint is necessarily partial. To Haraway and other STS scholars (for example, Latour & Woolgar, 1979), objective knowledge is one form of situated, locally-produced knowledge, and though it may be an important form of knowledge, it also necessarily offers only a partial vision of reality. She elucidates here point that:

only partial perspective promises objective vision. This is an
objective vision that initiates, rather than closes off, the problem of

⁹⁵ As previously mentioned, Haraway’s critiques have been important in the development of actor-network theory and other material-semiotic attuned methods (see Law, 2009).

responsibility for the generativity of all visual practices. Partial perspective can be held accountable for both its promising and its destructive monsters. (Haraway, 1991c: 190)

To Haraway, responsibly and ethically conducting research requires self-reflexivity on the researcher's own embeddedness and the limits (or partialness) of the perspectives they offer. This goes for scholars working with material-semiotic approaches and those in the field of nuclear physics or biology.⁹⁶ As in Haraway's metaphor of a cyborg, partial perspectives of multiple realities mix, mingle and interfere with each other in everyday, situated activities where "partial connections"⁹⁷ are created across difference and exist both within and without (Haraway, 1991a: 181).

2.6.6 *Material semiotics and konran*

Material semiotics provides many insights that will be useful in studying experiences of *konran* following TEPCO's nuclear disaster. First, the approach opens up opportunities to conceptualize TEPCO's nuclear disaster as a hybrid, emergent happening that takes into consideration the participation of humans and more-than-humans. Taking the example of Wynne's (1992) research on post-Chernobyl nuclear fallout, material-semiotic thinking helps to recognize how sheep, radionuclides, technical instruments, texts, farmers, rain, scientists, the Sellafield nuclear fuel reprocessing complex, and numerous other humans and more-than-humans are simultaneously acting, interacting and being enacted in multitude ways that emerge as the complex happenings at the center of his study. Material-semiotic sensibilities not only bring the mess of human and more-than-human sociomaterial entanglement and relationality into view, but also provide tools for conceptualizing how more-than-humans are integral to attempts at social ordering (see Callon, 1991; Law, 1986).

Material-semiotic approaches have not only successfully been used in the study of sociotechnical disasters, but also in the field of agrifood studies. In the late 1990s, Whatmore and Thorne (1997: 289) argued that concepts from actor-network theory

⁹⁶ See Gilbert and Epel (2015) for an interesting and open discussion on the philosophical concerns pertinent to the field of ecological developmental biology.

⁹⁷ The concepts of 'partial connections' and ontological multiplicity are also explored by anthropologist Marilyn Strathern (2004).

could be used to uncover realities invisible in traditional political economy approaches in ways that “elaborate an understanding of global networks as performative orderings (always in the making), rather than as systemic entities (always already constituted).” Since then, a number of agrifood scholars have begun conducting research using material-semiotic sensibilities as an alternative to the structural logic offered by political economy approaches (see Le Heron et al., 2016; Murdoch et al., 2000). These sensibilities allow researchers to conceptualized once seemingly closed and controllable agrifood systems as open-ended agrifood assemblages, where the agency of myriad more-than-humans—often treated as passive agents in political economy approaches—could be recognized within and contribute to research. From butterflies and bees, to microbes of all sorts (for example, Bingham, 2016; Paxson, 2008), the literature in agrifood studies have begun noticing heterogeneous actors relating within newly conceptualized agrifood assemblages (see Forney et al., forthcoming).

The ethical dimensions of material semiotics also allow agrifood researchers to recognize and reconcile with their own embeddedness and agency within various assemblages. That is, as researchers realize their embeddedness within bundles of relations, research itself is being recognized as being performed within these relations (see Carolan, 2013; Law & Urry, 2004). Agrifood scholars Campbell and Rosin (2011) provide an interesting reflection of how their research project on audit systems assisted in not only enacting an audit system, but also influencing how people began perceiving themselves as subjects of the audit process. Other studies have been conducted on the performativity of more-than-humans in agrifood assemblages. Busch (2007; 2011) in particular has shared many interesting insights on standards as intermediaries and actors. Similarly, Carolan (2015; 2008; 2011; 2013) has highlighted the embodied nature of food and food politics, as well as the important role embodied experiences play in enacting positive futures within agrifood assemblages.

Food—as a material, sociomaterial, taste, concept, subject, object, multispecies engagement, and ontonormative enactment—has also become an exciting topic being explored by scholars using material-semiotic sensibilities (see Bennett, 2010; Haraway, 2008; Harbers, Mol, & Stollmeyer, 2002; Mol, 2008a; 2009; 2012; 2013). Of particular interest is Mol’s (2013) use of ‘ontonorms’ in studying food and diet. In an article entitled “Mind Your Plate! The Ontonorms of Dutch Dieting,” Mol introduces and uses

ontonorms⁹⁸ as a tool for noticing and exploring the ways in which different dietary advices enact very different types of foods and bodies, paying particular attention to the normativities that participate in these enactments. In investigating the topic, Mol (2013: 381) asks:

What are goods and bads relevant to different ways of enacting food, and of affording food with particular possibilities to act? What becomes of bodies in Dutch dieting; how are they being valued; and what about their own, bodily, engagements in valuing?

Through her analysis, she describes how different forms of dieting advice—much which ascribe to the message ‘Mind your plate!’—enact bodies as untamed, pleasure-seeking entities which must be restrained through rational control.

Noticing food as a potential agent of disruption following a nuclear disaster is also of particular interest in this thesis. Historian Brett Walker (2010: 7)⁹⁹ illustrates his conceptualization of the ethical and embodied aspects regarding this issue:

People, and I include most scholars, too, tend to view themselves as outside or beyond nature, even while eating and digesting other living things. [...] Presenting food as culture rather than as nature is done through obscuring the histories of different foods, which includes their exposure to deadly toxins or heavy metals or dangerous pesticides. But our inseparable, and quite natural relationship to the ‘biological’ in these biotechnologies, such as engineered farm animals and grains, become apparent when we experience pain.

Within his book *Toxic Archipelago*, Walker draws on actor-network theory to retell fascinating and terrifying histories of pollution incidences in Japan. He describes how the experience of pain can be one embodied experience capable of attuning humans to their embeddedness within heterogeneous assemblages humans and more-than-humans, including imperceptible industrial pollutants. From the introduction of pesticides, to

⁹⁸ Following Mol’s (2013: 390) request, I will not attempt to define ontonorms, but explore how the concept can serve as a tool for deepening onto-political reflections and interfering with stories of singularity and control.

⁹⁹ Walker draws on Michael Pollan (2006) in his conceptualizations on food.

copper mining, to cadmium and methylmercury poisoning in Japan, Walker (2010: 16-20) paints captivating and intricate portraits of the heterogeneous actors, human and more-than-human, that contributed to what he terms events of “hybrid causation.”

Like Walker, a number of other scholars have begun using material-semiotic sensibilities to re-tell histories. Of particular relevance to this thesis are the material-semiotic infused historical accounts of overflow and contamination in Japan. Pritchard (2012: 223) interestingly borrows Perrow’s (1999) concepts of ‘normal accidents’ and ‘eco-system accidents’ as well as Hughes’ (1983) work on technical networks to retell, or reinterpret, the story of TEPCO’s nuclear disaster through the concept of “envirotechnical systems”—a term that “encapsulates and specifically foregrounds [the] dynamic imbrication of natural and technological systems.” According to Perrow (1999), nuclear power plants are designed as complex and tightly coupled systems in order to manage and contain the very unstable nature of radionuclides they harbor inside. Though such rigid systems may be necessary for containing unstable radionuclides, they are very difficult to manage in the event of even a minor disruption or disturbance. Thus, even though some ‘unexpected’ relational encounter may cause a catastrophic breakdown, the event cannot be termed a surprise or an ‘accident.’ Instead, Perrow (1999) terms disasters at nuclear power plants “normal accidents” as the particular design of nuclear reactors guarantees the technology may not easily cope with even small, predictable disruptions.

Similar to the notion of the fluid Zimbabwe bush pump which is embedded within the active ground and water table of a local village setting (de Laet & Mol, 2000), Perrow’s (1999: 296) notion of an “eco-system accident” is used to highlight how nuclear power plants are also embedded within active, natural environments. Resembling the notion of sociotechnical ‘overflow’ (Callon et al., 2009), Perrow (1999: 296) explains how “eco-system accidents illustrate the tight coupling between human-made systems and natural systems. There are few or no deliberate buffers inserted between the two systems because the designers never expected them to be connected.” Seen this way, a nuclear power plant is not an isolated technology, but a sociotechnical—or socio-envirotechnical—actor that is necessarily ‘intra-acting’ with a multitude of other humans and more-than-humans. Importantly, however, while the bush pump is materially fluid, simple and loosely coupled, nuclear power plants are materially rigid,

complex and tightly coupled and, thus, less able to cope with relational disturbances. Hughes' (1983) historical account of the development of electricity networks also share some common ground with material-semiotic approaches, particularly in the way he discusses these networks as a form of sociotechnical order.¹⁰⁰

Ultimately, Pritchard's (2012: 233) retelling of the TEPCO disaster using material-semiotic sensibilities highlights how histories that include "the complex, dynamic, porous, and inextricable configurations of nature, technology, and politics" help readers to understand the disaster not as an uncomplicated event that can be described through simple categorizations, but as a hybrid happening. However, she does not overlook ethical questions involved in noticing the agency of more-than-human actors. The author points out how some critics "fear that multicausal accounts reflecting complex understandings of historical agency that decenter people as primary causal agents threaten to diffuse, if not undermine, the responsibility and ultimate culpability of powerful groups" (Pritchard, 2012: 230). Similar critiques have targeted actor-network theory as being "agnostic" toward power relations and politics (Marsden, 2000: 21). Here Mol's (2002) question of 'what to do?' confronts researchers.

Agrifood scholar Michael Carolan (2016: 236) also grapples with the question of what it means to move away from the "humanist tradition" of social science. He acknowledges the concern that expanding the focus of research to include more-than-humans may appear to disregard the suffering of human beings. However, Carolan (2016: 236) ultimately argues that material-semiotic approaches can help in illuminating "that suffering is a product of us not caring fully for everyone involved."¹⁰¹ Sarah Whatmore (1997) has also argued that the perspective of connectivity and embeddedness offered by material-semiotic sensibilities actually has the potential to enhance ethical engagement among actors. In a similar vein, Carolan (2016: 236) goes on to argue that ignoring more-than-human actors and relations may actually make "suffering more acute." Instead he advocates that scholars openly engage with the ethics of discussing or denying human and more-than-human relations. Thus, material-

¹⁰⁰ See Law (1991) for a discussion on Hughes' (1983) work from the perspective of actor-network theory.

¹⁰¹ Also see Carolan (2015) and Latour (2003b: 38).

semiotic approaches that honestly and proactively engage in ‘ontological politics’ (Mol, 2002) and adhere to the ethics of ‘situated knowledge’ (Haraway, 1991c) have the potential to tell stories that add to our understanding of how human suffering is enacted through relations among myriad heterogeneous actors, as opposed to some singular, individual experience that is easily labeled as ‘irrational’ or ‘unscientific.’ Though humans and their relations with ruling texts will be at focus in this thesis, I take very seriously the ethical responsibilities necessitated in the field of material semiotics and expect that engagement with these ethical considerations will enrich my analysis.

Material-semiotic thinking also helps to reconsider how we think of epochal time. Carolan (2013) provides an interesting discussion on the difference between the absolute, objectified form of time conceptualized by classical physics and the concept of epochal time. He explains: “An epochal view of time [...] directs attention to the process itself, the network, the assemblage. Rather than giving *a priori* existence to individuals, things, or emergent identities an epochal view of time understands that becoming precedes being” (Carolan, 2013: 420, original emphasis). Risk society, reflexive modernization and governmentality all provide epochal views of history. Another epochal view of time that is very pertinent to discussions on nuclear disasters is the notion of the Anthropocene. The transition to the Anthropocene signifies a shift in geological time from a more stable Holocene with its “refugia”¹⁰² supporting biological life and lifeways, to an era where human manipulation of the planet is creating instability in planetary systems (Chakrabarty, 2009; Steffen, Crutzen, & McNeil, 2007; Zalasiewicz et al., 2008). While the onset of the Anthropocene is still under discussion, recently geologists have argued that the presence of radionuclides, specifically plutonium-239, in stratigraphic samples dating back to nuclear weapons testing in the 1950s could serve as a geological indicator for the epoch (Waters et al., 2015; 2016). From a material-semiotic perspective, the names and stories behind both the Anthropocene and risk society may be problematic as they are “premised on a dualistic ‘social driver plus environmental consequence’ model” (Moore, 2015: 175). Thus, instead of highlighting the heterogeneous relations that have contributed to the

¹⁰² Tsing (2017a: 54) offers a discussion of the Anthropocene as a time when places of refuge (or “refugia”)—areas necessary for resurgence and cultivating livability on this planet which were abundant during the Holocene—are being rapidly destroyed.

socioecological or sociotechnical troubles we face today—and therefore point toward possible solutions for overcoming them—the consequence model focuses attention on abstract social groups that are to blame for the problems (for example, abstract modern institutions that produce Beck’s *new risks*, or an abstract conceptualization of humanity as a whole). Put differently, within the Anthropocene, socioecological and sociotechnical controversies become trapped within modernist ontologies of “human exemptionalism” (Dunlap:1994wf; Murdoch, 2001).

The term “Capitalocene” has been offered as a different way of conceptualizing the attempts at coordination that, since the 1400s, have been organizing humans and more-than-humans in ways that have led to the sociotechnical and socioecological controversies we are experiencing today (Moore, 2015; 2014). Jason Moore (2014: 1) explains how the concept helps in reconceiving capitalism as “a world-ecology, joining the accumulation of capital, the pursuit of power, and the co-production of nature in dialectical unity.” He goes on to explain how this new way of thinking “opens up the possibility of moving from the ‘environmental’ consequences of ‘social’ processes to the socio-ecological constitution of Anthropogenic drivers themselves” (Moore, 2014: 8).¹⁰³

While the term ‘Capitalocene’ can help to focus people’s attention on the economic processes and modernist ontologies that need modification, it alone is not big enough to conceptualize all the troubles threatening human and more-than-human livability on planet Earth. The term “Plantationocene” has also been offered as a way to conceptualize the processes of uprooting humans and more-than-humans and relocating them into systems organized for capitalist extraction and mass production (Haraway, 2015; Haraway et al., 2016). Slave-labor-powered sugar plantations, modern feedlots, and perhaps even nuclear power plants are examples of these forms of organization (Haraway et al., 2016; Tsing, 2012).

¹⁰³ The title of this 2014 essay by Moore, which was uploaded onto his website, later became the title of a journal article (Moore, 2017). The quotation borrowed from the 2014 version is not included in the 2017 paper, but encapsulates many of his arguments also found in his 2015 book (Moore, 2015).

Haraway (2015; 2016) has also offered the term “Chthulucene”¹⁰⁴ to help in re-attuning to and re-engaging with the complex multispecies assemblages we as humans are entangled within, but have been trained to ignore through decades of ideological work. The Chthulucene provides an invitation for scholars to attune to sociomaterial entanglements which are both vital and vicious, to ‘stay with the trouble’ that these messy entanglements enact—even though it may be monstrous and uncomfortable (Haraway, 2016). What is important to grasp in these various stories is that a single, master narrative style of explaining the world is no longer useful for finding solutions for what may be a “boundary event,” or time of planetary transition similar to previous extinction events (Haraway, 2015: 160; Haraway et al., 2016: 540-1; Zalasiewicz et al., 2015). Thus, there is a need for the ‘Anthropos’ to understand their own embeddedness within heterogeneous relations of humans and more-than-humans; it is only from an attunement to sociomaterial entanglement that ways of disrupting deleterious relations can be discovered without reproducing the same relations that got us into these troubles in the first place (see Latour, 2013). I would argue that material semiotics can offer insights for researchers and research participants learning how to better engage with and carefully tinker within¹⁰⁵ the heterogeneous more-than-human relations within which we are all entangled.

¹⁰⁴ Haraway (2015: 160) describes how the Chthulucene is a term that scholars can use to attune to “the dynamic ongoing sym-chthonic forces and powers of which people are a part, within which ongoingness is at stake. [...] These real and possible timespaces are not named after SF writer H.P. Lovecraft’s misogynist racial-nightmare monster Cthulhu (note spelling difference), but rather after the diverse earth-wide tentacular powers and forces and collected things with names like Naga, Gaia, Tangaroa (burst from water-full Papa), Terra, Haniyasu-hime, Spider Woman, Pachamama, Oya, Gorgo, Raven, A’akuluujjusi, and many many more. ‘My’ Chthulucene, even burdened with its problematic Greek-ish tendrils, entangles myriad temporalities and spatialities and myriad intra-active entities-in-assemblages—including the more-than-human, other-than-human, inhuman, and human-as-humus.”

¹⁰⁵ The concept of “care” has been used by Annemarie Mol and colleagues (see Mol, 2008b; Mol et al., 2010b) to point to the locally situated, messy processes of “tinkering” performed by people embedded within heterogeneous material relations. This distinction helps to highlight how ‘care’ is in tension with concepts such as ‘choice’ or ‘control’ which assume people to be autonomous individuals, a cognitive maneuver which involves overlooking one’s embeddedness within messy material relations (Heuts & Mol, 2013; Mol, 2010b).

2.7 Moving forward

In this chapter I have attempted to locate the empirical themes of this thesis within the scholarly literature, guiding readers on an ontological odyssey through a vast terrain of theoretical frameworks and concepts that allow for grappling with experiences of *konran* related to everyday eating in the aftermath of a nuclear disaster. Through the process of traversing this particular theoretical terrain and reflecting on questions of ontology, it soon became evident that there are many limits to studying the emergent experiences of *konran* using theoretical frameworks that are either trapped within modernist ontologies (Latour, 1993)—the risk society thesis and the theory of reflexive modernization—or which confine research participants and their experiences “to a phenomenal world in which nothing ever happens” (D. E. Smith, 1999: 98)—governmentality and biopolitics. Instead, this particular odyssey revealed that theoretical frameworks and concepts that allow researchers to engage in ontological politics are necessary when dealing with messy and ontologically destabilizing materials, such as imperceptible and unstable radionuclides.

Ultimately, while each stop on my journey through this particular theoretical terrain was quintessential to the evolution of this project—each encounter providing invaluable insights and concepts that guided me to my next destination—in the performance of this thesis, I will leave behind the theoretical frameworks presented by the risk society thesis, the theory of reflexive modernization, governmentality and biopolitics. Instead, I will take an empirically-based approach guided by sensibilities from the fields of material semiotics and institutional ethnography that will allow for my participants’ experiences of *konran* to be understood as emerging from interactions among heterogeneous assemblages of humans and more-than-humans. Moving forward, in the following chapter I will elaborate a particular methodology that can situate institutional ethnography within the burgeoning field of material semiotics, describing how I will apply sensibilities from both fields of scholarship in exploring my participants’ experiences of *konran* related to eating following the onset of TEPCO’s nuclear disaster.

3 What to do? Toward a vital institutional ethnography

3.1 Introduction

This thesis began with my interest in studying the *konran* experienced by myself and others living in the Kansai region relating to everyday eating following TEPCO's nuclear disaster, not as a singular experience of a bounded, rational, autonomous individual, but as an experience that is not only multiple and partial, but reveals how people's everyday practices are connected within greater relations of ruling. As my literature review illustrates, I traversed the literature in search of theoretical insights positioned to attend both ethically and ethnographically to the embodied experiences and practices of my study's participants. Having lived in the Kansai region for about five years¹⁰⁶ before undertaking my PhD study, my own embeddedness in these relations was impossible to deny. Yet, being so thoroughly embedded, I often felt confined in my attempts to critically explore and discuss the topics of food and food safety following TEPCO's nuclear disaster. What I required was a method for both recognizing and breaking through these limitations.

I discovered institutional ethnography at the end of 2015 and designed my ethnographic fieldwork based on its principles. It appeared to be a method of inquiry that could creatively and ethically address the experiences of *konran* in a way that was attentive not only to the situated actualities of myself and my study's participants, but how we are acting and being enacted within complex, often invisible, textually-mediated relations of ruling. I especially appreciated the method's commitment to producing insights that would be of interest to my participants, engaging them as collaborators in the research process with the goal of producing information that could help them better conceptualize their own embeddedness within relations of ruling. At the same time, however, I wondered whether or not institutional ethnography was analytically suited to the challenge of attending to myriad other non-textual actors contributing to the experiences of *konran*, including, of course, radionuclides. In the way that Davis and Hayes-Conroy (2017) used Steinberg and Peters' (2015) concept of "wet ontologies" to highlight the biophysical presence of unstable and fluid-moving radionuclides within the social milieu, I wondered how I could keep the relations among humans and more-

¹⁰⁶ Approximately two years prior to and three years following TEPCO's nuclear disaster.

than-humans—radionuclides and others—vibrant in my research. Though I was first exposed to the field of material semiotics in 2015, I did not quite understand its application to my project until late 2016, after the completion of my fieldwork.¹⁰⁷ Once thoroughly exposed to scholarship in the field, I was sure that many of its insights and sensibilities could contribute greatly to my analysis, providing tools for attuning to the heterogeneous actors that participate in the enactment of *konran*. In my struggle to decide on how to proceed, Annemarie Mol's (2002: 177) question of "what to do?" rang through. What was the best way to proceed in my particular project? What could emerge from blending aspects of these two methods in practice?

Editors of the recently published *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene* (Tsing et al., 2017) seemed to be in a similar position in regards to the 'what to do?' question. In the book's introduction to the section on the ghostly hauntings of the Anthropocene, they pose an important query about the purpose of their collective work: "How can we best use our research to stem the tide of ruination?" Their answer?

[B]y showing readers how to pay better attention to overlaid arrangements of human and nonhuman living spaces [in hope] that such attention will allow us to stand up to the constant barrage of messages asking us to *forget*—that is, to allow a few private owners and public officials with their eyes focused on short-term gains to pretend that environmental devastation does not exist. (Gan et al., 2017: G1, original emphasis)

The response of these scholars—their attentiveness to tracing and explicating the messy, situated, historically embedded, yet historically contingent human and more-than-human material-semiotic relations in a way that attunes readers to the art of noticing these relations—provided an important example of how material-semiotic

¹⁰⁷ I would like to thank Annemarie Mol who visited the University of Otago's Centre for Sustainability in late 2015 and encouraged me to look beyond governmentality. I am also thoroughly indebted to my supervisors, Katharine Legun and Hugh Campbell, who encouraged me to use material-semiotic sensibilities in analyzing my thesis topic in a book chapter we co-authored (see Burch, Legun, & Campbell, forthcoming). I have to admit that since I began attuning to my project using material-semiotic sensibilities, I have found it difficult, if not impossible, to ignore or switch them off.

sensibilities could enhance my analysis. Not only could I use my research to explicate ruling relations in a way that was useful for my participants, but I could also provide a space for myself and my participants to engage in onto-political play, which begins with noticing our own embeddedness within heterogeneous material-semiotic relations. As mentioned, openly discussing radiation and food following TEPCO's nuclear disaster in a way that acknowledges the multiplicity of people's experiences has been challenging in a political climate trying to contain the 'overflow'¹⁰⁸ of radionuclides—expressly epitomized in Japanese Prime Minister Abe Shinzō's (2013) monumental assurance to the International Olympic Committee, and the world, that “the situation is under control.” This challenge of vocalizing that which should not be spoken exists for both myself as a researcher trying to problematize these issues, as well as my study's participants who were asked to openly discuss their experiences. So, what exactly was I doing studying this topic five years after the onset of the nuclear disaster, during a period when everything was “under control”? Would ontological play and the explication of ruling relations be creating turbulence? Or would it be attuning to tensions already permeating people's everyday experiences? This is where I turned to Donna Haraway (2016) for insights into “staying with the trouble.”

In her 2016 book of that title, Haraway (2016: 1) explains: “staying with the trouble requires learning to be truly present, not as a vanishing pivot between awful or edenic pasts and apocalyptic or salvific futures, but as mortal critters entwined in myriad unfinished configurations of places, times, matters, meanings.” She argues that it is through staying with the trouble and thinking together across all our differences that we may “become capable, with each other in all of our bumptious kinds, of response,” that we may become ‘response-able’ in turbulent times in which not only the usual pace of life, but also the potential for mutual survival, is disrupted or destroyed (Haraway, 2016: 1). According to Haraway (2016: 38), it is only through being attentive to our messy entanglements that “response-ability” can be cultivated, which in turn may lead to the collective cultivation of “conditions for ongoingness.” This form of collective paying-attention and cultivation of the conditions necessary for the ongoingness of life on this planet requires sensibilities for recognizing ruling relations—the pulsating

¹⁰⁸ Callon et al. (2009). See Section 2.6.4.

drumbeat of modern Progress¹⁰⁹ with its fervent calls for simplicity and the smoothing over of multiplicity and difference—along with the situated messiness of sociomaterial entanglements from which anything we might recognize as ‘the social’ emerges. Material-semiotic sensibilities and collaborative forms of onto-political play seemed essential to my project, especially because the realities I explore involve attuning and attending to relations among myriad heterogeneous actors—including unstable, imperceptible and ontologically destabilizing radionuclides.¹¹⁰

In the field of material semiotics, there have been discussions on how to best attend to heterogeneous relationality among humans and more-than-humans, while remaining staunchly attentive to the unevenness of the world,¹¹¹ and the often invisible and geopolitically infused power relations that contribute to the emergence of locally situated practices.¹¹² Encouraged by these projects, in this thesis I would like to contribute to this discussion by exploring how insights from institutional ethnography, infused with material-semiotic sensibilities, help me to attend to both textually-mediated ruling relations and wider sociomaterial entanglements. Thus, in this thesis I adopt insights from institutional ethnography to trace textually-mediated attempts to coordinate everyday practice, as well as sensibilities from the field of material semiotics to attend to difference, multiplicity and other human and more-than-human relations that contribute to the enactment of local realities. I refer to this as ‘a vital institutional ethnography.’¹¹³

¹⁰⁹ I borrow the metaphor of a drumbeat from Anna Tsing (2015) who uses it to describe the rhythm that coordinates unified advancement toward the universal Progress promised by promoters of modernist projects. ‘Progress’ is capitalized because of its universal character and its disconnection from situated sociomaterial entanglements. Tsing (2015: 23-4) compares the “single perspective” offered by drumbeat modulated rock-and-roll from the twentieth century, to polyphony where there are multiple melodies and rhythms existing at the same time, with no central unifying beat. The latter is much closer to the conceptualizations of assemblage she bases her work on (see Section 2.6.2).

¹¹⁰ See Barad (2017) for a captivating description of the ontologically destabilizing force of radionuclides.

¹¹¹ The term “uneven world” was used by Swanson (2013) who borrowed it from Radhakrishnan (2003).

¹¹² See, for example, Swanson (2013) and Tsing (2005; 2015).

¹¹³ According to an online etymology dictionary, the word ‘vital’ comes from the Latin term *vitalis* which refers to “of or belonging to life” and was later used to refer to something of necessity or importance in the sense that something was “essential to life” (see <https://www.etymonline.com/word/vital>). The Online Oxford English Dictionary describes the

3.2 Finding common ground: Institutional ethnography and material semiotics

When Canadian sociologist Dorothy E. Smith (1987: 2) first developed institutional ethnography, she was focused on creating an “alternative” sociology able to account for the particular experiences of women in their everyday lives. Noticing that the experiences of women were not adequately accounted for within traditional sociology, Smith was looking for a method to uncover and illustrate the ways in which women’s everyday embodied experiences were being coordinated by decisions made extra-locally. However, it soon became clear that what was initially intended to serve as a ‘sociology for women,’ was also an approach useful for investigating the everyday experiences of any people embedded within ruling relations (M. Campbell & Manicom, 1995: 7-12). Since its inception, institutional ethnography has been used to explore the social organization of a vast array of topics spanning health care (M. L. Campbell, 1998; McCoy, 2005; Mykhalovskiy, 2001; Mykhalovskiy & McCoy, 2002; Rankin, 2001; 2014; Rankin & Campbell, 2009), the everyday experiences of women and mothers (Griffith & Smith, 1987; 2005; D. E. Smith, 1978), the work of feeding a family (DeVault, 1994), activism (G. W. Smith, 1990c), education (Manicom, 1995; McCoy, 1999; Rankin et al., 2010), the criminal justice system (Pence, 2001), social work (De Montigny, 2014), environmental policies (Eastwood, 2005; 2011; S. M. Turner, 2002; 2003a), disaster recovery (A. Williams & Rankin, 2015), international development regimes (Mueller, 1995), nutrition (Travers, 1996), organic farming regulations (Wagner, 2014), and youth homelessness (Nichols, 2014), to name just a few. Institutional ethnography has also been discussed in the Japanese literature (Uetani, 2009), notably used as a method of inquiry to explicate the social organization of middle class family life in Japan (Ueda, 1995). There have additionally been some scholars who have combined insights from both institutional ethnography and actor-network theory in their inquiries (Thompson & Pinsent-Johnson, 2011; Tummons,

word ‘vital’ is an adjective referring to something of ‘absolute necessity’ or “indispensable to the continuance of life,” something “full of energy,” or even something “fatal”—as in a vital wound (see <https://en.oxforddictionaries.com/definition/vital>). I see a ‘vital institutional ethnography’ as encompassing all of these aspects in the ways it can attune to myriad actors and activities that have been ignored or silenced within the ruling relations of the Capitalocene and Anthropocene—both the actors and activities that are life-giving and life-taking, what I refer to as the vital and the vicious. The vital (essential) nature of an inquiry that attunes to both ruling texts and other humans and more-than-human sociomaterial relationality will be touched on throughout the thesis and addressed directly in the conclusion (Chapter 8).

2010). Similar to these authors, I find many similarities and opportunities for exchange between institutional ethnography and material-semiotic attuned approaches, and will outline them in this section.¹¹⁴

To begin, institutional ethnography is similar to other material-semiotic attuned methods in its rejection of grand narrative theory.¹¹⁵ Additionally, as with material-semiotic attuned methods, institutional ethnography is not considered a methodology with specific prescribed ways of conducting research. Instead, it is referred to as a ‘method of inquiry’ which directs researchers on how to go about uncovering the ways in which people participate in the enactment of ruling relations—how their everyday activities are coordinated by material texts and discourses produced in extra-local settings and established through trans-local material relations.¹¹⁶

Given institutional ethnography’s focus on explicating the material coordination of social organization, the method of inquiry finds most common ground with studies and

¹¹⁴ I have just recently become aware of cautions against the blending of institutional ethnography with actor-network theory and other material-semiotic attuned methods, including the work of Mol (2002). The cautions came from Janet Rankin (2017), an institutional ethnographer I highly respect, whose comments arise from concerns that blending these methods distract from the analytical project of institutional ethnography. Although in this thesis I attempt to infuse institutional ethnographic attunements with those from material semiotics, I do take these concerns seriously and will address them in the conclusion (Chapter 8).

¹¹⁵ In fact, institutional ethnography’s classification as an ‘alternative sociology’ is partially based on its rejection of “the dominance of theory” (D. E. Smith, 2005: 49-50) in traditional sociological inquiries—that is, the tendency for traditional sociological inquiries to strip autonomy from people’s everyday realities in favor of accounts of an abstract ‘social’ represented in theoretical concepts. In describing her early work in studying the women’s movement, Smith (2005: 28, original emphasis) explains that she noticed how the implantation of sociological theory onto people’s activities prevented more interesting, and potentially useful, insights from surfacing out of research participants’ own lived experiences: “Once the sociological frame was committed, inquiry and discovery *from within* the women’s movement was precluded.”

¹¹⁶ McCoy (1999) distinguishes between Smith’s use of the term ‘extra-local’ and her use of the term ‘trans-local,’ arguing that while ‘extra-local’ points to something happening beyond the local setting, ‘trans-local’ helps to focus on happenings and coordination across space and time. She argues that the term ‘trans-local’ “reminds us always to see local moments as constituents of extended relations. The term ‘extra-local’ is appropriately used to describe textual forms of knowledge that are not based in the (local, embodied) experience of the knower” (1999: 249-50, n.4). In this thesis, I will use McCoy’s distinction in referring to the location of ruling institutions as ‘extra-local,’ but the active coordination of ruling relations as ‘trans-local.’

conversations in the field of material semiotics focusing on processes of coordination across difference (Mol, 2002; 2010a; Swanson, 2013; Tsing, 2005; 2015) and the ways in which ““endless attempts at ordering” (Law, 1994: 101, original emphasis) are actualized—or not—through situated practices (Callon, 1986; 1991; Law, 1986; 2012). This shared focus on the material coordination of situated, embodied activity reflects institutional ethnography’s own form of ontological politics: its grounding in the “ontology of the social” (D. E. Smith, 2005: 51-4).¹¹⁷

The ‘ontology of the social’ is intended to guide researchers to view ‘the social’ not as an entity in itself, but as an enactment of a number of locally situated, extra-locally coordinated activities. In Smith’s (2005: 50) words, “[c]ommitment to learning from actualities as they are experienced and spoken or written by those actively involved in them is essential to the project.” She goes on to explain:

In working through the design of an ontology for institutional ethnography, we confront, as a problem, the strange disappearance of people from mainstream sociological discourse and the strange detachment from actualities to which sociology’s discursive practices commit its practitioners. Institutional ethnography’s design, by contrast, must ensure that people remain the subjects, the knowers, or potential knowers of what institutional ethnography discovers. (D. E. Smith, 2005: 52-3)

As Smith’s quote makes explicit, in institutional ethnographies the lived, embodied experiences of participants do not disappear into abstract categories used to explain ‘the social,’ nor is ‘the social’ considered to be located entirely within discourse as in many postmodern conceptualizations (see DeVault, 1999: 50). Instead, ‘the social’ is enacted through the activities of situated people whose experiences and realities are necessarily

¹¹⁷ While the ontology of the social was inspired by Marx’s social ontology, institutional ethnography differs in its way of viewing “the everyday world as reflexively, recursively organized. In particular, [institutional ethnographers] insist that investigation being from inside an actual world with the intention of making sense of it in its own terms” (G. W. Smith, 1995: 26). Thus, institutional ethnography allows for broader investigation into the vast array of ruling relations involved in social organizing beyond economic organization and ruling relations directly involving capital and production.

multiple and partial.¹¹⁸ Institutional ethnography's conceptualization aligns well with Latour's (2005: 7) decision to "define the social not as a special domain, a specific realm, or a particular sort of thing, but only as a very peculiar movement of re-association and reassembling." Law (1994: 2, original emphasis) similarly describes 'the social' as a hybrid enactment: "what we call the social is *materially heterogeneous*: talk, bodies, texts, machines, architectures, all of these and many more are implicated in and perform 'the social'." Thus, it seems that Smith, Latour and Law are in general agreement that simplified, abstract categorizations of 'the social' conceal the real messiness, contingency and heterogeneous actors involved in enacting locally-situated realities.

In addition, Smith (2001: 161, original emphasis) explains her desire "to create a sociology *for* rather than *of* people" which "draws on people's own good knowledge of their everyday/everynight¹¹⁹ worlds and does not substitute the expert's 'reality' for what people know in the doing." It is within people's local, embodied experiences that institutional ethnographers collect clues in a 'botanizing fashion' (Eastwood, 2005: 59-61) on the material relations that contribute to the emergence of everyday activities, paying specific attention to instances in which people's personal lived experiences seem to be at odds with how these experiences are being referred to officially (usually in objectified and generalizing ways). These unsettling experiences, or *disjunctures*,¹²⁰ direct researchers to the problematic that guides the study's analysis (M. L. Campbell

¹¹⁸ DeVault (1999: 50) describes institutional ethnography's take on multiplicity and partialness: "[Institutional ethnography] refuses any single view or narrative; the world 'out there' looks quite different from different locations. Multiple views can be connected because of the places and interactions that bring people together from their different locations. Here, I do not mean 'bring together' in a feeling sense, but very literally—as when a social worker travels to her job at a Headstart program in a poor neighborhood, when a waitress serves a business lunch in a downtown restaurant, or when a middle-aged male employee comes into my university office to empty the trash. The concreteness of these examples—the particularity they suggest—is meant to work as a kind of touchstone: this specificity is essential to the analysis and must remain in view in the institutional ethnographer's account."

¹¹⁹ Smith (1987: 90) describes the everyday/everynight world as "that world we experience directly. It is the world in which we are located physically and socially. [...] It is necessarily local—because that is how we must be—and necessarily historical."

¹²⁰ While disjunctures are usually referred to in the singular form, I sometimes use the plural form to represent the multiplicity of these experiences.

& Gregor, 2004: 48). In this thesis, both my own and my participants' experiences of *konran* attuned me to the study's problematic.

Borrowing Marx's method of historical materialism, institutional ethnographers share with the field of material semiotics an understanding of the contingency and indeterminacy of history and the material relations that participate in enacting 'social order.'¹²¹ Institutional ethnography takes seriously not only the contingency of social ordering and the agency of research participants in enacting ruling relations, but also participants' ability to comprehend their own embeddedness within these relations. Thus, the method is referred to as a "reflexive-materialist methodology" (G. W. Smith, 1995: 24). That is, its goal is not only to serve as an academic exercise of tracing or mapping ruling relations, but to produce knowledge for participants about their own embeddedness within these relations, giving them the opportunity to use this information to enhance their own understandings of their experiences of disjuncture.¹²²

Therefore, institutional ethnography addresses issues of social and environmental justice, not through normative arguments about what is right or wrong, good or bad, but by producing research for study participants—the ones experiencing disjunctures in their everyday lives. That is, institutional ethnographic research results should be designed *for* participants, providing them with information so they might better understand their own embeddedness within trans-locally coordinated material semiotic relations.¹²³

¹²¹ As mentioned in the literature review, Law's (1986: 234) early work on the materially-mediated organization of Portuguese imperial expansion in the 15th and 16th centuries revealed that forms of 'social order' are possible if humans and more-than-humans act, or are enacted, as docile and passive. At the same time, the field of material semiotics has been successful in demonstrating how, given the indeterminate agency of human and more-than-human actors, such orderings are actually quite precarious, though sometimes manage to "hang together" long enough to appear stable (Mol, 2002: 5). What we realize is that 'the social' is not a static, certain and completely knowable entity, but "the recursive but incomplete performance of an unknowable number of intertwined orderings" (Law, 1994: 101).

¹²² Smith (2005: 29, original emphasis) explains: "The aim of the sociology we call 'institutional ethnography' is to *re-organize the social relations of knowledge of the social* so that people can take that knowledge up as an extension of our ordinary knowledge of the local actualities of our lives."

¹²³ Some scholars in the field of material semiotics also share the sentiment to connect with audiences and intervene in ways that might improve how multiplicity and difference is handled

While institutional ethnography's ontological grounding and research goals seem to position it as a method of inquiry trapped solely within the social science's 'humanist tradition,'¹²⁴ confined to the paradigm of human exceptionalism, or "human exemptionalism" (Dunlap:1994wf; Murdoch, 2001), the method's focus on materially-mediated coordination requires researchers to recognize the agency of humans and more-than-humans. That is, institutional ethnography "assumes an actual, material world" (DeVault, 1999: 50), where people are embedded within sociomaterial relations—some visible and some invisible to them—which contribute to the enactment of their everyday lives. The shared commitment to acknowledging and tracing material-semiotic relations in a way that recognizes the participation of humans and more-than-humans in enacting realities is where I see the real potential for work in institutional ethnography and material semiotics to link up. Both methods are grounded in strong ethical commitments, institutional ethnography offering a robust method of tracing trans-local ruling relations and attending to the agency of participants in the research process, and material-semiotic sensibilities providing guidance on engaging with ontological politics and noticing heterogeneous relations among humans and (more-than-textual forms of) more-than-humans—as well as the tensions permeating these relations—that contribute to everyday, situated happenings.

Given institutional ethnography's commitment to producing research that contributes to the onto-political play of human actors,¹²⁵ I see this thesis as an attempt to bring the method of inquiry into conversations on the ethics of recognizing more-than-human agency as discussed by Carolan (2016).¹²⁶ While institutional ethnographers usually

in practice. For example, as previously mentioned, some scholars attempt to engage readers by showing them "how to pay better attention to overlaid arrangements of human and nonhuman living spaces" (Gan et al., 2017: G1). In addition, Mol (2002: 116) describes her call for empirical scholarship as "a plea for attending to the various ways in which differences are handled in various sites and situations—and a way of wondering when and where we might do better."

¹²⁴ See Carolan (2016: 236) and Section 2.6.6.

¹²⁵ As previously mentioned, one of the goals in institutional ethnography is to help study participants to understand 'the social' through a different ontological lens, that of 'the ontology of the social' (see D. E. Smith, 2005: 29).

¹²⁶ As described in Section 2.6.6, Carolan (2016: 236) ponders: Does focusing attention on more-than-humans disregard the suffering of human beings? Or is suffering "a product of us not caring fully for everyone involved"?

limit their engagement with more-than-humans to material texts that participate in coordinating relations and activities across space and time, in this thesis I will follow this tendency while also using sensibilities from the field of material semiotics in order to remain attentive to myriad other heterogeneous humans and more-than-humans participating in everyday enactments. I will explicitly adopt Latour's (1999: 288) definition of *action* which refers not simply to "what people do," but "what is accomplished along with others"—human or more-than-human. This definition also fits well with Mol's (2002: 44, original emphasis) efforts to disrupt commonly held definitions and assumptions about active (human) subjects and passive (natural) objects, framing them instead "as parts of events that occur and plays that are staged. If an object is real this is because it is part of a practice. It is a reality *enacted*." Both of these conceptualizations became very useful in sensitizing my analysis to explore experiences of *konran*, and even food, as multiple, hybrid enactments (see Latour, 1993)—as opposed to the result of 'rational' or 'irrational' 'choices' made by 'autonomous,' 'liberal,' 'individual' actors.¹²⁷

Law (1994: 95) has argued that inquiries concerned with "ordering and inequalities" need to be handled "within a pragmatic and relationally materialist sociology." As in material-semiotic attuned methods, institutional ethnographers depend on 'immutable mobiles,'¹²⁸ specifically texts, to provide clues to these, often invisible, attempts at ordering. In this thesis, I will be guided by insights from both the fields of institutional ethnography and material semiotics, a collaboration which emerges as a vital institutional ethnography—a relational-materialist-reflexive (and hopefully diffractive¹²⁹) method of inquiry for tracing ruling relations while remaining attentive to

¹²⁷ See Callon and Law (1995), Mol (2010a; 2010b), and Abrahamsson et al. (2015) for interesting insights into how the field of material semiotics views the contradictions inherent in concepts of 'autonomy' and 'choice.' Also see Haraway (1994: 64-6, original emphasis) for a discussion on the potential troubles stemming from unreflective use of the terms "*actors, agencies and actants*" and how these troubles might be addressed. In this thesis, my use of the term 'actor' does not imply independent autonomy. An actor is just one of many humans or more-than-humans entangled and 'intra-acting' (Barad, 2007: 33) within dense material-semiotic assemblages. See Section 3.3.2.3 for more on Barad's (2007) concept of 'intra-action.'

¹²⁸ See Latour (1986) and Section 2.6.3.

¹²⁹ Haraway (1994: 63) refers to *diffraction* as her "favorite optical metaphor," describing it as "the noninnocent, complexly erotic practice of making a difference in the world, rather than displacing the same elsewhere." Also see Barad (2014).

the reflexive capacity and subjectivity of study participants, as well as the participation of more-than-humans in their textual and non-textual forms.

3.3 Piecing together a vital institutional ethnography

Similar to other studies in institutional ethnography, I structured my thesis to engage in two different types of investigations: an entry level, ethnographic investigation beginning with the everyday activities and lived experiences of human actors experiencing *konran*; and a secondary level analytical investigation tracing how these experiences have emerged through situated entanglements with textually-mediated ruling relations. However, the analysis does not end with attention to explicating ruling relations. Instead, I expand my analysis, adopting sensibilities from the field of material semiotics to notice other participants—human and more-than-human—contributing to the enactment of *konran*. Thus, my analysis not only traces material ruling relations contributing to these experiences but, following Mol (2002: 26), works to “unravel” these experiences in ways that attend to “[a]n endless list of heterogeneous elements that can either be highlighted or left in the background, depending on the character and purpose of the description.” By welcoming both textual and non-textual more-than-human materiality into the analysis, my goal is to engage in ontological play in a way that guides my participants to notice their embeddedness within a messy, heterogeneous and precarious “established disorder”¹³⁰—a conceptual space where the singular and the multiple, as well as the tensions, coherences and incoherencies among them, are able to coexist across space and time.

Expanding my analysis to explicate how ruling relations are enacted within the contingent ‘established disorder,’ I will adopt the “logic of oscillation” presented by Law (2002: 9) as way of attuning to the wavering between the single and the multiple. I will additionally borrow the concept of “single reality” as discussed by both Mol (2002: 87) and Law (2002) to illustrate how ruling texts and discourses attempt to order people and their heterogeneous sociomaterial entanglements in ways that fit into a coherent, single, established way of doing or being. Single realities, translated into ruling texts

¹³⁰ The term was first used by Haraway (1994), and later borrowed by Law (2002: 126).

and discourses, are essential to the process of social coordination.¹³¹ At the same time, however, studies into multiplicity and difference have shown us that behind the ‘presence’ of a seemingly coherent object—be it the body, the wing of an aircraft, or a ruling text—lies myriad heterogeneous relations left ‘absent.’ Law and Singleton (2005: 343-4) refer to this as “absent presence.”¹³²

Law and Singleton’s ‘absent presence’ is similar to the figure of the ‘ghost’ that appears in the book *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene* (Tsing et al., 2017). In their introduction to the section on ghosts, the book’s editors describe how they use ‘ghosts’ as figures to help in thinking through various historical happenings—and their participants—that have been brushed aside or ignored in the linear, forward-moving industrial progress projects of the Capitalocene, their enduring existence haunting humans and more-than-humans who inhabit the Anthropocene. The editors explain:

The winds of the Anthropocene carry ghosts—the vestiges and signs of past ways of life still charged in the present. [...] Our ghosts are the traces of more-than-human histories through which ecologies are made and unmade. Our era of human destruction has trained our eyes only on the immediate promises of power and profits. This refusal of the past, and even the present, will condemn us to continue fouling our own nests. How can we get back to the pasts we need to see the present more clearly? We call this return to multiple pasts, human and not human, “ghosts.” (Gan et al., 2017: G1-2)

Throughout this thesis, I follow the editors in attuning to the ‘ghosts’ that lurk within Japan’s post-2011 ruling relations. I additionally follow the editors in attuning to

¹³¹ Put by Law and Singleton (2005: 342), a single reality “makes it possible to negotiate and secure transactions between different cultures or professional groups.”

¹³² Law and Singleton (2005: 343-4) explain ‘absent presence’: “we cannot understand objects unless we also think of them as sets of present dynamics generated in, and generative of, realities that are necessarily absent. Such objects are transformative, but the transformations are not the gentle flows discussed [...] in fluid objects. [...] This is because they take the form of jumps and discontinuities. In this way of thinking, constant objects are energetic, entities or processes that juxtapose, distinguish, make and transform absences and presences. They are made in disjunction.”

‘monsters’ of the Anthropocene—specifically monstrous sociomaterial entanglements with humans and more-than-humans—which are often obfuscated within ruling relations and, thus, difficult to notice. In their introduction to the section on monsters, the editors use ‘monsters’ as figures to describe the frightening, monstrous qualities of some sociomaterial entanglements, and the need to attune to these messy material-semiotic relations through careful, and often times uncomfortable, “arts of noticing.”¹³³ They explain:

The seductive simplifications of industrial production threaten to render us blind to monstrosity in all its forms by covering over both lively and destructive connections. [...] Somehow, in the midst of ruins, we must maintain enough curiosity to notice the strange and wonderful as well as the terrible and terrifying. [...] Such curiosity also means working against singular notions of modernity. How can we repurpose the tools of modernity against the terrors of Progress to make visible the other worlds it has ignored and damaged? Living in a time of planetary catastrophe thus begins with a practice at once humble and difficult: noticing the worlds around us. (Swanson et al., 2017: M7)

Throughout this thesis, I attune to the ‘absent presence’ of both ‘ghosts’ and ‘monsters’ by attending to the oscillation between the “multiple absence” of heterogeneous relationality lying behind the “singular presence” of ruling texts and discourses (Law, 2002: 9), while at the same time noticing how relations among these heterogeneous elements play out through everyday practices and ‘tinkerings.’¹³⁴ I will also explore how the single reality being deployed through ruling relations attempts to ‘mute’ (Latour, 2005) and marginalize some actors and activities at the expense of others. In particular, I will focus on the muting of radionuclides, the people who try to notice them, as well as on how processes of muting may be contributing to experiences of *konran* or other forms of suffering (see Carolan, 2016: 236). In the following sections I will describe how both the entry level and secondary level investigations were actualized in the current research project.

¹³³ The phrase “arts of noticing” comes from Tsing (2015: 17). Also see Section 2.6.1.

¹³⁴ See Mol et al. (2010a: 13), Section 2.6.4 and Section 2.6.6.

3.3.1 Entry-level ethnographic investigation

As its name suggests, institutional ethnography depends on the use of ethnographic methods to conduct scientific inquiry into everyday practices that make up the precarious assemblages we refer to as ‘the social.’ However, differing from classical ethnographic methods where scholars describe and interpret “how the culture-sharing group works” (Creswell, 2013: 92), institutional ethnography is focused on tracing the trans-local material relations that coordinate and contribute to the enactment of local, situated activity. Based on the principles and analytic goals of institutional ethnography (see M. L. Campbell, 1998; Deveau, 2008), my ethnographic inquiry was guided by three basic assumptions: (1) people are experts¹³⁵ in conducting their everyday activities; (2) knowledge¹³⁶ is produced through people’s everyday activities in situated, local settings; and (3) the everyday activities of locally-situated people are coordinated through trans-local, textually-mediated relations.

Smith (1990a) uses the concept of *ruling relations*¹³⁷ to explain the social organization of particular, locally-based activities by powerful, extra-locally situated forces. The concept of ‘social relations’ is also paramount to institutional ethnography as it “directs attention to, and takes up analytically, how what people are doing and experiencing in a given local site is hooked into sequences of action and coordinating multiple local sites where others are active” (D. E. Smith, 1999: 7, emphasis removed). The concept of ruling relations points to an institutional complex which, though it exists beyond the local setting, is active in attempting to coordinate people’s activities through material

¹³⁵ This is similar to Law’s (1994: 4, original emphasis) view that “we are *all* social philosophers.”

¹³⁶ While I focused on *knowledge* during my fieldwork, through the incorporation of material-semiotic sensibilities I eventually turned away from epistemological debates, attending instead to ontological politics and the enactment of, and relations among, multiple realities. See Chapter 6 and Section 3.3.1.4.

¹³⁷ Similar to governmentality, in institutional ethnography the concept of ‘ruling relations’ refers to historically specific relations which, similar to the concept of the *dispositif* (see Section 2.4.2), are used to manage the social milieu in a way that promotes circulation of the economy (DeVault, 2006: 294; Nichols, 2014: 6-8). In Smith’s (1990a: 6) words, ruling relations refer to “those forms that we know as bureaucracy, administration, management, professional organization, and the media. They include also the complex of discourses, scientific, technical, and cultural, that intersect, interpenetrate, and coordinate the multiple sites of ruling.”

texts.¹³⁸ This is what Smith (1990a; 1990b; 1999) is referring to when she says that social relations are ‘textually mediated.’ Texts provide the materiality researchers need to trace social relations and understand institutions’ roles in shaping everyday local experience. As with other institutional ethnographic studies, in this thesis ethnographic observation and immersion into a specific local setting serves as an entry point for discovering and exploring the study’s problematic (Section 3.3.2.2), which involved searching for clues to how people’s experiences of *konran* are embedded within, and emerge from, trans-local textually-mediated ruling relations. The following sections will address some of the aspects of this entry-level ethnographic investigation.

3.3.1.1 Entering the material-semiotic field

Guided by insights from institutional ethnography, discovery and exploration of the study’s problematic involved in-depth interviews and focus group discussions with forty-three participants in conjunction with participant observation, casual conversations, and auto-ethnographic reflections (see M. L. Campbell & Gregor, 2004; DeVault & McCoy, 2002; S. M. Turner, 2003a). All interviews and discussions were conducted by myself in Japanese, were recorded and later transcribed into Japanese. The interviews and focus groups were of great importance as they were opportunities to collect very rich descriptions and detailed accounts of people’s experiences of *konran* following TEPCO’s nuclear disaster. While my fieldwork was originally designed to trace textually-mediated ruling relations, the attentiveness to “events-in-practice” (Mol, 2002: 21) required for such a project produced process-narratives that were also useful for an analysis using material-semiotic sensibilities. Similar to Mol’s (2002: 15, original emphasis) ethnographic approach of ‘praxiography,’ my participants were asked questions as if they were ethnographers¹³⁹ of their own experiences, giving them the opportunity to describe, in detail, how things are “*done* in practice.” Thus, though insights from institutional ethnography were used in designing the ethnographic

¹³⁸ Smith (1999: 49) describes those who rule as: “that internally coordinated complex of administrative, managerial professional, and discursive organisation that regulates, organizes, governs, and otherwise controls our societies.”

¹³⁹ In institutional ethnography, all participants are regarded as competent and knowledgeable informants, or ‘knowers,’ whose experiential accounts hold clues as to how their everyday lives are socially organized (M. L. Campbell & Gregor, 2004: 78). It is the task of institutional ethnographers to begin their inquiries from the actual experiences of the embodied knowers whose everyday actions are being coordinated by extra-local forces.

inquiry, what resulted were thick descriptions where experiences, objects and practices emerged as “both material and active” (Mol, 2002: 20), making them accessible for analysis using material-semiotic sensibilities.

Ethnographic fieldwork for this thesis took place in six prefectures in the Kansai region of Japan including Kyoto, Osaka, Hyogo, Nara, Shiga and Wakayama (Figure 6).¹⁴⁰ The Kansai region is located approximately 600 kilometers south-west of TEPCO’s nuclear disaster. As previously mentioned, by the time I began my fieldwork I had lived in the region for about five years. There are three major reasons for choosing to conduct my research in the region. First, my study’s problematic originated from some of my own observations and experiences of everyday eating in the Kansai region following the nuclear disaster, so staying in the region made sense for explicating ruling relations from that particular standpoint. Second, the region’s distance from TEPCO’s nuclear disaster makes it an interesting location to study trans-local ruling relations. Because fallout from TEPCO’s nuclear disaster was not severe in the Kansai region, people’s everyday lives do not tend to involve navigating their relationship with radionuclides in the environment,¹⁴¹ but with navigating their relationship with radionuclides in food and other mobile materials. Thus, fieldwork in the region—an area where people should be far enough removed from the nuclear disaster that radiation should not be of concern—provided fertile ground for exploring the trans-local ruling relations involved in coordinating everyday eating post-2011. Third, ‘consumers’—especially those living outside of prefectures directly suffering from the overflow of TEPCO’s radionuclides—continue to be chastised in public discourse, blamed of spreading *‘fūhyōhigai’* (literally ‘harm caused by rumors,’ but understood as scientifically ‘groundless’ and ‘harmful

¹⁴⁰ While all of my participants were living in Kyoto, Osaka, Hyogo, Nara and Shiga in 2016, I have spent all of my time living in Japan in Wakayama—including during fieldwork for this project in 2016. I include it here as some of my auto-ethnographic reflections are based on my experiences in Wakayama. Also see Figures 3, 4 and 5 for the location of my participants in March 2011 and at the time of their interview or focus group session in 2016.

¹⁴¹ Of course, seventeen of my participants had moved from areas within 260 kilometers of TEPCO’s nuclear disaster where they dealt with external exposure from TEPCO’s radionuclides. However, all participants were living in the Kansai region at the time of our interviews in 2016.

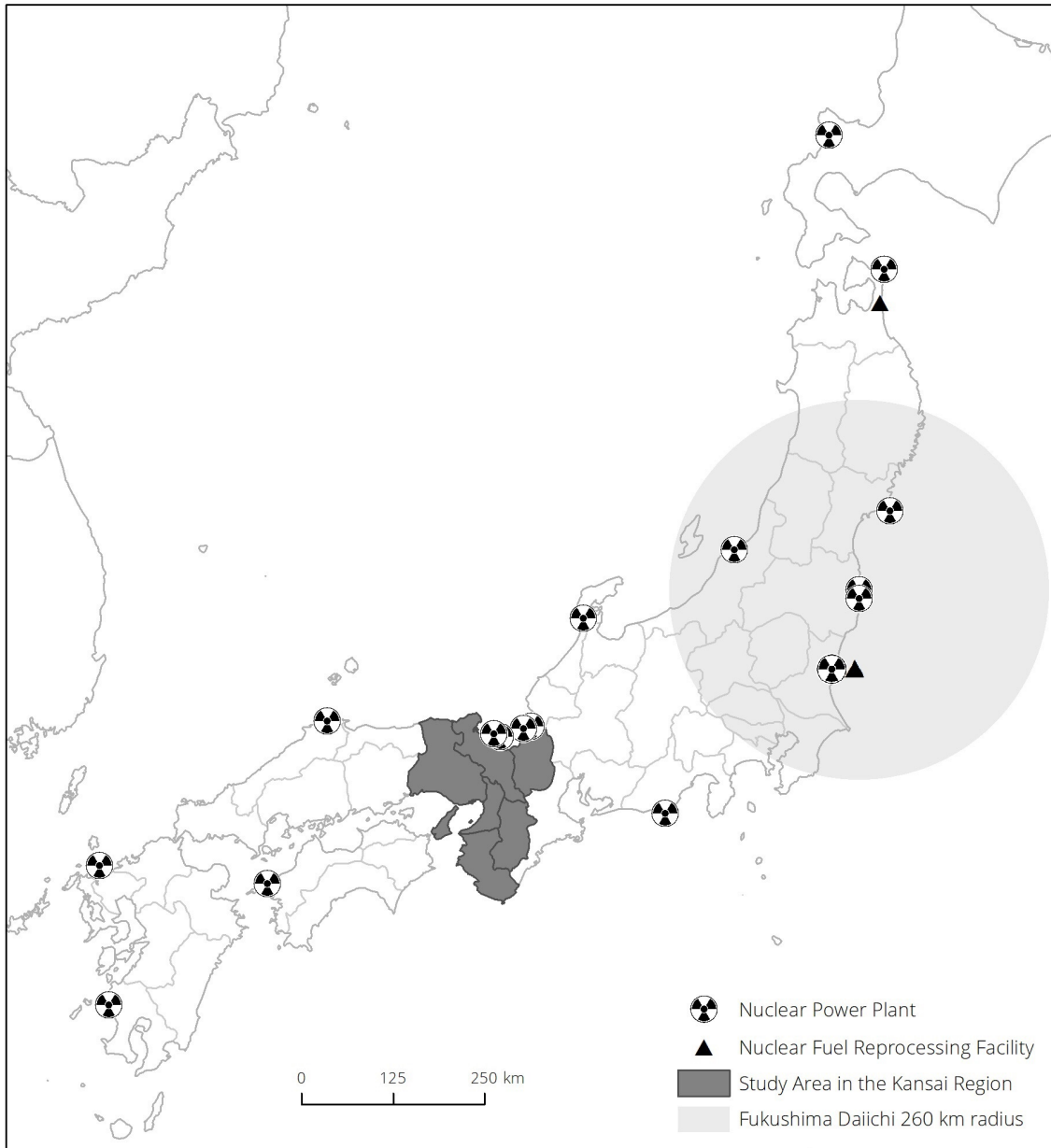


Figure 6 Study area in the Kansai region.

rumors’ that lead to economic damage) if they choose not to purchase foods based on concerns about the possible presence of radionuclides. Through attending ethnographically to “events-in-practice” (Mol, 2002: 21), this thesis is an attempt to ‘unravel’ some of these categorizations and concepts to better understand how they participate in trans-local ruling relations and in enactments of everyday eating.

My ethnographic fieldwork took place over seven months in 2016 and was conducted in two time frames: the first from March to June, and the second from September to November. The multi-sitedness of the inquiry was not designed to compare experiences

of participants, but to provide a rich diversity of experiences to allow for tracing how people situated in different localities around the region were “hooked up” within ruling relations (D. E. Smith, 2005: 41), providing insights and clues as to how the activities of people embedded within material-semiotic relations in different locations are being coordinated across space and time. Conducting a multi-sited ethnography that attends to multiplicity also proved to be important as it provided a rich opportunity for tracing other heterogeneous actors involved in enacting experiences of *konran* related to everyday eating. Interviewing a variety of people from across the region became an informative way for tracing how materials and discourses, including ruling texts, appear and are ‘tinkered with’ by people within their own particular material-semiotic entanglements.

3.3.1.2 Attuning to ruling relations: Noticing the everyday activation of ruling texts

Very similar to Latour’s (1986) concept of immutable mobiles (see Section 2.6.3), ruling texts do not only refer to printed or digital documents, reports and forms, but also photographs, sound recordings, videos, drawings and other formulations. The one thing that is required of the texts is that they have:

a relatively fixed and replicable character—that they can be stored, transferred, copied, produced in bulk, and distributed widely, allowing them to be activated by users at different times and in different places—that allows them to play a standardizing and mediating role. (DeVault & McCoy, 2002: 765)

Smith (2001: 168) sees texts as being “of foundational ontological significance to the existence of anything we can call ‘large-scale organization,’ or ‘institution.’” Institutions depend on objectified forms of knowledge to coordinate the activities of large groups of people situated across various locations.¹⁴² At the same time, institutions themselves do not exist as entities or objects, but “only in actual people’s doings [...which] are necessarily particular, local and ephemeral” (D. E. Smith, 2001: 163). Institutional ethnography challenges researchers to view and investigate institutions, not as taken-for-granted or abstract entities, but as a “complex of textually-

¹⁴² Smith (2001: 164) describes texts as necessary to the existence of institutions as their generalized and standardized forms allow institutions “to exist beyond particular times, places, and people’s doings.”

coordinated work processes” (D. E. Smith, 2001: 177), a complex of ruling relations that are accomplished through the *activation* of ruling texts in local settings.¹⁴³

By viewing everyday activities as embedded within material relations of ruling, seemingly taken-for-granted everyday activities become “textually invaded and regulated” (D. E. Smith, 2001: 173). This does not imply that texts hold any power to subordinate people in and of themselves. A text’s ability to coordinate social relations is only possible when *activated* by a person in the everyday (M. L. Campbell, 2014: 1503; D. E. Smith, 1999: 148-51). In other words, people are not completely subservient to textually mediated ruling relations. Instead they “actively constitute social relations. People participate in social relations, often unknowingly, as they act competently and knowledgeably to concert and coordinate their own actions with professional standards or family expectations or organizational rules” (M. L. Campbell & Gregor, 2004: 31).

One of the ways texts are implicit in social organization is through *text-reader conversations* (see D. E. Smith, 2014; S. M. Turner, 2014). According to Smith (2001: 175), people engage in text-reader conversations when reading, referring to or talking about ruling texts in their everyday activities.¹⁴⁴ Though they are termed ‘conversations,’ people’s interactions with texts do not allow for any discussion or revision of the original form. That is, while the reader is active in producing and reproducing knowledge through the act of reading, the text itself is static, immutable and unresponsive (D. E. Smith, 2001). Instead, “[t]he text establishes a set of terms, formalized sequences, providing standardized-for-all-participants methods for analyzing and recognizing what might be done and what gets done” (D. E. Smith, 2001: 183). Such texts are designed to coordinate work process so that they are efficient and accountable, while also ensuring that activities reflect the interests of the institution itself. However, through this process, other people’s interests can be subordinated in favor of the institution.

¹⁴³ See Smith (1990a; 1999) and Campbell (2014).

¹⁴⁴ Smith (1987: 166) explains that these actual activities are the “ways in which people are actually involved in the production of their everyday world, examined with respect to how that world is organized by and sustains the institutional process.”

Moreover, texts have the power to create generalized, abstract accounts of reality,¹⁴⁵ which are objective and do not account for the actual, local, unique, everyday bodily experiences of people acting and being enacted within specific historical settings, locations and times (M. L. Campbell & Gregor, 2004; D. E. Smith, 1999). Texts generalize and standardize the local, stripping people of any individual attributes and assigning them with institutionally defined subject positions such as ‘citizen,’ ‘consumer’ or ‘lay public’ (D. E. Smith, 2001: 185). These categories define and direct appropriate behavior and indicate what forms of action are recognizable by the institution. However, as mentioned, texts written in ways that construct specific accounts of reality do not have the power to suppresses divergent opinions or force people into subservient subject positions. It is people’s active participation in *activating* institutional texts and discourses that accomplishes ruling relations. Therefore, unlike governmentality which tends to view discourse as a powerful force conducting activities, scholars of institutional ethnography see discourse as something that is *activated*, or not, in practice. That is, institutional ethnographers focus not on discourse, but on how “people *participate* in discursive activity” (M. L. Campbell & Gregor, 2004: 41, original emphasis). Campbell (2003: 15) explains the implications of the focus on discourse-in-action: “If we accept Smith's view, no longer can we think of ruling being done by powerful others, somewhere out there, entirely separate from ourselves. We all take up ruling concepts and activate them as we go about our daily lives.” With this understanding, I asked many questions about practices during my interviews, specifically directed toward people’s experiences of *konran* related to everyday eating. In listening to their stories, I took note of ruling discourses or clues indicating textual mediation of their experiences, which I would bring up for discussion to clarify and problematize along with my participants.

3.3.1.3 Attending to work (broadly defined)

According to the principles of institutional ethnography, another way that texts organize social relations is through “the work processes and organization in which the text-reader conversation is embedded” (S. M. Turner, 2003a: 95). According to institutional ethnography, the organization of work processes does not only take place within hospitals, schools, government offices and other workplaces, but expands to

¹⁴⁵ Smith (2001: 176) has referred to this as a “virtual reality.”

organizing the everyday work (generally defined) of homemakers and homeless people, among myriad others. Thus, textually mediated attempts at coordination are not only deployed to guide the activities of paid workers in hospitals, schools and other places of work, but numerous other everyday activities and forms of unpaid work enacted by ‘citizens,’ ‘consumers,’ ‘women’ or any other categorization of people. Regardless of where texts are activated, they have the power to create accounts of reality which are objective and do not account for the everyday experiences of locally situated people (M. L. Campbell & Gregor, 2004: 37). In other words, they are an attempt to enact a ‘single reality’ based on the goals of the institution.

Conducting an institutional ethnography requires understanding that ruling relations that objectify and attempt to standardize people’s experiences also participate in invisibilizing some of the activities accomplished by people in their everyday lives. When first developing institutional ethnography, Smith (1987) realized the concept of work, which usually refers to activities involving some form of paid labor, seemed to obscure or make invisible the everyday activities of women. This is why institutional ethnographers view the things people do in everyday life through a “generous concept of work.” That is, the concept of work is extended to include anything “people do that requires some effort, that they mean to do, and that involves some acquired competence” (D. E. Smith, 1987: 165-6). Seeing work as including activities beyond paid labor allows institutional ethnographers to gather robust accounts of what is actually happening in the everyday lives of people, giving them the opportunity to identify and explicate the subtle ways in which institutional texts mediate even the most seemingly mundane activities.¹⁴⁶ While making everyday work processes visible is not the analytical goal of institutional ethnography, thick descriptions of these activities create data that holds clues to how institutional processes are organizing people’s activities.

¹⁴⁶ DeVault (1994) skillfully uses institutional ethnography’s generous concept of work to make visible the multitude of activities actually involved in “feeding the family”—work composed of innumerable tasks ranging from paying attention to supermarket sales, traveling to the supermarket, carefully making food choices that fit with their values and needs, organizing a meal time that fits with the needs of family members, preparing food, serving food, paying attention to items that need to be purchased, among numerous other activities.

Through their everyday work, people are active in constituting their own realities within relations of ruling, even if they are unaware that social organization of their activities is taking place. For example, DeVault (1994: 60) demonstrates how the often taken-for-granted work of provisioning food actually “connects ‘public’ and ‘private’ realms, but since it is largely invisible, the connections go unnoticed. Instead, people do shopping and use their purchases, to produce ‘personal life’ and thus, actually to construct the boundary between home and market.” It is the task of the institutional ethnographer to make visible the various overlooked or taken-for-granted linkages between what seem to be mundane, personal activities and the ruling relations which coordinate them.

DeVault (1994: 12) goes on to explain the importance of collecting detailed accounts of people’s everyday work as the basis for completing institutional ethnography’s analytic goals of explicating ruling relations. She highlights that “[t]hrough their work, women are connected with organizations and institutions—families, workplaces, schools, stores and services, and the state. Typically, activities in these settings are organized by discourses that coordinate the workings of organizations and institutions in different local settings.” However, given the ephemeral nature of this work, the first step in explicating ruling relations is to collect detailed descriptions of everyday activities; only then could the institutional processes embedded within these activities be made knowable and traceable.¹⁴⁷

During my ethnographic inquiry, I had to learn to see my participants’, as well as my own, everyday activities, as well as my own, as being embedded within materially mediated ruling relations, while at the same time being fully aware that such relations are often not visible to most people in their everyday lives. Knowing that “analytical thinking begins in the (data-collection) interview” (DeVault & McCoy, 2002: 757),¹⁴⁸ during my interviews I was aware that my analytical task would not involve *making*

¹⁴⁷ Campbell and Gregor (2004: 72, original emphasis) explain how such inquiry into the particulars of everyday work “would name the participants, and the account would show the difficulties to be overcome as well as the tensions absorbed as part of doing the work. If an account were made of managing the household finances as *work*, it could no longer remain an abstract undertaking, with no subject, no particular object of action, and no social relations.”

¹⁴⁸ This quote comes from an interview with institutional ethnographer Eric Mykhalovskiy.

connections between the (local) and macro (extra-local institution), but *explicating*—making visible—the trans-local ruling relations that are being enacted through everyday practices (see Travers, 1996). Thus, during my interviews I attentively listened for traces of discourses or texts in people’s descriptions, as these would make up the material clues necessary for later explicating ruling relations. Whenever texts or discourses were detected, I asked for further explanation as to the role they played in people’s everyday work and tinkering.

3.3.1.4 Standpoint, researcher positionality and collaboration in the ‘in-between’

In order not to get lost within the vastness of the institutional complex, institutional ethnographers explore their study’s problematic from the standpoint of the people experiencing disjunctures, with a commitment to “knowing on behalf of those whose lives she studies” (M. L. Campbell & Gregor, 2004: 48). That is, researchers explicate ruling relations in a way that keeps participants and their situated experiences as an anchor in the analysis. In institutional ethnography people’s concerns are taken seriously, but are not considered as isolated incidents needing to be theorized. Instead, researchers maintain a focus on processes and activities in order to conduct research in a way that provides participants with a description of how these experiences “actually happen as they do” (M. L. Campbell & Gregor, 2004: 49).

Explicit in the concepts of ruling relations or social organization are two different subject positions: actors who are organizing (i.e. those who rule) and actors whose activities are being organized (i.e. those who are being ruled). Attuning themselves to the existence of ruling relations, institutional ethnographers conduct their research from “the standpoint of those who are being ruled” (M. L. Campbell & Gregor, 2004: 16). Campbell and Gregor (2004: 48) point out that while openly taking the standpoint of those being ruled may seem biased, “[r]esearch is always framed from the perspective of those who need to know, whether it is those who are living in the setting or those who are located outside it and looking in.” That is, though in many scientific inquiries the standpoint of the researcher is not always stated outright, it is made explicit within institutional ethnography because it is only from the standpoint of people being ruled at the local level that the organization of social relations can be researched. Thus, while scholars within the rational risk paradigm may conceptualize differences in knowledge as an ‘expert-lay divide’—that is, ‘correct’ expert knowledge is pitted against

‘incorrect’ or ‘irrational’ everyday, tacit knowledge—institutional ethnography’s theoretical framework is grounded in a different understanding of what knowledge is and how it is produced. To institutional ethnographers, knowledge is produced through the active engagement of people entangled within textually-mediated ruling relations. As such, institutional ethnography’s ontological grounding is sometimes also referred to as the ‘theory of the social organization of knowledge’ (D. E. Smith, 1990b; 1999).

In the field of material semiotics, however, the concept of standpoint has sometimes been met with critique. Mol (1999; 2011a) has pointed out that the notion of a standpoint can be implicated in perpetuating “perspectivalism”—the number of gazes from which to view a single reality is multiplied, but reality remains single and intangible, and perspectives on this reality distinct and plural. In reviewing the vast scholarship of Mol (1999; 2002; 2013) and other material-semiotic attuned scholars¹⁴⁹ we discover that there is not a single, ‘true’ reality of which there are multiple perspectives, but there are multiple realities being enacted simultaneously in different locations.¹⁵⁰ While both institutional ethnography and material-semiotic attuned methods maintain a strong commitment to studying situated practices, institutional ethnography maintains a focus on the production of knowledge, while material semiotics maintains a focus on the production of reality.

Both Law (2002) and Mol (2002) have discussed the role of perspectivalism in projects of coordination. Law (2002: 89) describes the essential role of perspectivalism in the coordination of modern projects, which depend on maintaining a simple, singular ontological framing and the centrality of the singular objects this reality enacts:

On the one hand there is the normative simplicity of the modern project, which seeks to enact the god-eye and presupposes the ontological singularity of the world that it desires to know and make. The simplicity is sustained by the theory of perspectivalism that

¹⁴⁹ For example, Law (2015), Law and Lien (2013), Law and Singleton (2005), and Mol and Law (2004).

¹⁵⁰ To repeat Mol’s (2002: vii) insight: “Attending to enactment rather than knowledge has an important effect: what we think of as a single object may appear to be more than one.”

allows, indeed requires, different viewers to see different things when they look at an object.

The struggle, according to Law, is to keep the single reality, and the objects it enacts, as appearing singular, even in the face of ruptures and the exposure of heterogeneity—something that is inescapable according to the ‘logic of oscillation.’ According to Mol (2002: 6), a single reality is epistemologically normative: “it tells how to know properly.” Perspectivalism provides a tool for maintaining the centrality of these objects, categorizing differences in experience as perspectival and not ontological in nature (Law, 2002: 64).

Through the incorporation of material-semiotic sensibilities, this thesis will be an attempt to turn away from epistemological debates involved in a focus on knowledge production, attending instead to ontological politics and the enactment of, and relations among, multiple realities.¹⁵¹ Thus, in this thesis *standpoint* is principally articulated as a way of situating the inquiry within a specific, locally situated “regional space” (Law & Mol, 2001: 619)—a particular location from which people’s activities become ‘hooked up’ within ruling relations, and where particular ‘versions’ of reality are enacted through everyday practice (Mol, 2012).¹⁵² Specifically, this project is conducted from the situated standpoint of people living in the Kansai region who became concerned about food following TEPCO’s nuclear disaster and took some action to face and deal with these concerns. Participants in this study self-identified as being someone living in the Kansai region who was “concerned about” (*kanshin no aru*) food following TEPCO’s nuclear disaster. While I directly invited some participants to join my study, others contacted me after hearing about my study from a friend, meeting me at an event, hearing me speak at a meeting or event, or receiving my information sheet. This method of recruiting resulted in a heterogeneous collection of participants with a rich *mélange* of experiences from which ruling relations and material-semiotic entanglements could be explicated and explored.

¹⁵¹ This is similar to a commitment made by Law (2002: 5) who positions his study as “an inquiry into ontology, into what is made, rather than what is represented.” He explains how his insights were drawn from Andrew Pickering’s (1993; 1995) writings on the “mangle of practice.”

¹⁵² See Section 2.6.4 for more on Mol’s concept of ‘versions.’

Of the twenty-one people who participated in one-on-one interviews and the twenty-two people who participated in focus groups, ten were male, seventeen were living within 260 kilometers of TEPCO's nuclear disaster in March 2011, two held a position within a cooperative that tests for radionuclides in food, four ran restaurants or cafés that tested for radionuclides, ten volunteered at citizen radiation measuring stations (CRMSs, 市民測定所, *shimin sokuteisho*),¹⁵³ one was a freelance journalist, three were involved in organizing recuperation camps for children living in radioactive hot spots, five were plaintiffs in court cases in which nuclear refugees¹⁵⁴ sued TEPCO and the Japanese government for cutting financial support based on their classification as 'voluntary evacuees,' among many other experiences. As clearly articulated on my study's information sheet and ethics forms, all participants knew they would be asked about the ways they face (*mukiai*) and deal with (*taisho suru*) concerns about food in their everyday lives. Given the myriad experiences I was able to learn from through my interviews and fieldwork, my study's standpoint became an essential tool for grounding my project as I ventured into the diaspora of heterogeneous sociomaterial relations in my analysis.

3.3.1.5 Access to participants and study sites

My first attempt to make contact with potential research participants was on March 11, 2016, at events surrounding the fifth anniversary of the onset of TEPCO's nuclear disaster. I attended my first event in Kyoto City, accompanied by an academic colleague with connections to the event's organizers and speakers. As became the case at the numerous other events I attended, I would exchange business cards and share my

¹⁵³ See Kimura (2016a: Chapter 4) for an overview of the locations and numbers of citizen radiation measuring stations (what she refers to as citizen radiation-measuring organizations or CRMOS) in Japan until February 2014.

¹⁵⁴ While people who relocated from areas with high concentrations of TEPCO's radionuclides are often referred to as 'evacuees,' I will follow some of my participants who instead refer to themselves as 'nuclear refugees' as they are seeking long term refuge—not temporary reprieve—from TEPCO's radionuclides. I discussed this issue with many of my participants who were classified as either 'evacuee' or 'voluntary evacuee.' Many of them also agreed that the term 'evacuee' was not adequate for describing their experiences. As we discussed the label, we came to notice that the term 'refuge' is often used when there is a visible threat posed by war. However, when it comes to natural disasters, the term 'evacuee' is often used. Through our discussions, it seemed that the imperceptibility of radionuclides may play a role in the categorization of people as 'evacuees' instead of 'refugees.'

information sheet with anyone who showed interest in me or my project. It was often the case that I was the only foreigner at these gatherings, so it was not uncommon for me to be approached by people wondering about my interest in the topic at hand. I attended over fifty events throughout the duration of my fieldwork. These events were gatherings large and small, including: information sessions; seminars given by doctors, lawyers, nuclear refugees, politicians, journalists, academics, scientists and activists; various *kōuryūkai*,¹⁵⁵ annual meetings of CRMSs; court hearings and their subsequent information sessions; planning meetings for recuperation camps; English classes for nuclear refugees and friends; and café times at various CRMSs, just to name a few. I also had the opportunity to visit five CRMSs, the radiation testing station of a food cooperative, as well as shops, cafés and restaurants that test for, or try to address, the possible presence of radionuclides in food.

Trains became my main mode of transportation to and from interviews and events. Because most events were intentionally held near public transportation to increase turnout, transport was never an obstacle. The CRMSs I visited were also conveniently located near public transport. The long hours spent on trains became an important time for taking field notes and reflecting on my experiences at events or in interviews. In particular, because of my busy schedule and inability to fully transcribe interviews right away, train ride reflections played an essential role in the organization of my ideas. Long train rides became a space for working out my developing understanding of people's sociomaterial entanglements which I could then test back¹⁵⁶ for clarification in follow-up dialogues or with participants in future interviews and focus groups.

For example, I went to my first interviews with a number of questions to guide my conversations with participants. While I did not always refer to these questions during the interview itself, the process of creating questions prepared me for these encounters, and were always available to help me in putting conversations back on track if

¹⁵⁵ These are meetings for exchanging ideas, mingling and coming together. The three *kanji* characters that make up the word (交流会) signify 'crossing', 'flowing' and 'meeting.'

¹⁵⁶ While 'testing back' is normal practice in institutional ethnography (see M. L. Campbell & Gregor, 2004: 85; DeVault & McCoy, 2002: 757), it is also a strategy used by scholars in the field of material semiotics—for example, Krzywoszynska (2012) who adopted it from grounded theory methodology.

necessary. On my train rides home, I would take notes (in English and Japanese), often using the interview questions and notes taken during interviews to guide my notetaking on important insights I had gained. I would also list any confusions or new questions that arose. When I returned home, I would update my questions for my next interview, making sure to include queries that needed clarification or further discussion. Through this process, I had the opportunity to discuss my evolving understandings of people's experiences and interactions with different texts, discourses and other humans and more-than-humans, collaborating with my participants in clarifying or correcting my comprehension.

Ultimately, it took me two months to set up my first interview, the first two months spent solely attending events, introducing myself to people and circulating my information sheet. While finding participants was initially a struggle, by the end of my fieldwork I received an outpouring of interest that I had not anticipated at the outset of my research.

3.3.1.6 Researcher positionality, 'the sensate' and collaboration in the 'in between'
In addition to research standpoint, the positioning of the researcher in institutional ethnography is of utmost importance. Differing from other sociological methodologies which envision the researcher as existing in a place beyond what is happening in the local setting being researched, in institutional ethnography "findings are in and of the same world that it investigates" (D. E. Smith, 2005: 52). That is, institutional ethnographers must see their own lives as embedded within the same forms of social organization as the everyday lives of their participants.¹⁵⁷ Again, there have been many notable critiques pointing out the unfeasibility of proclaiming true "transparent reflexivity" about one's positionality in research (for example, G. Rose, 1997: 305). Recognizing this, I feel that institutional ethnography's focus on overtly enunciating the researcher's standpoint and considering researchers as being physically positioned somewhere within the same materially-mediated ruling relations as their participants avoids this problem, as this form of positionality is not based on an assumption that positionality is static or fully knowable. Instead, positionality becomes an important

¹⁵⁷ In Smith's (2001: 161) words, "[t]he project calls on sociologists to discover just how the everyday/everynight worlds we participate in are being put together in people's local activities, including, of course, our own."

tool for ensuring researchers view themselves as locally situated, thus explicitly evading the lure of the “god trick” (Haraway, 1991c: 189) in the research process.¹⁵⁸

As a foreigner who lives and conducts research in Japan, my positionality might be referred to as “inside outsider” (Keesing, 1992), a label that comes with many complications and dilemmas, especially when a researcher’s goal involves an attempt to ‘represent’ the knowledge perspectives of a group of people (see Gregory & Ruby, 2011; Harris, 1976). Here, I believe my research’s focus on situated processes and ontology (as opposed to epistemology) buffers me from such dilemmas, allowing for a much more fluid positionality. In addition, through adopting the concepts of standpoint and positionality from the field of institutional ethnography, I was able to curate a research project that allowed for reciprocal, fluid and collaborative engagement with my participants. Following Krzywoszynska (2012), a Polish scholar in the field of material semiotics who conducted fieldwork in Italian and wrote her thesis in English, I attempted to conduct my cross-lingual, cross-cultural research through a space “in-between”—a hybrid space where understanding emerges through a fluid co-construction among researchers and participants (F. M. Smith, 1996: 163). These spaces emerge out of shared “interestingness” in the project and my attempts to maintain a sense of collaboration and politeness throughout the research process (Krzywoszynska, 2012: 68).¹⁵⁹ Both my ‘insider’ experiences and ‘outsider’ roles, responsibilities and ethical commitments were clearly communicated through my information sheet and my ethics forms prior to my interviews. All forty-three interviewed participants signed an ethics form¹⁶⁰ which provided them with clear information on their own rights within the research process—one of these rights being the ability to read through and edit their interview transcript before it was used in my analysis.

In addition, because the vocalization of any concerns about food and radioactivity continues to be chastised in public discourse in Japan, the ‘in-between’ became a space where my participants could share experiences and speak the unspeakable. I found

¹⁵⁸ See Section 2.6.5.

¹⁵⁹ Also see Despret (2005; 2008).

¹⁶⁰ My ethics application was reviewed and approved by the University of Otago Human Ethics Committee.

Harrison's (2000) concept of "the sensate" helpful for understanding the delicate terrain within which my participant recruitment and interviews took place.¹⁶¹ Roughly defined as "the relation to an outside" which "constitutes the surface on which we dwell in everyday life," the concept highlights the necessity to understand the "lived present"—whether it be the interview itself or ethnographic descriptions of people's lived experiences—as "open-ended generative processes; as practice" (Harrison, 2000: 499, original emphasis). Not only were the everyday experiences shared by my participants "fluid, turbulent and blended,"¹⁶² but so, too, were my interviews. Harrison (2000: 502, emphasis added) goes on to describe 'the sensate' as "the surface and limit of everyday life. It is the in-between of the 'vague and unordered feelings or sense of context'; the skin, texture, and ethos of everyday life. *The sensate governs the continual movement from the multiple to the singular.*" Navigating 'the sensate' became an important part of my interviewing process which involved an exploration into the multiple and its often turbulent relation to the singular. Having lived in Japan for three years following TEPCO's nuclear disaster, I was already attuned to what was 'okay' and 'not okay' to speak of regarding radiation and food in public spaces. During my interviews, I tried to create a space where people could speak openly and anonymously about their multiple experiences, without feeling the pressure to self-sensor. As a result, participants were allowed to choose the interview location, and focus groups were always assembled by participants themselves. While in most cases this careful curation allowed for very open conversations, there were always some instances when participants hesitated, looked around the room, or drastically lowered their voices before answering a question. Of course, these instances also became opportunities for better understanding people's everyday experiences and their embeddedness in ruling relations.

Within the 'in-between,' my positionality was able to shift fluidly as I worked with my participants to understand their experiences of *konran* following the onset of TEPCO's nuclear disaster. As an 'insider' I was a Japanese-as-a-second-language speaking, eating body¹⁶³ that participated in ordering food and drink, chatting, sipping, listening,

¹⁶¹ I first learned about 'the sensate' from reading Krzywoszynska (2015).

¹⁶² In this quote, Kavanagh (1986) is reviewing and interpreting the work of philosopher Michel Serres.

¹⁶³ The term 'eating body' is borrowed from the title of an interdisciplinary research project funded by the European Research Council and led by Annemarie Mol entitled 'The eating body

chewing and tasting along with my participants during our interviews and focus groups.¹⁶⁴ While we all have very different experiences of *konran* related to eating, focusing on activities and processes allowed for conversations about many shared activities—shopping, chopping, frying, baking, seasoning, boiling, burning, packing, setting, serving and cleaning grime in our daily lives in Japan. As an ‘outsider’ I am a researcher working with a university in New Zealand who is responsible for explicating people’s embeddedness within heterogeneous sociomaterial and ruling relations for both an English speaking academic audience and, eventually, my Japanese participants. The fluidity inherent in these ‘in-between’ spaces helped to avoid the false assumption that both myself and my participants remained autonomous and unchanged throughout the research process. Instead, it allowed us to view the experience as processes of “worlding” (Tsing, 2010)—processes of collaboration and cross-cultural, cross-lingual, co-creation of understanding and meaning-making that characterized my ethnographic encounters.

3.3.2 Analysis

Like other material-semiotic attuned methods, institutional ethnography is not fixed in its form, instead allowing researchers to fluidly adopt concepts and sensibilities as applicable to their specific project. As DeVault and McCoy (2002: 755) put it, “[t]here is no ‘one way’ to conduct an [institutional ethnography] investigation; rather, there is an analytic project that can be realized in diverse ways.” They go on to describe how “investigations are rarely planned out fully in advance. Instead, the process of inquiry is rather like grabbing a ball of string, finding a thread, and then pulling it out” (DeVault & McCoy, 2002: 755). Similar metaphors have been used to discuss analytical processes in the field of material semiotics.¹⁶⁵ The difference I see between these practices is that while institutional ethnographers are trained to follow threads of

in Western practice and theory.’ More on the project and its findings can be found at <http://whatiseating.com>. Also see Mol (2011b) for a discussion on the tasting body.

¹⁶⁴ Interviews and focus groups often took place at people’s homes or at cafés, so food and drink were almost always involved.

¹⁶⁵ Haraway (2016: 3) describes a similar process used in her material-semiotic attuned approach: “promiscuously plucking out fibers in clotted and dense events and practices, I try to follow the threads where they lead in order to track them and find their tangles and patterns crucial for staying with the trouble in real and particular places and times.” Also see Haraway (1994).

textually mediated ruling relations, material-semiotic sensibilities allow for following other, messier and somewhat wilder, knotted and tangled threads that make visible human and more-than-human sociomaterial relationality (textual and otherwise).

Following the principals of institutional ethnography, I have designed my analysis so that it “begins in experience and returns to it, having explicated how the experience came to happen as it did” (M. L. Campbell, 1998: 56). However, explication will not involve a precise mapping of textually-mediated ruling relations, but include an exploration of other human and more-than-human entanglements, including how attempts at coordinating everyday eating follow a “logic of oscillation” (Law, 2002: 9) between singular ruling logics and the multiplicity of everyday experiences. Thus, throughout my analysis, I will be attending to the ceaseless vacillation between the singular and the multiple in a way that attunes to myriad heterogeneous relations, and tensions, contributing to my participants’ experiences of *konran* related to everyday eating following TEPCO’s nuclear disaster. The following sections will provide an overview of some of the concepts and sensibilities from both fields that guided my analysis.

3.3.2.1 Language and collaborative meaning-making

As mentioned, all interviews and focus groups in this study were conducted by myself in Japanese. In addition, all interviews were recorded and transcribed into Japanese either by myself or by a Japanese transcriptionist. Given the vast amount of data involved—each interview or focus group session was between 1.5 to 3 hours in length—this was a very time-consuming process spanning almost a year from the time the first interview was conducted in May 2016. However, what seemed to be long and arduous processes of transcription and translation turned out to create amazing opportunities for constant reflection into my research topic and research process.¹⁶⁶ As a Japanese-as-a-second-language learner, each interchange between Japanese and English provided an opportunity to reflect and deepen my grasp on both the content and meaning of what I or my participants were trying to communicate. From translating my ethics forms from English to Japanese; to making corrections to these forms after receiving feedback from Japanese colleagues; writing and designing my Japanese

¹⁶⁶ See Crane (2009) and Tremlett (2009) for similar reflections.

information sheet; making corrections to that sheet; engaging in polite verbal and written Japanese correspondence with potential participants; embarrassingly realizing when I had made mistakes during these exchanges; conducting interviews in Japanese with participants; writing field notes (in a mix of English and Japanese) about these interviews or events; transcribing interviews into Japanese; engaging in conversations with my transcriptionists in English and Japanese;¹⁶⁷ reviewing the corrections and feedback I received from participants who reviewed their transcripts;¹⁶⁸ reading updates from participants who were unable to participate in the review; coding interview transcripts; translating insights from my fieldwork into an English dissertation—each experience, interaction or challenge that arose provided an opportunity for deeper reflection.¹⁶⁹ And, of course, all of this was made possible through collaboration with my participants and colleagues who worked with me in discovering and making meaning across the two languages.

Co-constructing meaning with my participants—in interviews, post-interview dialogue, and my strategy of ‘testing back’ ideas—created a situation where meaning was generated through collaboration. As someone who considers herself to be fluent in conversational Japanese,¹⁷⁰ as a second-language learner there were always opportunities to ask for clarification on terms—whether they be for my own comprehension or to unravel insider language or work processes (M. L. Campbell & Gregor, 2004: 72). Thus, I follow Watson (2004) and Krzywoszynska (2012) in

¹⁶⁷ I found it interesting that in some cases my Japanese transcriptionists were not familiar with vocabulary my participants and I were using. That is, we were using many words related to radiation that they had never heard of, but that I and my participants used freely throughout our conversations.

¹⁶⁸ Participants were contacted in May 2017 and asked if they would like to review their transcripts before they were used in the final analysis. Of the forty-three participants, twenty-four requested to review their transcripts. Of the people who declined the invitation, a number sent short updates about experiences or thoughts they believed would be of interest to my project.

¹⁶⁹ I expect that the process of translating my findings back to Japanese to share with my participants will add another layer to this process of reflection.

¹⁷⁰ I began studying Japanese in high school and returned to my studies upon moving to Japan for the first time in 2008. In addition to living in Japan for approximately five years, I was enrolled in an intensive Japanese language course for one year, passed Level-N2 of the Japanese-Language Proficiency Test, and passed two semesters of 300-level Japanese courses at the University of Otago before embarking on my PhD fieldwork.

acknowledging that engaging in language learning with my participants and other Japanese colleagues was also one method that helped to greatly enrich and deepen my understanding and analysis.

Linguistic translation is an inherently complex, political process that needs to be taken seriously by researchers (see Müller, 2007; Temple, 2005). To address this, I again follow Krzywoszynska (2012) in adopting some tools for staying attuned to the political nature of translation, as well as my positionality within this process. First, in the spirit of collaboration and to avoid concealing the multiplicities of experiences into a single narrative, I attempt to preserve a sense of “polyvocality” (or multivocality) (Coffey, 2002) throughout the thesis. That is, instead of a sanitized narrative where I attempt to represent my participants by organizing them into simplified categories, I make an attempt to keep multiplicity and its inherent tensions alive throughout the pages, providing opportunities for participants to speak for themselves when possible. Second, in order to attend to the contingency of translation and meaning, I also adopt Müller’s (2007) strategy of “holus-bolus.” I employ this strategy—described as “an instrument to problematize the fixation of meaning through translation and draw attention to the contingency of meaning” (Müller, 2007: 210)—by maintaining some original Japanese vocabulary in my writing and explicating the meanings of these words in a way that allows for attending to their ‘slippery’ nature.¹⁷¹ Adopting this strategy not only prevents “premature closure” and “tacit imposition of meaning” (Müller, 2007: 210-11), but also highlights my own positionality in the translation process and how these ‘slippery’ terms are specifically used and attended to in my analysis.¹⁷²

3.3.2.2 Why food? Clarifying the research problematic

Another step in my analysis was to clarify my study’s problematic. According to the principles of institutional ethnography, identifying the study’s problematic involves discovering troubling experiences which point to clues of a disjuncture (or a contradiction) existing between what people are experiencing in their everyday lives and the official explanations of what and how something happens (M. L. Campbell &

¹⁷¹ I borrow the term from Law and Lien (2013) who use it to describe multiple objects, in their case the multiplicity of Atlantic salmon.

¹⁷² ‘Polyvocality’ and ‘holus-bolus’ are also used by Krzywoszynska (2012).

Gregor, 2004: 48).¹⁷³ Smith (2005: 41) describes the essential role of the problematic in institutional ethnography:

The ethnographic problematic recognizes the real interpenetration of the present and immediate with the unknown elsewhere and elsewhen and the strange forms of power that are at once present and absent in the everyday. A problematic is a territory to be discovered, not a question that is concluded in its answer. Exploration opens up an institutional complex as it is relevant to the problematic.

Thus, disjunctures provide fertile opportunities for discovering how people's everyday lives are embedded within textually-mediated ruling relations, and how people themselves participate in those relations.

Smith (1987: 49-50) refers to a disjuncture as a "point of rupture" or a "line of fault" which directs researchers to focus on understanding how an experience or activity "is organized, how it is determined, [and] what the social relations are that generate it." These are instances in which "[a]n orderly and familiar local world is suddenly disrupted by interventions that come from outside, that have no logic within the daily routines and the ordinariness of local life" (D. E. Smith, 2005: 39). The problematic does not refer to a research question or a problem in the way it is explained by study participants (M. L. Campbell & Gregor, 2004). Instead, it is used as a concept "to direct attention to a possible set of questions that may not have been posed or a set of puzzles that do not yet exist in the form of puzzles but are 'latent' in the actualities of the experienced world" (D. E. Smith, 1987: 91). Thus, while materially-mediated ruling relations are present in people's everyday lives, they are often invisible to those who participate in them and it is usually "only when something goes unaccountably wrong that we stop and notice the organized complexity of our lives that we otherwise navigate so easily" (M. L. Campbell & Gregor, 2004: 31).

I believe the concepts of "breakdowns" (Latour, 2005), "ruptures" (Krzywoszynska, 2012), "interferences" (Mol, 2002: 142-9) and "controversies" (Mol, 2002: 88-100;

¹⁷³ The original concept of the problematic in institutional ethnography was taken from Louis Althusser (1971). See Smith (2005: 38) for further explanation.

Callon et al. 2009 : Chapter 1) discussed in the field of material semiotics both complement and enhance the concept of disjuncture. In this thesis, it is people's experiences of *konran* that point me to disjunctures in their experiences. Disjunctures are useful for directing my attention to textually mediated attempts to coordinate my participant's activities, some of which may need to be explicated to understand how they are entangled within trans-local, textually-mediated ruling relations. However, the concepts of 'breakdowns' or 'ruptures' are also helpful for attuning me to myriad other human and more-than-humans that participate in enacting situated experiences or objects. While multiple experiences, ways of ordering and versions of objects may be able to 'hang together' (Mol, 2002: 5) in some instances, new actors on the scene can multiply enactments and exacerbate tensions. Mol (2002: 121) explains: "where two or three modes of ordering, two or three ways of enacting a specific object meet: there is interference."

If interferences proliferate "when two (or more) practices which enact a particular 'object' contradict or clash with each other" (Krzywoszynska, 2012: 65), then ethnographic inquiry into people's experiences of *konran* provide opportunities to discover the myriad actors contributing to, though often not attended to, in these experiences. It is also an opportunity to uncover traces of actors that are silenced, ignored or "muted" (Latour, 2005) through attempts at ordering. 'Muting' usually takes place when something that is multiple and partial is translated into a "single reality" (Mol, 2002: 87), or unquestioned "matters of fact" (Latour, 2005: 114).¹⁷⁴ Thus, a blending of insights from institutional ethnography and material semiotics provides a space to ethnographically explore the tensions and incompatibilities that emerge when standardized, single-reality wielding attempts to 'control' and direct activities enter the everyday, where specific, local, messy and multiple realities are enacted through careful forms of 'tinkering' within heterogeneous sociomaterial relations. Put differently, attuning to everyday experiences using sensibilities from these two fields of scholarship is expected to expose seemingly stable 'matters of fact' as being heterogeneous sociomaterial assemblages—or 'matters of concern.' And once

¹⁷⁴ According to Latour (2005: 114, original emphasis), simplified, black-boxed 'matters of fact' contrast greatly with emergent "matters of concern"—"[w]hile highly uncertain and loudly disputed, these real, objective, atypical and, above all, *interesting* agencies are taken not exactly as object but rather as *gatherings*."

seemingly singular ‘matters of fact’ are exposed as ‘matters of concern,’ a further step can be made to attend to the vigilant forms of *care* involved in living within these entanglements, exposing them to be what de la Bellacasa (2011) has termed “matters of care.”¹⁷⁵

As mentioned in my literature review, food possibly containing industrial toxins has a particularly disruptive agency given its simultaneous vital and vicious enactments, which can destabilize modernist ontological framings of ‘rational choice’ and ‘control.’ This disruption can lead to experiences of *konran* throughout the agrifood assemblage, from food safety officials to producers, manufacturers, and even people purchasing and ingesting these foods located far distances from toxic overflows themselves. In this study, the problematic originally arose from my own experience¹⁷⁶ of *konran* related to everyday eating following TEPCO’s nuclear disaster (see Chapter 1). Though my partner and I were living in the Kansai region, 600 kilometers from the nuclear disaster, we found ourselves as active participants in an agrifood assemblage, compelled to understand our new relationship with historically reemerging actors: anthropogenic radionuclides. My awareness that we were embedded within complex sociomaterial relations was accompanied with a burning curiosity to understand how my own experiences were ‘hooked up’ within the greater ruling relations. However, as a foreigner living with my Japanese partner, I wanted to include the experiences of other locally situated people in my study—people whose own particular experiences of *konran* and experiences of eating in post-2011 Japan could enrich my analysis.

In order to address the multiple experiences of *konran* felt by myself and my research participants, the institutional ethnographic problematic guiding my analysis has

¹⁷⁵ According to de la Bellacasa (2011), ‘care’ cannot be considered abstractly in the way ‘concern’ might. Thus, attending to care involves exploring situated experiences within messy sociomaterial entanglements, where the ethics of what is attended to and what is not become essential. The art of representing ‘matters of care’ also becomes an ethical and political question which researchers must grapple with. De la Bellacasa (2011: 94) describes: “To represent matters of care is an aesthetic and political move in the way of re-presenting things that problematizes the neglect of caring relationalities in an assemblage.”

¹⁷⁶ It is common for institutional ethnographers to include auto-ethnographic accounts of their own experiences within textually-mediated ruling relations (for example, M. L. Campbell & Gregor, 2004; S. M. Turner, 2003a).

developed as: *How is everyday eating being coordinated following TEPCO's nuclear disaster?* This question was expected to open up the institutional complex to allow me to explore and trace materially-mediated ruling relations from the experiences of *konran* felt by myself and shared by my participants. However, this problematic also paved the way for using sensibilities from material semiotics for exploring two further questions pertinent to eating following TEPCO's nuclear disaster: First, *how do multiple 'safe foods' emerge and relate to each other in practice?* Second, *how do experiences of konran emerge through these ruling relations and how do processes of highlighting or muting relations among actors—human and more-than-human—contribute to people's suffering?* These guiding questions, paired with sensibilities from both fields of scholarship, provided me with a clear objective, yet an unrestricted pathway for entering the diaspora of heterogeneous material relations contributing to my participants', and my own, experiences of *konran* following TEPCO's nuclear disaster.

3.3.2.3 Rhizomes, 'folded time' and sympoiesis: Re-entangling the 'established disorder'

Mapping is a common metaphor to describe the analytical work involved in conducting an institutional ethnography. Smith (2005: 29, original emphasis) describes institutional ethnography as

a method of inquiry into the social that proposes to enlarge the scope of what becomes visible from that site, mapping the relations that connect one local site to others. Like a map, it aims to be through and through indexical to the local sites of people's experience, making visible how we are connected into the extended social relations of ruling and economy and their intersections.

That is, the practice of mapping used in institutional ethnographic analyses involves tracing people's embeddedness, and participation, within textually-mediated ruling relations.

Adopting insights from the field of material semiotics, I draw on Deleuze and Guattari (2004) to problematize and differentiate between the practices of *tracing* ruling

relations and explicating a *rhizomatic map*¹⁷⁷ of heterogeneous relational materiality. In the introduction to their book *A Thousand Plateaus*, Deleuze and Guattari (2004) use the image of a rhizome as a tool for visualizing the messy, overlapping relations and entanglements among heterogeneous humans and more-than humans within an assemblage. Here, I adopt the concept of a rhizomatic map—or the “rhizome-root assemblage” (2004: 16)—as a metaphor for imagining the ‘established disorder’ within which ruling relations are deployed. According to Deleuze and Guattari (2004: 15), a focused tracing of ruling relations alone risks concealing multiplicity and the myriad heterogeneous actors participating in enactments and happenings. The authors use the images of trees and roots, with their stable root-tree structure, to represent single-reality ordering projects which can be traced—or as the authors put it, “the tree or root [...] plots a point, fixes an order” (2004: 7). Deleuze and Guattari (2004: 15) expound:

The tracing has already translated the map into an image; it has already transformed the rhizome into roots and radicles. It has organized, stabilized, neutralized the multiplicities according to the axes of significance and subjectification belonging to it. It has generated, structuralized the rhizome, and when it thinks it is reproducing something else it is in fact only reproducing itself. That is why the tracing is so dangerous. It injects redundancies and propagates them. What the tracing reproduces of the map or rhizome are only the impasses, blockages, incipient taproots, or points of structuration.

In making this distinction between tracing and mapping, I am in no way accusing institutional ethnographers of using the method of tracing in a way that reproduces the ruling relations they are attempting to explicate—disrupting these ruling relations is of course the explicit goal of their analytical project. However, because one of the goals of this thesis is to engage in and provoke ontological politics, analysis will entail not only

¹⁷⁷ Greiller (2013) uses a technique of rhizomatic mapping in a study to problematize student learning approaches at an Australian university. There are a number of other scholars who have been working in the field of rhizomatics and rhizomatic analysis (Grosz, 1993; Lather, 1997; Smitka, 2012). In a way that is different from these authors, I adopt the concept of the rhizomatic map in an attempt to conceptualize the heterogeneous relational materiality of the ‘established disorder’ which I attempt to explicate.

the tracing of ruling relations, but attuning my participants to their embeddedness within a wider assemblage of heterogeneous sociomaterial entanglements. Thus, in my analysis I adopt sensibilities and tools from both institutional ethnography and material semiotics in taking up Deleuze and Guattari's (2004: 14, original emphasis) call to put tracings "*back on the map*"—referring, of course, to a rhizomatic map where the multiplicity and singularity that make up the 'established disorder' co-exist and clash in practice.

An embodiment of historical contingency, the rhizomatic map "has no beginning or end; it is always in the middle, between things, interbeing, *intermezzo*" (Deleuze & Guattari, 2004: 27, original emphasis). Thus, I required a clear strategy for entering and explicating the rhizome. How to begin? Contemplating their own arguments, the authors ponder: "If it is true that it is of the essence of the map or rhizome to have multiple entryways, it is plausible that one could even enter them through tracings [...], assuming the necessary precautions are taken" (Deleuze & Guattari, 2004: 16). These precautions involve a staunch commitment to "[plugging] the tracings back into the map, [connecting] the roots or trees back up with a rhizome" (Deleuze & Guattari, 2004: 15). In this thesis, I adopt the 'logic of oscillation' to attend to the vacillation between the singular (the tree, ruling relations) and the multiple (the rhizome, the diaspora of heterogeneous material relationality) that constitute the 'established disorder.' That is, in tracing ruling relations, I will also be exploring "at what point in the rhizome there form phenomena of massification, bureaucracy, leadership, fascization, etc., which lines nevertheless survive if only underground, continuing to make rhizome in the shadows" (Deleuze & Guattari, 2004: 16). This means that as I trace textually-mediated ruling relations—and the single reality they attempt diffuse and coordinate—I am simultaneously attending to other 'ghostly' and 'monstrous' sociomaterial relations that are being ignored or shunned to 'the shadows,' as well as the forms of suffering this exclusion might cause.

The concept of 'folded time' offered by philosopher Michel Serres seems to be a good place to begin rhizomatic explorations for those of us working within the confines of tree traces. According to Serres, time is not necessarily linear, homogenous or predictable through metrics, but folded, heterogeneous, stochastic and complex. In a translated conversation with Bruno Latour, he describes his concept of time:

Time does not always flow according to a line [...] nor according to a plan but, rather, according to an extraordinary complex mixture, as though it reflected stopping points, ruptures, deep wells, chimneys of thunderous acceleration, rendings, gaps—all sown at random, at least in a visible disorder. [...] [E]very historical era is likewise multitemporal, simultaneously drawing from the obsolete, the contemporary and the futuristic. An object, a circumstance, is thus polychromic, multitemporal, and reveals time that is gathered together, with multiple pleats. (Serres, Latour, & Lapidus, 2011: 57-60)

Serres goes on to use the metaphor of a handkerchief—one crumpled and folded, and another meticulously ironed-out—to differentiate between time as it is experienced by people in their everyday lives and time as mapped out through metrics and ruling logics:

Classical time is related to geometry, having nothing to do with space, [...] but with metrics. On the contrary, take your inspiration from topology, and perhaps you will discover the rigidity of those proximities and distances you consider arbitrary. And their simplicity, in the literal sense of the word *pli* [fold]: it's simply the difference between topology (the handkerchief is folded, crumpled, shredded) and geometry (the same fabric is ironed out flat). As we experience time [...] it resembles this crumpled version much more than the flat, overly simplified one. Admittedly, we need the latter for measurements, but why extrapolate from it a general theory of time? *People usually confuse time and the measurement of time*, which is a metrical reading on a straight line. (Serres et al., 2011: 60-1, original emphasis)

Inspired by Serres' linguistic play, I turned to an online etymology dictionary¹⁷⁸ to explore the root *pli*. According to the dictionary, *pli* comes from the Latin term *plicare* which means 'to fold' or 'to weave.' The word is also similar to the Latin term *plectere* which is 'to weave, braid, twine, entwine.'" These terms can be found in the words

¹⁷⁸ <https://www.etymonline.com>

simplify (to make one fold), *complicate* (to fold/weave/entwine with/together), *multiply* (to make many folds) and even *explicate* (to unfold). Here we get to the crux of the concept of folded time. It is not simple (one fold), but multiple (many folds) and complex (intertwined, interwoven, entangled). If modern science and industrial progress projects of the Capitalocene and the Anthropocene depend on linear, simplified conceptualizations of time (a singular fold, or a singular trace within which all must fit), it requires that the existing multiple, messy entanglements and stochastic realities be ironed out, overlooked, ignored. My participants and myself live our everyday lives acting and being enacted within the simplified tree traces—traceable through textually-mediated ruling relations. However, the stories my participants shared in interviews and focus group sessions revealed how they experience time as much more folded—past experiences and concerns about the future were all mixed up in a thick, crumpled present. Taking seriously the multiple experiences of my participants would, thus, involve attending to both linear and folded time. The analytical work of putting simplified traces of trees back onto the complex, multiple rhizome would necessarily involve both explicating (unfolding) the tree's traces and re-complicating (re-entangling) these traces. The conception of a vital institutional ethnography is just that: combining institutional ethnography's goals of explication with material semiotics' interest in re-entanglement.

The differences between the tree and the rhizome could also be described as what Haraway (2016; 2017)—drawing on M. Beth Dempster (1998)—distinguishes as a difference between *autopoietic* stories and systems, and those that are *sympoietic*. While processes of autopoiesis enact realities where autonomous, atomized units produce and reproduce themselves within a harmonious, controllable and predictable whole, sympoiesis acknowledges the complex material-semiotic entanglements—the human and more-than-human collaborations involved in enacting objects, happenings and biological life itself. While autopoietic stories tend to be linear—and are thus never complete¹⁷⁹—their contingency and dependency on material semiotic relationality is not always acknowledged within their stories of control and predictability. Sympoietic stories, on the other hand, do not imagine that everything fits into a romantically

¹⁷⁹ See Haraway (2016: 185, n54).

harmonious whole, the ‘intra-activity’¹⁸⁰ among myriad heterogeneous collaborators imbue them with an enduring element of surprise or spontaneity—a performance of the “becoming-with” that both Isabelle Stengers (2011: 134) and Donna Haraway (2016: 40; 2017: M26) speak of. In fact, the term sympoiesis, itself, means “making with” (Haraway, 2016: 58). While autopoietic and sympoietic stories often enact frictions (aggravated tensions in the Annemarie Mol sense), these frictions can also be generative (‘creative frictions’ in the Anna Tsing sense) (Haraway, 2017: M27; Mol, 2012: 11; Tsing, 2005: x-4). Scientific knowledge and technologies produced within and through processes of autopoiesis may also be necessary for carefully working within sympoietic processes—especially in dealing with the overflows of toxic materials produced through autopoietic scientific processes—and, thus, should not be seen as antagonistic or oppositional to each other (see Haraway, 2017: M27). It is within a healthy interplay and oscillation between autopoietic and sympoietic stories and processes that opportunities for ‘creative frictions’ emerge. Thus, problems arise when this oscillation becomes static and stale, and only one form of storytelling is taken as the single, ‘correct’ way to enact reality—for example, when only autopoietic stories are acknowledged and sympoietic relationalities are discounted, disregarded or blatantly ignored.

Anchored by my study’s standpoint, I have structured my analysis as a journey into the greater ‘established disorder,’ where I engage in tracing ruling relations while at the same time attempting to tell complex stories which highlight their entanglement within greater material-semiotic rhizomatic relations. While my background and analysis chapters (Chapters 4, 5, 6 and 7) vary in focus, each engages in some way with the oscillation between the singular and the multiple. In attuning to the oscillations between the singular and the multiple, the autopoietic and the sympoietic realities acting and being enacted within the ‘established disorder,’ I hope to open possibilities for thinking differently about my participants’ experiences of *konran* following TEPCO’s nuclear disaster.

¹⁸⁰ See Barad (2007; 2017) and Section 2.6.2.

3.3.2.4 Making sense from within the textual complex

Following other studies in institutional ethnography, analytical thinking for this project began during fieldwork, where I would listen for hints of social coordination through my interviews and when attending events. Most of my initial analytical insights were captured in my field (train) notes and provided the basis for later coding of interview transcripts. Japanese interview transcripts were coded using the qualitative software program MAXQDA. While I used the features of MAXQDA to search for specific terms and hone in on certain areas of interest, my goal was to discover and code “chunks of data” (M. L. Campbell & Gregor, 2004: 92)—as opposed to isolated extracts—that contain contextualized accounts that were useful in deepening my understanding of the research problematic and guiding questions.

Given the vast amount of textual data I was dealing with, I used my field notes to guide my initial attempts at coding. I began by trying to trace ruling texts and discourses that seemed to tie my participants into greater ruling relations by writing stories based on my field notes. Food safety metrics, food labels, discourses of *fūhyōhigai* (harmful rumors that lead to economic damage) and *fukkō* (recovery, reconstruction, revitalization), school lunch regulations, mass media news coverage, advertisements asking people to support the people of Fukushima by eating, just to name a few. It was clear that my participants were constantly relating to a barrage of institutional texts and discourses that infiltrated their everyday experiences. I began to question, what was the best string to follow to address my research problematic in a way that would be of most use and interest to my participants?

I consider this thesis to be a co-constructed text as the experiences, knowledge and folded descriptions offered by my participants inspired my writing, directing me toward the strings that needed to be followed to explicate ruling relations, as well as other ghostly and monstrous sociomaterial entanglements that needed to be attended to.¹⁸¹ While I was unable to incorporate quotations from all of my participants within this

¹⁸¹ For example, the stories from my participants who were children during the time of hydrogen bomb testing in the Pacific, who were raising children during the Chernobyl nuclear disaster, or who lived through previous radiological overflows were especially informative. Many of my participants also taught me a lot about Japan’s long history of industrial pollution, insights which helped greatly as I myself explored these incidents.

thesis, insights that arose throughout all of my interviews and focus groups are woven within the body of this text, and the text itself designed in a way to provide insights that will be useful in some way to all of my study's participants. Thus, direct quotations were not chosen as a way to represent a number of perspectives about radiation and food, but based on their ability to highlight how ruling relations—within which all of my participants participate—are enacted in practice. The analytic projects of both explicating my study's problematic and re-entangling my participants within ghostly and monstrous sociomaterial relations have shaped the following four chapters (Chapters 4, 5, 6 and 7).

In Chapter 4, I situate my participant's current experiences living in the aftermath of TEPCO's nuclear disaster within Japan's long history of industrial pollution. In retelling entangled stories that highlight the ghostly and monstrous sociomaterial entanglements and the role of ruling texts in muting humans and more-than-humans living within industrial ruins, I collect insights that help to guide the analytic projects of explication and re-entanglement I undertake in Chapters 5 and 6.

All of my study's participants were concerned in some way about the origins and scientific validity of the 100 Bq/kg reference limit for radionuclides in food, a metric used to ensure the 'safety' of the foods lining supermarket shelves my participants visited. Thus, in Chapter 5, I follow a string from these experiences into the vast institutional complex of radiation protection standards which participate in coordinating all of my participants' everyday eating practices, but which are decided extra-locally. Through the process of explicating how these ruling relations evolved and are enacted, I highlight many of the ghostly and monstrous entanglements which are obfuscated within the ruling relations.

In Chapter 6, I follow another string from my participants' experiences, this time explicating how both radionuclides and my participants' concerns about food 'safety' are muted through various enactments of 'safe food.' Here, telling entangled stories that highlight the humans and more-than-humans that participate in the multiple enactments of 'safe food' helps to illustrate how everyday eating is being coordinated in post-2011 Japan. Finally, in Chapter 7, I again step back to take a broader view, telling entangled

stories of how my study's participants carefully enact their lives within the constrictive ruling relations explicated in Chapters 5 and 6.

3.4 Into the 'established disorder'

In this methods chapter, I have illustrated the need for an innovative method that allows for disrupting modernist ways of conceptualizing experiences of *konran* related to eating in the aftermath of TEPCO's nuclear disaster. Borrowing sensibilities and tools from the fields of institutional ethnography and material semiotics, I have attempted to sketch out my conception of a method—a vital institutional ethnography—I believe is up to the challenge.

Through the following four chapters, I will lead the audience of this thesis into the 'established disorder' of human and more-than-human sociomaterial relationality from which my participant's experiences of *konran* emerge. Following the 'logic of oscillation,' I will attempt to explicate my study's problematic in a way that allows readers to notice and attune to people's sociomaterial entanglements and the tensions and inconsistencies inherent in their everyday experiences, without attempting to smooth them over or explain the differences away. My goal is to create a narrative that holds true to the multiplicity inherent in the contingent histories and histories-in-the-making I explore, a narrative that refuses "redemption into singularity" (Law, 2002: 195).

4 Entangled in toxins and texts: Re-attuning to historical and current industrial overflows by attending to sociomaterial entanglements in industrial ruins

4.1 Introduction

Hirata Madoka (pseudonym) was in Koriyama City in Fukushima Prefecture, taking care of her newborn baby and three-year-old son at the time of the earthquake on March 11, 2011. Koriyama is located approximately 60 kilometers due west of TEPCO's nuclear disaster, and suffered not only from earthquake damage, but also radioactive fallout—though no official evacuation notice was deployed. At the time of the disaster, Madoka knew very little about radioactivity, and, like many of my participants, was not acutely aware of the nuclear power plants in her prefecture of residence. Because her home was destroyed by the earthquake, she was living in an evacuation center with her children and husband when the nuclear disaster began. With no internet, all she could rely on was the TV news and her own knowledge about nuclear power and radioactivity.

My knowledge about nuclear power was that it was safe and clean, and that there was absolutely no chance that an accident would occur. That's all I knew. I didn't know how to deal with [a nuclear disaster]. So information was flowing from the TV, from news media and whatnot. The government's instructions were being announced, that's all I had to listen to. While on one hand they were announcing, "There will be no immediate health effects," the circular zone [for evacuation and calls for residents to stay indoors] was 2 kilometers, 3 kilometers, 20 kilometers, 30 kilometers. It was getting closer. So, it was very scary.

She describes how calls for 'reconstruction' and 'revitalization' [*fukkō*]¹⁸² were being made almost directly after the onset of the nuclear disaster, at the same time that she

¹⁸² The term *fukkō* is made up of the *kanji* characters of *fu* (復) 'return' and *ko* (興) 'arise' or 'amusement.' While the term is often used to describe physical 'reconstruction' or 'recovery' following a disaster, it also refers to a 'revitalization' or 'revival' of the activity and energy of a place. In fact, the term 'revitalization' is the translation for *fukkō* used by the Fukushima

was trying to apprehend and enact her new relationship with the invisible radionuclides now swirling around her neighborhood.

From the outset, there was the earthquake, the explosions. Within a month it was like “Keep Trying Tōhoku [Ganbarō Tōhoku]!” “Reconstruction/Revitalization [fukkō]!” “All Fukushima [Ōru Fukushima]!” “All Eastern Japan [Ōru higashi Nihon]!” “All Japan [Ōru Jyapan]!” It was totalitarian-like. Reconstruction [fukkō], bonds [kizuna], keep trying [ganbarō]. Since immediately after [the disaster], this was the customary grand chorus. Therefore, to even start thinking about evacuating gave you an extreme feeling of guilt. There was already a hurdle. It wasn’t only radioactivity and all of that. In a place where [the message is] “keep trying [ganbarō],” “head toward the goal of reconstruction [fukkō wo mezashite],” it was like you were running away and turning your back on everyone, exactly like a traitor [hikokumin]. It was a sequential reconstruction [fukkō]. Bonds [kizuna], keep trying [ganbarō], buy to support [katte ōen], eat to support [tabete ōen], go to support [itte ōen],¹⁸³ all of it. It was pressuring us not to leave.

The term *hikokumin*, Madoka went on to explain, literally translates as ‘not a citizen’ and was used to describe those people who were not swept up by the drumbeats of war in 1945, seventy-one years before our interview. She also described how the chorus of

Prefectural Government on their English language website:
<http://www.pref.fukushima.lg.jp/site/portal-english/>.

¹⁸³ This is referring to the major efforts put into increasing tourism in Fukushima Prefecture following the nuclear disaster.

*ganbarō*¹⁸⁴ and *fukkō* began coordinating activities around the city.¹⁸⁵ First, the phrase “keep trying toward reconstruction [*ganbattemasu fukkō ni*]” was broadcast on TV news. In April preschools and elementary schools opened as usual with their entrance ceremonies. Local news outlets encouraged people to keep trying (*ganbarō*) and to work toward reconstruction (*fukkō*). Roads and bridges destroyed by the earthquake were being repaired. Messages of “keep trying Tōhoku [*ganbarō Tōhoku*]” were broadcast by large supermarket chains which were back in business. Glass windows shattered in the earthquakes were covered with sheets spelling out *GA-N-BA-RO-U, FU-KKŌ, O-O-RU JYA-PA-N*. While outside of her new home, the rhythm of everyday life seemed to be progressing as people were swept up in a flood of nationalistic solidarity and a reconstruction spirit, Madoka was struggling to care for her children:

I also feel like I was trying my best [ganbarō]. I am a mother, so at the same time doing my best meant I had to bring my children outside to play. I had a 3-year-old so I had to periodically get him in the sun, hang out the bedding [futon]. But I couldn't hang them out. I couldn't put them outside. [We] didn't step one foot outside. We were like moles. Even though we sealed up the room and confined ourselves inside, radioactivity flew about. We didn't turn on the ventilation fan.

¹⁸⁴ The term *ganbarō* has been translated in many ways, ranging from “Stay strong” (Tsuiki et al., 2012: 558), to “Let’s hang on” (Shindo, 2014: 17), “Let’s do our best” (Hommerich, 2012: 48), “Don’t give up” (Hornung, 2011: 1; Kimura, 2017: 461), “Hang in there” (R. Pringle, 2011: 24), “Keep it up” (“Silenced by gaman,” 2011), and even “It’s hard, but keep trying! Together we’ll succeed! Go! Go! Go!” (specifically referring to the phrase *ganbarō yo* that was activated in discourse following the greatly destructive and deadly 1995 Hanshin earthquake in Kobe, Japan) (Hanson, 1999: 43). The mutable meaning of the word means that it sometimes changes connotation depending on the situation. I follow the author of an article published in *The Economist* which uses the phrases “keep it up” as the message being deployed by the authorities in post-2011 discourse, as it highlights the plea for people to endure (*gaman suru*) the hardships they are facing and continue to perform their everyday lives as usual (“Silenced by gaman,” 2011). It points to the need for the struggle to be a collective act of perseverance (see Samuels, 2013). That said, I may use some of the other translations for this word depending on the connotations intended by my participants, which sometimes differ from the meaning deployed in ruling texts and discourses.

¹⁸⁵ Others have also pointed out the instantaneity of the deployment and activation of term such as *ganbarō* (for example, Samuels, 2013).

We didn't open the windows. It's completely bizarre. It's not the occasion to have "keep trying [ganbarō]" plastered onto windows.

I then asked her what she did about food in the early days after the onset of the nuclear disaster. Not knowing much about radioactivity, Madoka explained that she did not know how to carefully enact her relationship with radionuclides at the outset.

I was really wondering, what should I eat? First, there was no water. Not even bottled water at the supermarket. So there was only tap water to drink. Next, vegetables. [...] People [at the evacuation shelter] were talking about putting harvested vegetables in a barn or a shed, and quickly picking all vegetables currently growing because radiation was falling. [...] So for food, I first stopped buying vegetables. Then, about contaminated water and such, I didn't know about that yet. [...] I was experiencing disorder [konran] about my cooking tools. My house was wrecked by the earthquake, so I didn't have many household goods. So we ate boil-in-the-bag foods. I care about additives in foods, but I didn't care for the time being, we just ate what we had. [...] But I didn't know much about radioactivity. If you boil radioactivity, like bacteria, you can eliminate it. That was my level [of understanding].

Though Madoka was overwhelmed with the vast efforts involved in taking care of a newborn baby and a 3-year-old, she was paying attention to the restrictions on food being announced by the government, alongside the experiences of local farmers. In particular, she remembers hearing the news about the farmer in Sukagawa (a city just south of Koriyama) who committed suicide after finding out vegetables he had sold were over the 'provisional reference limits.' Madoka went on to share how back in 2011 she also noticed the suffering of the dairy farmers living nearby, and connected their experiences with that of her own as a breastfeeding mother:

The dairy farmers, I watched as they had to keep milking the dairy cows so they wouldn't die, but cried as they discarded the milk onto their fields. I deeply thought, hey, [the cows are] mammals. I'm also a mammal because I'm feeding my daughter breastmilk. But she also drinks the water. It's the same, no? So milk was also out. For myself

also, I didn't know how much exposure I had received. But I was feeding [my daughter]. I remember feeling really afraid.

Despite the deafening chorus summoning people to stay, endure and rebuild their city in solidarity, Madoka carefully observed her surroundings. Not only did she notice the suffering of local farmers, but that there were no children outside in her neighborhood, no children in the parks. While at first she did not notice people leaving, it soon became clear that a number of people were—though sometimes it was only a brief escape over the weekends. In May, Madoka herself relocated to the Kansai region with her two children, though her husband stayed behind to work and live in Koriyama City. She classifies herself as *boshi hinansha* (母子避難者), referring to a configuration of mothers who sought or continue to seek refuge for their children outside of radioactive hot spots, leaving their husbands behind—possibly because the men need to continue working to support their family, have work or community duties and obligations they do not want to abandon, or have separated or divorced their wives, often due to perspectival debates.¹⁸⁶

In this chapter, I will situate my participant's experiences of *konran* following TEPCO's nuclear disaster in 2011 within Japan's long history of industrial pollution and industrial ruination. In her book *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*, Tsing (2015: 6) uses the concept of "ruins" to

¹⁸⁶ Of the *boshi hinansha* I interviewed, all of their partners were supportive of their decision to leave and protect their children. However, there were, of course, a number of strains on all aspects of their family relations. There were people who told me that they were so overwhelmed with everyday life as a nuclear refugee with no financial support that they hardly ever speak to their partners. One woman I spoke with brought most of her children with her from Fukushima Prefecture to the Kansai region, but her eldest child refused to come, staying behind with her father. She was already in high school and did not want to leave her friends. Others had to tempt their children with trips to Disneyland and trips to hot springs before they would agree to relocate. While relocating with a young child has its own set of challenges, it was definitely easier as the children followed without many complaints. Ripping children away from their schools and friends was just one of the many challenges for people trying to seek refuge from TEPCO's radionuclides. The bullying of refugee children at schools has also been a challenge for those families who have relocated (for example, AFP New Agency, 2017). However, the bullying does not stop in schools, but permeates throughout the everyday experiences of nuclear refugees. As just one example, in April 2017, the Reconstruction Minister told reporters asking questions on behalf of the 'voluntary evacuees' to "shut up!" at a press conference ("Minister yells," 2017).

refer to physically damaged landscapes produced through the enactment of industrial progress projects. She points out how both simplification and alienation are essential ingredients for enacting these projects and, thus, the ruins they leave in their wake: “simplification for alienation produces ruins, spaces of abandonment for asset production.” Exploring the “world-making projects”¹⁸⁷ of *matsutake* mushrooms—a delectable delicacy in Japan which also happen to be an efficient bioaccumulator of radionuclides—Tsing (2015: 131) illustrates how “salvage rhythms” sometimes take over when the drumbeats of progress become faint as capitalist investors abandon the ruins they create. While industrial projects tend to require progress stories presented on a linear, forward-moving trajectory where imagined human subjects and natural objects can participate in harmonious unison, the temporality of ‘salvage rhythms,’ Tsing (2015: 131-2) argues, is much messier and diffuse: “without the singular, forward pulse of progress, the unregularized coordination of salvage is what we have.”

The concepts of ‘ruins’ and ‘salvage’ not only attune us to the destruction, contamination and precarity¹⁸⁸ enacted through industrial progress projects, but how stories of ‘progress’ and conceptualizations of human bodies as both ‘liberal’ and ‘autonomous’ participate in these enactments. However, industrial overflows¹⁸⁹ disrupt this linear, forward-moving trajectory, creating *konran* in the lives of humans and more-than-humans caught in their wake. A historical lens reveals how, far from being an experience particular to the aftermath of TEPCO’s nuclear disaster, experiences of *konran* following industrial overflows have been faced by humans and more-than-humans throughout the history of Japan. In fact, overflows of industrial toxins have been producing industrial ruins throughout the Japanese archipelago dating back to at least the 1600s.

In the following sections, I follow Tsing (2017b: 8) in using various historical “high seats” to explore sociomaterial entanglements within Japan’s industrial ruins, with a particular focus on people’s entanglements within industrial toxins and textually-mediated ruling relations. Guided by insights from both the fields of institutional

¹⁸⁷ See Tsing (2015: Chapter 1).

¹⁸⁸ Here, I borrow the definition of precarity provided by Tsing (2015: 2) who describes it as “life without the promise of stability.”

¹⁸⁹ I borrow the concept of ‘overflow’ from Callon et al. (2009). Also see Section 2.6.4.

ethnography and material semiotics, I will retell these stories in a way that highlights how overflows of industrial toxins cause suffering in the everyday lives of people forced to live within industrial ruins, and how textually-mediated ruling relations interfere in people's attempts to enact their everyday lives within complex, messy and contaminated spaces. I then turn to a short reflection on monstrous entanglements before discussing the implications of attuning to the materiality of toxins and texts in the aftermath of TEPCO's industrial overflow.

4.2 Industrial toxins and institutional texts enter 'the myriad things'

I take the Edo era as my first high seat for exploring sociomaterial entanglements within industrial ruins. Spanning from 1603 to 1868, the Edo era was a period of feudalistic ruling relations in Japan in which a centralized Tokugawa shogunate employed Neo-Confucian ideologies of social harmony and respect of hierarchies in an attempt to coordinate the activities of humans and more-than-humans. At the top of the hierarchy sat the emperor, and at the bottom the lowest cast—derogatively referred to as *burakumin* (hereafter 'outcasts'), a categorization which contained an even lower classification of people referred to as *hinin* ("non-persons") (Thomas, 2010: 36). The period is described as 'early modern' as it signaled a change in how people related to each other, their country and their sociomaterial entanglements (B. L. Walker, 2015). While there were various terms used within philosophical texts to describe sociomaterial entanglements during the Tokugawa period, the term *shizen*—now a common term for 'nature' which is used to describe "the natural environment [*shizen kankyō*]"—seems to have been scarcely mentioned (Thomas, 2010: 312-3). Instead, terms such as *manbutsu* (万物—"the myriad objects" or 'the myriad things'), *tenka* (天下—"all under heaven")¹⁹⁰ and *kaibutsu* (開物—"the opening up of things") were used to describe the situated sociomateriality human bodies found themselves entangled within (Morris-Suzuki, 1991; Thomas, 2001).

¹⁹⁰ Interestingly, the same *kanji* characters make up the word *amakudari* (天下り—"descendant from heaven"), a word that refers to the established institution in which Japanese government officials are guaranteed an industry position upon retirement, usually within the same industries that they were once responsible for regulating (Aldrich, 2013: 254; Colignon, 2003; Lim, 2012: 14).

Thinking through material-semiotic sensibilities, I find the concept of *manbutsu* of particular interest. Made up of the characters *man* (万)—‘10,000’ or ‘myriad’—and *butsu* (物)—‘thing,’ ‘object,’ ‘figure’—the term seems to have connoted the “totality of the physical universe” (Morris-Suzuki, 1991: 83, n13), while also having acknowledged the myriad sociomaterial relations within which humans were entangled and expected to enact their everyday lives. The Japanese anthropologist Fukushima Masato (2005) also points out that the word *butsu* (also read *mono*) not only refers to physical ‘objects’ or ‘things,’ but also the dead and spirits—a nuance which signals the word’s ability to hold the ghostly presences often obfuscated in modernist progress stories. On the other hand, the term *kaibutsu*—made up of the *kanji* characters for ‘open’ (開) and ‘things’ (物)—denotes a transition from appreciating humans as one of various heterogeneous actor within the vast ‘myriad things,’ to a particular kind of actor with a “special role,” a “uniquely active role” in “improving” ‘the myriad things’ as a part of its moral duty (Morris-Suzuki, 1991: 83-6). According to historian Tessa Morris-Suzuki (1991: 84-5), the term *kaibutsu* could be translated as “‘revealing the nature of things’ or as ‘developing’ or ‘making use of’ the natural world,” and, thus, has a deep connection to technological developments of the time, especially in agriculture. While the term *manbutsu* may have attuned people to their own embeddedness within a rhizomatic heterogeneous materiality, *kaibutsu* provided a way forward for tracing out stable root-tree structures to coordinate human activities and to map out and enact progress projects (see Section 3.3.2.3).¹⁹¹ Thus, *kaibutsu* may be thought of as a concept deployed in an attempt to coordinate harmony; a way to harmonize the messy heterogeneity inherent in ‘the myriad things.’ Before concepts like *kaibutsu* emerged, the sociomaterial relations people found themselves embedded within were probably considered to be much more *fushigi* (mysterious or strange).¹⁹²

¹⁹¹ Morris-Suzuki (1991: 84) describes the writings of philosopher Kumazawa Banzan who uses the image of a plum tree to describe the special role of humans within *manbutsu*, specifically their role “in the survival and growth of the whole.” He describes the roots as the sky, the trunk as the nation, *manbutsu* as the leaves, and humans as the flowers and fruits.

¹⁹² I borrow the term *fushigi* from Stolz (2014) who highlights its use among philosophers imagining the separation of humans from their natural environments, as well as people living in toxic industrial ruins. Following Stolz, I will use the term in a similar fashion to describe the ‘strange’ things that happen when industrial toxins enter people’s sociomaterial entanglements—especially in times when bodies are supposed to be autonomous and liberated from entanglements with the natural world.

However, the process of enacting *kaibutsu* helped to produce a vision of sociomaterial entanglement not as “a hostile force, but instead abundant and benign” (Morris-Suzuki, 1991: 85). The simultaneously vital and vicious entanglement of Haraway’s (2016) Chthulucene were ideologically tamed through such simplified conceptualizations.

Beginning in the 1600s, an array of materials—including coal, copper and silver—were being discovered beneath farmlands and in other locations throughout Japan. As industrial projects were enacted, farmers and fishers began noticing changes to the fields and waterways they interacted with everyday (Iijima, 1979; Stolz, 2014; B. L. Walker, 2010). Until this point concepts of ‘pollution’ tended to refer to the Shinto notion of defilement or impurity (*kegare*) and the avoidance of dirt, blood and death (*imi*), or Buddhist teachings on the impurities and evils of eating or killing animals. Rituals and taboos were formed to deal with the major ‘pollutants’ of the day and to protect people from ‘demons’ that accompanied them—for example by putting ‘outcasts’ in charge of all practices of butchery, death or defecation (Pharr, 1990: Chapter 5). Historian Robert Stolz (2014: 21-33) also points out that concepts of outside and inside—specifically “that world [*ano yo*]” and “this world [*kono yo*]”—were already being used in both Shinto and folk medical practices as a way to ward off disease and hinder the spread of epidemics. Many rituals were created to ensure the impurity (*kegare*) and deathly (*yomi*) qualities of ‘that world’ remained separate from ‘this world’—referring to the human body and its dwellings. Thus, much before the emergence of ‘modern,’ ‘autonomous,’ ‘liberal’ bodies, bodies as ‘individual’ and separate from an ‘outside’ world were already being discussed and enacted through ruling texts and discourses. People were enacted as individual bodies which could remain healthy if they could protect themselves from external invaders. However, with the dawn of modern industrial projects, novel forms of ‘pollution’ began to migrate from newly established mines into local sociomaterial entanglements and agrifood assemblages within which human bodies were to act out their moral obligations. In the way that Madoka’s knowledge on bacteria was unable to help her in carefully interacting with radionuclides, the knowledge on avoiding pathogens would be of little help to the people living downstream of new industrial projects and their effluents.

Within the feudalistic ruling relations of the time, protesting industrial pollution of local farming and fishing grounds was not easy, as there existed no legal appeals

system for people within the Tokugawa ruling regime. However, this did not make protest impossible. As social harmony and respect of hierarchy served as the basis of ruling relations, causing an open conflict was going strongly against the norms of society. Under this form of feudalism, however, people in authority were expected to protect the interests of those beneath them and, therefore, protest within these ruling relations was possible if people could criticize those in authority for not adequately meeting their needs (Pharr, 1990). Petitions were sent to local officials from farmers and fishers who were either concerned about possible contamination, or who were physically suffering from overflows of industrial toxins. There were some cases where farmers or fishers succeeded in winning some forms of compensation. In some instances, people were offered silver from the shogunate's Ginza mint—ironically the same silver collected through the mining practices themselves—as a way to monetarily compensate damages to people's livelihoods. In other cases, restrictions to mining practices were enacted—for example, mines could agree to operate only during the off-season of farming. There was even the possibility for the complete shutdown of some mines.¹⁹³ On the other hand, it was also possible for people's concerns to be ignored, or for the shogunate to send a mission to investigate. However, this could end in people being forced to sign an agreement declaring that they would no longer interfere with mining operations. Regardless of the outcome, these protests generally took place at the local level—though sometimes composed of people from multiple villages—and locally situated bodies began enacting their everyday lives in relation with these novel forms of pollution (Iijima, 1979).

Here we see early forms of the entangled trouble that would ensnarl my participants in 2011: even over 300 years ago, people's sociomaterial entanglements with industrial toxins were being met with further entanglement within textually mediated ruling relations and monetary compensation schemes. The physical entanglements of people's situated realities were being mediated by objectified versions and ways of handling

¹⁹³ The decision to shut-down a mining operation seemed to be dependent on how important it was to the shogunate. For example, during this time period the Besshi copper mine in Ehime Prefecture suffered from many natural disasters—including fires, storms and earthquakes—and operators themselves asked the shogunate if they could suspend their mining practices. Instead of agreeing to the mine's request, the shogunate ordered its owners to continue mining silver in order to meet its needs (see Iijima, 1979; Ui, 1992).

these experiences; monetary compensation, and their accompanying textual contracts, would be a tool for pacifying those bodies living within ruined landscapes of overflowing industrial effluents. Put differently, people's everyday experiences with industrial toxins could be 'muted'¹⁹⁴ by institutional texts designed to 'solve' the *konran* they were experiencing as they attempted to conduct their lives within ever-expanding industrial ruins.

4.3 Designing liberal citizens: Pure, rational and disentangled from the natural world

The onset of Japan's Meiji Restoration becomes my next high seat for exploring sociomaterial entanglements within industrial ruins. With the fall of the Tokugawa shogunate in 1868, the Meiji Restoration period (1868-1912), ruled by the Meiji oligarchy, began reorganizing ruling relations in Japan with the goals of securing "civilization and enlightenment" (*bunmei kaika*) through rational and scientific thought (Stolz, 2014: 3; B. L. Walker, 2015: 8 & 72). The *kanji* characters for *bunmei kaika* (文明開化) represent 'literature' 'bright/light' 'open/unfold'¹⁹⁵ and 'change into'—terms which elicit a sense of positive transformation, a chance to escape from the dark ages of Tokugawa feudalism and head toward modern visions of enlightenment and progress. The newly established Meiji government would use liberal philosophies in an attempt to coordinate how humans enacted their everyday lives within increasingly industrialized landscapes.

During this period, philosophers began further reconceptualizing 'nature' (now referred to as *shizen*) as a resource that could be fully controlled by human activity. Historian Julia Adeney Thomas (2001: 32-4) emphasizes how the term *shizen* was methodically used by the Enlightenment philosopher Maruyama Masao to erase the multiple 'natures' that existed during the Tokugawa period. This new singular 'nature' represented an abstract, stable, inactive and controllable resource from which humans could easily extract raw materials to fulfill the Meiji policies of "encouragement of industry" and creation of a "rich nation, [with a] strong army" (Stolz, 2014: 20). Thus,

¹⁹⁴ See Latour (2005) and Section 3.3.2.2.

¹⁹⁵ This is the same character as found in *kaibutsu* (開物).

‘nature’ no longer needed to be considered as frightening and strange (*fushigi*), but could be rationalized in ways so that human bodies could be liberated from their sociomaterial entanglements with the natural world (Stolz, 2014: 42). These newly imagined ‘liberal citizens’ would receive a number of “inalienable natural rights” (Stolz, 2014: 79) which would serve as the basis for their existence, not to be disrupted by previous, messy entanglements within ‘the myriad things.’ From public spaces to clothing, sociomaterial relations of this period were to be reconstructed and reenacted in purified and rationalized ways in order to fit with Meiji philosophy. The ‘ghosts’ of the past were also cleansed from Meiji landscapes, and public hygiene practices further enacted bodies as ‘individual,’ ‘autonomous,’ ‘rational’ and ‘pure.’¹⁹⁶

The reconceptualization of human bodies as disentangled, alienated and liberated from their situated, ‘natural’ sociomaterial entanglements made possible the enactment of a new type of political subject to function within the newly designed liberal ruling relations. The Meiji Constitution provided a set of rights for governing the modern, autonomous, liberal bodies that could inhabit such a story. Stolz (2014: 22) explains:

By transcending the natural body, liberal political philosophy sought to create an ideal body with no (or only voluntary) relations with the outside world. This transcendence was accomplished through the epistemological, discursive, and (as much as possible) physical separation of the new political subject from the material environment.

In other words, the Meiji government attempted to engineer and enact human bodies which, epistemologically separated from their situated sociomaterial entanglements, would support the new government on its path toward economic and military advancement.¹⁹⁷ Meiji liberal subjects would be those who prioritize entanglement

¹⁹⁶ Stolz (2014: 28) explains: “we can see the goal of evacuating a central point—whether the individual body or the new imperial capital—of all wastes and impurities, leaving a pure, rational space, a clean slate with an unlimited possibility for expansion.”

¹⁹⁷ This is not to say that no remnant of Tokugawa ruling relations remained. In fact, though the new concept a ‘liberal individual’ was created, this subject was expected to follow the same Neo-Confucian principles of social harmony and respect for hierarchy—which maintained the status and power of the emperor who remained a very powerful figure within the period’s ruling relations. These social norms were disseminated through the new public education system’s ‘morals courses’ (Pharr, 1990: 24; Ui, 1992), and within the workplace (Gordon, 1985). According to the Japanese environmental scholar Ui Jun (1992: 5), “strong group

within textually mediated liberal ruling relations, not the messiness of everyday situated entanglements with dirt, microbes and other unruly human and more-than-human participants.

Beginning in the 1880s, however, the seemingly stable and controllable ‘nature’ (*shizen*) began acting in strange (*fushigi*) ways again, calling into question the validity of the concept of a normative, external ‘nature’¹⁹⁸ that underpinned the existence of the autonomous, liberal bodies essential to Meiji ruling practices (Iijima, 1979; Stolz, 2014: 33-5). The onset of a long-term overflow of industrial pollutants from the Ashio mining complex beginning in the late 1880s—considered the first major pollution incident of the Meiji period—provides a vantage point for exploring the *konran* experienced by people living within competing sociomaterial entanglements: textual ruling relations enacting pure, liberal bodies and the contaminated sociomaterial entanglements of people living within industrial ruins. Thus, from my high seat in the Meiji period, in the next section I tighten my focus on people’s lives within the industrial ruins of the Ashio copper mine.

4.3.1 *From pure citizens to poisoned victims: The limits of liberal subjectivity in industrial ruins*

The copper extracted from the Ashio mine, tied to the state power in both the Edo and Meiji periods, was a great source of foreign wealth as a material export,¹⁹⁹ but was also used for domestic projects—including the transmission of electricity (Shoji & Sugai, 1992; B. L. Walker, 2010: 72). Located in Tochigi Prefecture at the top of the Watarase and Tone watersheds, this government-owned mine was eventually sold to the Furukawa *zaibatsu* (financial conglomerate) in 1877 (Iijima, 1979; McKean, 1981). At its peak in 1890, the Ashio copper mine was producing almost forty-percent of Japan’s

orientation, loyalty to the organization, decision-making inability relative to primary concepts, submission to authority, attitudes of discrimination, and excessive concern for social status are all national characteristics of the Japanese which have been nurtured throughout the length and breadth of the educational system.”

¹⁹⁸ Thomas (2001: 32-3, n3) points out how when used in its adverb form, *shizen*—the currently widespread Japanese term for ‘nature’—connotes ‘spontaneity,’ a nuance that, as some linguists argue, is not implicit in its English translation. It is also a nuance that seems to disrupt notions of the controllability of nature and the existence of autonomous liberal subjectivities.

¹⁹⁹ Copper earned capital which allowed Meiji leaders to purchase industrial machinery and weapons for their military projects (see Shoji & Sugai, 1992; B. L. Walker, 2010).

total copper output. Though the Meiji Constitution was established in 1889—creating the Meiji Diet—the state remained under the authority of the emperor who maintained full control over the military and was the only entity with the power to create or dissolve government organizations. While the Lower House of the Diet was filled through elections, the Upper House was filled with appointed bureaucrats, industrial capitalists, large landowners and noblemen (Shoji & Sugai, 1992). Within these newly established ruling relations, the Furukawa *zaibatsu* had successfully built many relationships with government officials, often through familial and personal ties (Shoji & Sugai, 1992; Ui, 1992).

While attempts at alienating city dwellers from their situated, ‘natural’ sociomaterial entanglements may have been less of a challenge, farmers and fishers still depended on these entanglements to perform their livelihoods. It is, therefore, no surprise that these very people began noticing changes in fish abundance and plant health beginning in the 1880s. By 1881, the overflow of toxins from the mine forced the governor of Tochigi to ban the sale of fish from the Watarase river, years before massive toxic floods hit the Watarase and Tone watersheds in 1890 (Iijima, 1979). Eventually, farmers and fishers became vocal about the role of Ashio’s pollutants in disrupting their everyday lives (Iijima, 1979; Shoji & Sugai, 1992; Stolz, 2014). Not only were farmlands destroyed, but fisheries were left barren and illness ravaged villages along the river. The normal flows of birth, death and breast milk were all unsettled by the overflow of Ashio’s sulfuric acid and heavy metals (B. L. Walker, 2010: 96); the pollution was so bad that people began renaming the Watarase river “the River of Death” (B. L. Walker, 2010: 96). Walker (2010: 96-7) describes the scene:

Fisheries crashed, insects no longer chirped, seedlings no longer grew, and grotesque sores developed on the hands and feet of the farmers who labored in the paddies and irrigation channels. Farmers drew on local traditions and assumed that the river deities had become possessed by demons, but the only demons were the Ashio bosses who had ordered that the waste be discharged into the river: sulfuric and arsenic poisons, ammonia, cadmium, chlorine, copper, iron, lead, magnesia, nitrates, phosphoric acid, and zinc.

At this point, some people began requesting that the local government survey their land; they wanted to prove that the suffering and death erupting within and around them was caused by Ashio's pollutants. As 'liberal citizens' entangled within textually-mediated ruling relations, they needed to scientifically prove this link for their concerns to be taken seriously. Other ways of entangled knowing—for example, the complete lack of birdsongs noted by Matsumoto Eiko (2000), a female journalist reporting on Ashio's pollution for the *Mainichi Shimbun*—provided insufficient evidence.

Matsumoto's (2000) reporting revealed a messy, entangled reality that could not be comprehended by those who viewed humans and their bodies as disentangled from their situated sociomaterial entanglements. Her writings provide thick ethnographic accounts of how Ashio's pollutants defied all concepts of Meiji individuality, liberalism, autonomy and divisions of 'inside' and 'outside'—they freely flowed through water, fish, plants and human bodies. Both her stories and the detailed drawings that line the pages of her manuscript illustrate that these pollutants were not benign as the philosophers preached, but material, vibrant and remarkably vicious. In her writing, Matsumoto (2000: 17) described the pollution as a "strange thing [*fushigina mono*]," pointing out how the many news articles, speeches and volunteer efforts produced and enacted to help in solving the pollution problem were not of much use in curbing the contamination and suffering these materials caused in the lives of people living within Ashio's overflow. Instead, both the suffering and the care involved in living intimately with Ashio's pollutants became as invisible as many of the pollutants themselves. She goes on to explain the "strange feeling [*fushigi no kan*]" that emerged from this blindness to people's real sociomaterial entanglements with vicious toxins: "No one stands against the victims, nowhere has a contrary voice been raised. And yet the problem has receded into the background, operating now in the shadows. Truly, this gives rise to a sense of the strange [*fushigi no kan*]" (Matsumoto, 2000: 17).²⁰⁰ Thus, far from being disentangled liberal subjects, people's intimate and situated sociomaterial entanglements with Ashio's effluents erupted not only as malaise—through blindness, sores and illness—but through loss of livelihood, low birth rates, loss of voting rights, poverty, inability to marry due to discrimination, among many

²⁰⁰ The English translation is borrowed from Walker (2010: 47) whose writings first introduced me to the fascinating work of Matsumoto.

other egregious horrors (Matsumoto, 2000; Stolz, 2014: 45). Being a citizen within the ruling relations of the Meiji period required bodies to be pure and disentangled, a liberty that was not possible for the porous, contaminated bodies living downstream of Ashio's mine.

While scientific testing was conducted to measure Ashio's effluents in agricultural soils, the results were "immediately confiscated by the authorities" (Shoji & Sugai, 1992: 23). Originally having faith that industrial overflows could be resolved within Meiji liberal ruling relations, Lower House representative from Tochigi Prefecture and protest organizer Tanaka Shōzō argued for the rights of people living in Ashio's overflow whom he still considered to be liberal-bodied as stipulated in the Meiji Constitution. During the second Diet Session in December 1891, Tanaka argued that the Constitution provided for property rights as well as the inalienable right for citizens to petition the government. He also pointed out that, according to the country's mining laws, if mining operations harm public welfare, the mine loses its right to operate (Iijima, 1979; Shoji & Sugai, 1992; Strong, 1995; B. L. Walker, 2010: 98-9). The government's response was not what Tanaka had in mind. Instead of upholding the rights of liberal citizens, the Meiji government attempted to further alienate people from their situated sociomaterial entanglements—entangling them further within ruling texts that promised to 'solve' the industrial overflow while simultaneously ignoring people's very real entanglement with Ashio's toxins.

In its official government response in 1892, the Diet announced that the causes of pollution were still unknown, that a study was underway, and that pulverized ore collectors would be used to prevent copper from overflowing again—it did not seem to matter that pulverized ore collectors are only intended to recover waste, not prevent pollution (Iijima, 1979; Shoji & Sugai, 1992). The government's utilitarian stance—the shadow that lurked behind promises of enlightenment and perpetual progress—was more clearly illuminated in an 1892 response by the Ministry of Agriculture and Commerce which was printed in a Tokyo newspaper (quoted in Strong, 1995: 74):

Suppose for the sake of argument that copper effluent [was] responsible for the damage to the farmland on either side of the Watarase—the public benefits that accrue to the country from the

Ashio mine far outweigh any losses suffered in the affected areas.

The damage can in any case be adequately [...] taken care of by compensation.

For the porous and entangled bodies living along the Watarase watershed, this news added insult to injury. On the one hand, these people were experiencing the myth of liberal subjectivity—their intimate connection with Ashio's pollutants revealed they were neither autonomous and liberated from worldly entanglements, nor were their 'inalienable rights' acknowledged or protected under the Meiji Constitution. The ruling texts themselves refused to acknowledge their very real entanglements with Ashio's effluents. On the other hand, they were being enacted as liberal subjects within the established ruling relations and, thus, were expected to sacrifice their bodies for the nation. The message from the Ministry of Agriculture and Commerce was clear: sacrifices must be made and suffering must be endured to be a liberal body under Meiji rule, and financial compensation would be the tool for resolving any disputes (see B. L. Walker, 2010: 100).

As a result, financial compensation became the only resort for many people living in Ashio's industrial ruins. The same year the Ministry of Agriculture and Commerce's quote appeared in the Tokyo newspaper article, farmers and fishers joined negotiations which promised them annual compensation for losses. However, in return, they needed to abstain from protesting until June 1896 when the new pollution-preventing equipment would be tested (McKean, 1981; Shoji & Sugai, 1992). Ruling relations would ensure that those receiving compensation would no longer disrupt the flow of Ashio's effluents or business as usual.

Nevertheless, continual overflows of Ashio's effluents into people's everyday lives impeded attempts at simply pushing the pollution problem into the shadows or stabilizing unrest through monetary compensation schemes. Protests—silent during the Sino-Japanese war in 1894 and 1895—picked up again after an even larger flood hit the Watarase basin in 1896 (McKean, 1981). Fed up with the poor results they were getting from their interactions with local governments, people living within Ashio's ruins began revolting, this time protesting the central government. In 1896, approximately 2,000 people marched from Unryuji (Unryu-temple) in Gunma Prefecture to Tokyo—a

distance of over 60 kilometers. This resulted in further textually-mediated attempts at problem-solving: The Agriculture and Commerce Minister visited the mine, a meeting which ended in a thirty-seven-point order requesting the Furukawa *zaibatsu* improve mining operations which, if not obeyed, could result in the shutting down of the facility (Iijima, 1979). While the Furukawa *zaibatsu* did invest in new pollution control methods—and even undertook additional research for controlling the release of pollutants—these activities did not improve the situation downstream (McKean, 1981). In 1898, some people were awarded tax exemptions for having their farming or fishing livelihoods destroyed by Ashio’s toxins, but again accepting such monetary compensation often included a deal which infringed on their voting rights (B. L. Walker, 2010). In the same year, a second group of 3,000 people living in areas contaminated with Ashio’s pollution marched from Unryuji to Tokyo. In 1900, a third group of over 10,000 people made the same journey (Iijima, 1979). In the 1900 march, the people protesting overpowered police. As a result, the Diet passed a Police and Regulation Law to prevent such large-scale gatherings in the future (McKean, 1981).

The term *kōgai* has been used to refer to incidences of ‘pollution’ or ‘public nuisance’ dating back to Ashio’s overflows (Ui, 1980: 321). Stolz (2014: 94) points out how the term—which literally translates as ‘public injury,’ though tends to refer to something “injurious to the public [interest]”—was born out of liberal philosophy: a classification tool useful for distinguishing between what is public and what is private, as well as allowing for cost-benefit analyses to be used in deciding on “acceptable levels of toxicity” which would be “based on the current definition of public interest.”²⁰¹ The term also classifies people into categories of ‘victim’ and ‘perpetrator,’ creating blunt group divisions which make creatively solving the problem much more difficult, if not impossible (see Kada et al., 2006). Regardless of its role in polarization and categorization of people and their experiences, the term *kōgai* continues to be a tenet of Japanese environmental law today. Avoiding becoming trapped within the utilitarian debates implicit in the term *kōgai*, Tanaka instead referred to pollution in its material form—‘*doku*’ (poison, 毒)—which he viewed as disrupting the “eternal motion of

²⁰¹ This description is reminiscent of the process for crafting radiation protection standards which will be discussed in Chapter 5.

material energy”—what he referred to as ‘*nagare*’ (flow, 流れ)’ (Stolz, 2006; 2014: 94).

Realizing the vast complexity of Ashio’s toxic overflows²⁰² and the futility of his efforts to address these issues within the liberal governing structures, Tanaka turned away from liberal politics. Distraught and disenchanted with Meiji liberalism, in 1901 he attempted what he thought would be his final protest: a direct appeal (*jikiso*) to the emperor which, according to Tokugawa law, would have resulted in a death sentence. On the morning of December 10th, Tanaka ran toward the carriage of the Meiji emperor as it was leaving the national Diet in Tokyo. Yelling while waiving a written appeal above his head, he was ultimately unsuccessful in reaching the emperor, arrested after being obstructed by a police officer and his horse who had both collapsed during the incident. While his act was supposed to be legendary and resonant, Tanaka soon learned that *jikiso* was no longer illegal under Meiji rule. The symbolically heroic story that Tanaka attempted to enact that day would prove to be as futile as his attempts to protect people living within Ashio’s ruins through liberal governing structures. Though he was detained, Tanaka was soon let free, and copper effluent continued to freely overflow from the Ashio mine (Stolz, 2014: 51-5; Strong, 1995). In the end, the Ashio mine operations polluted around 250,000 acres of paddy lands, and contamination is still present today (Shoji & Sugai, 1992: 40-1). The government’s final solution in this case was to purchase Yanaka village—considered the heart of the protest movement—as part of its flood-control plan, erasing it, as well as any evidence of the suffering of its inhabitants, from the Earth so as not to stain the pure image needed for the progression of the Meiji Restoration.

Fast-forward to November 2013 and Yamamoto Tarō²⁰³ followed in Tanaka’s footsteps in using the process of *jikiso* to help people suffering from an industrial overflow, this time the overflow from TEPCO’s nuclear disaster. At a garden party, Yamamoto passed a hand-written note to Emperor Akihito, a note he says was intended to inform

²⁰² Tanaka began writing about the “‘invisible’ (*me ni mienai*)” nature of Ashio’s poisonous overflows, the resulting contamination which he felt required much care and caution (Stolz, 2014: 45, original emphasis; Strong, 1995).

²⁰³ Yamamoto is a young lawmaker in Japan’s Upper House who transitioned from an acting career to politics following TEPCO’s nuclear disaster.

the emperor about the realities of people working and living in areas contaminated by TEPCO's radionuclides. While *jikiso* is not illegal under current Japanese law, it is considered taboo, and the act of passing the letter opened Yamamoto to a barrage of attacks. Yamamoto, who ran as an independent and has since formed a coalition party,²⁰⁴ had run his campaign based on an anti-nuclear platform. However, after about a year in government he found himself in a similar position as Tanaka: he was unable to follow through on any of his campaign promises (see Associated Press, 2013). I saw Yamamoto speak at least three times during my fieldwork in the Kansai region. I twice heard him speak at Osaka Station in the heart of a busy shopping district, educating people on their constitutional rights and the current ruling Liberal Democratic Party's plans—under Prime Minister Abe Shinzō—to change the constitution.²⁰⁵ The third time, I heard him speak at a small café that tested its food for radionuclides.²⁰⁶

As *doku* (poison) from the melted cores of TEPCO's nuclear reactors have been continuously flushing into the Pacific Ocean each day since the onset of the nuclear disaster in March 2011—some of it diverted and piled up in hundreds of leaking, makeshift tanks—questions arise as to how much things have actually changed in over 100 years of liberal, and now neoliberal, ruling relations.²⁰⁷ While Ashio's overflowing effluents became a frightening reminder of people's inescapable sociomaterial entanglements,²⁰⁸ the disruption industrial toxins caused in people's everyday lives was never enough to stop the expansion of industrial progress projects—their bright future

²⁰⁴ While the party was first called the *Seikatsu no tō* (People's Life Party), it has now changed its name to *Jiyū tō* (Liberal Party).

²⁰⁵ The proposed changes would both allow Japan to engage actively in war, and also grant the government further powers during a state of emergency—for example the right to change the constitution following an emergency such as TEPCO's nuclear disaster. According to Assistant Professor Koide Hiroaki, Japan is still officially under a state of nuclear emergency—it issued a Radiation Emergency Declaration in March 2011 due to TEPCO's nuclear disaster—which has allowed for greatly changing laws relating to people's exposure to radioactivity (Hirano et al., 2016).

²⁰⁶ Yamamoto has always been a strong advocate for food testing, and even appeared as a spokesperson for *Co-op Shizen-ha*, a food cooperative that also tests the food it sells for radionuclides.

²⁰⁷ See Stapczynski and Urabe (2016) and TEPCO (n.d.) regarding the contaminated water building up and flowing into the ocean each day—approximately 300 metric tons of water flows through the damaged reactors each day according to TEPCO.

²⁰⁸ This concept is similar to Linda Nash's (2007) concept of “inescapable ecologies.”

projections blind to the situated suffering of the humans and more-than-humans entangled with their overflowing pollutants.

As the 20th century advanced, so did the expansion of industrial ruins throughout Japan—though the development of new technologies and the engagement in negotiations with local farmers and fishers did sometimes help to thwart overflows as large-scale as those experienced at Ashio.²⁰⁹ However, attempts made to better engage with local communities did not prevent the overflow of toxins and the expansion of industrial ruins. By the end of the Meiji period, not only were there imperial ruins²¹⁰ to overcome, but a sprawling of industrial ruins. How to keep people moving toward a bright future while they are living in industrial ruins? One way is through further entangling them within textually-mediated ruling relations. Here I turn to Japan's pollution incidences in the 20th century as my next vantage point for exploring sociomaterial entanglements within industrial ruins.

²⁰⁹ In 1894, the Besshi copper mine (owned by the Sumitomo *zaibatsu*) invested greatly in moving its operations to an offshore island to prevent the pollution of farmlands following complaints and protest due to crop damage. When that was not enough, the company agreed to pay compensation to farmers, limit its yearly production, and limit production when rice seedlings were most delicate (including shutting down operations for the ten days during the most vulnerable periods). As pollution did not improve the suffering of island residents, Sumitomo invested in new pollution-reduction technologies that went beyond government regulations, while also paying out large sums of compensation money to 'victims' of toxic overflows, not because they were legally bound to, but because of the pressure from local farmers. The Hitachi copper mine follows a similar storyline. In 1907, Hitachi began negotiating with farmer representatives after their effluents caused major damage to crops and forests. In this case the owner never refuted that the damage to the crops came from the mine. In order to deal with the pollution, the company implemented the use of dilution devices and, figuring compensation payments into the company budget, set up easy ways for farmers to negotiate and receive compensation payments for pollution. In addition, Hitachi increased the amount of compensation given to visible, calculable damage by ten percent in order to cover for any mental suffering that may occur, while also offering free medical care for people suffering from smoke-related problems. In 1914, Kuhara decided to construct the world's largest chimney as a dilution technology to prevent damage to local residents (McKean, 1981). These stories are reminiscent to the insights shared by Fressoz (2007) noted in Section 2.2.4, mainly that people's active participation in voicing their concerns about polluting technologies sometimes led to the creation of technologies that were less polluting.

²¹⁰ See Stoler (2008; 2013) for a discussion on "imperial debris."

4.4 Muting toxins and highlighting texts: Using ruling texts to contain overflows

For my final high seat, I turn to Japanese cases of industrial pollution and ruination of the 20th century, focusing specifically on people's entrenched entanglements within textually-mediated ruling relations in tandem with the vast proliferation of industrial ruins. In 1912, the Taishō government came into power and attempted to keep people aligned with its goals of empire building and military mobilization, even within sprawling industrial ruination. How were ruling elites able to enact progress projects while simultaneously creating industrial ruins? One way was by further alienating people from their situated sociomaterial entanglements and entangling them further within ruling discourses and texts. More specifically, ruling relations were coordinated through schools and workplaces that enacted 'nature' not as 'the myriad things' people were entangled within and dependent on for their survival, but an abstract concept representing national ideology. To coordinate this disentanglement from situated sociomaterial relations, local sites of worship which foster situated entanglement were destroyed. Trees were cut down and sold for lumber, and shrines were torn down, all as a way to physically disentangle people from their local sociomaterial relations (Thomas, 1998: 120-3).²¹¹ Historian Julia Adeney Thomas (1998: 128) explains: "one was either natural and, therefore, what one said and did was in harmony with Japanese culture, or one was unnatural, at odds with the national body and, not being part of that body, ultimately invisible and inaudible." Thus, if people did not agree with the new national policies, their disagreement would make them at best invisible, and at worst a target for persecution for not performing the progress goals of the nation. Not only would this result in a further alienation of humans from their situated sociomaterial entanglements, but the classification of protest or complaints about pollution as a threat to "national security" (Ui, 1992: 3)—a reality which is hauntingly reminiscent of the

²¹¹ Thomas (1998: 120-3) points out how, throughout local villages in Japan, Shinto shrines provided a space for villagers to revere the natural world and pay respect to their family ancestries. As these sites maintained nature as a physical space to perpetuate individual village identities, the government needed to co-opt it in order to enhance nationalism. This was done by de-emphasizing human connection with a physical nature (for example, the worshiping of a physical nature at diversified, local shrines) and instead focusing on a worship of an abstract, nationalized form of ancestor at new, district level shrines. As a result, local shrines connecting people to local sociomaterial entanglements were seen as detrimental to nation-building and were destroyed; the sacred parts of local shrines were moved in an attempt to ensure there was only one shrine for each administrative village where subjects were expected to worship ancestors of the national family of Japan within which they were expected to be a part.

current Japanese situation since the passing of the State Secrecy Law in December 2013.²¹²

The end of World War II signaled the defeat of the Japanese imperial rule and a new period of occupation by the United States (US). Facing a country whose infrastructure had been almost entirely destroyed through a widespread US bombing campaign, industry took the lead in pulling Japan out of its defeat and establishing it as a global economic power. Industry's ability to lead the nation back from defeat gained it much admiration from people throughout the country. While this was good for those profiting within the newly booming economy, those entangled with pollutants found themselves struggling in battles against industries who no longer felt compelled to follow government orders to act in ways that respected people's situated sociomaterial entanglements (McKean, 1981). Additionally, the new obsession with high-paced (but 'peaceful') economic growth—the new 'peace constitution' prevented Japan from having a military—made the task of protecting people from pollution even more difficult when using once-useful tactics such as direct action and informal negotiations (Hoshino, 1992). Instead, people suffering within industrial ruins started to move their battles into the judicial system.

By the 1970s, Japan's industrial ruination was no longer restricted to small towns and villages, but was expanding throughout the country, even into large cities (Ui, 1992). In fact, by the mid-1960s, the country was considered the most polluted of all industrialized nations (Almeida & Stearns, 1998). Along with sprawling industrial ruination, there were 'four big court cases' in particular fought in the 1970s that seemed to galvanize the interest of the wider Japanese public in pollution incidences (McKean, 1981)—so much so that they have been attributed to the birth of Japan's Environmental Agency in 1971 (Kada et al., 2006).²¹³ Here I would like to focus in on one of these

²¹² Frackler (2016) describes Japan's currently active State Secrecy Law, pointing out the "symbiotic relationship" between Japanese journalists and government which creates a frightening prospect for the state of press freedom in Japan. Symbiosis and its role in enacting monstrous sociomaterial entanglements will be discussed in further detail later in this chapter.

²¹³ While I will not discuss it in detail here, the creation of the Environmental Agency (now the Ministry of Environment) and enactment of subsequent environmental laws and bureaucratic and judicial processes for managing industrial overflows—what Avenell (2012) refers to as a "green leviathan"—was also a way for the Japanese government to textually define and

court case, that of methylmercury poisoning in Minamata City, Kumamoto Prefecture. In particular, I will explore how the overflow of industrial effluent into Minamata Bay has entangled people in toxins and textually-mediated ruling relations for the past six decades, seemingly ‘resolved’ through the rebirth of the city in March 2011.

4.4.1 Court battles, ‘rebirth’ and everyday care within industrial ruins

Methylmercury poisoning, or organic mercury disease, was first observed in Japan within the small fishing village of Minamata on the island of Kyushu in 1956.²¹⁴ In this case of industrial ruination, the Chisso chemical company released large amounts of industrial effluent into Minamata Bay, a vibrant fishing ground for local fishers and a food source for local villagers. Given the specific location of the industrial overflow, the mix of symptoms this specific type of poisoning enacts has become widely referred to as Minamata disease.²¹⁵ Chisso used mercury as a catalyst in its production processes; methylmercury itself is produced by bacteria interacting with the heavy metal (Grandjean et al., 2010; Hamdy & Noyes, 1975). Once in the marine environment, methylmercury bioaccumulated in the bodies of fish and shellfish, and ultimately wreaked havoc on the lives of any human or animal body that ingested it (Harada, 1995).

Similar to the experience of people living in the overflow of Ashio’s effluents, those living along Minamata Bay began noticing ‘strange’ things happening in their surroundings during the 1950s. Harada (1995: 3) paints a picture of the troubling scene:

During the 1950s, people began to witness strange phenomena in and around Minamata Bay. For no apparent reason, fish rotated continuously and floated belly-up to the surface, shellfish opened and decomposed, and birds fell while in flight. The most shocking of all incidents was the frenzied death of cats. Cats suffered from excessive

textually ‘clean up’ or ‘solve’ sprawling industrial ruination. Also, if some of these new laws meant that some polluting technologies were not allowed in Japan, companies would move abroad to create industrial ruins in less regulated spaces in Asia and Latin America (Ui, 1992: 11).

²¹⁴ Though symptoms were evident years before 1956, their link to methylmercury was not established by Japanese medical doctors until that year (see Harada, 1995).

²¹⁵ It is also sometimes referred to as Chisso-Minamata disease to highlight the role of the polluting company (see Nabi, 2014).

salivation and manifested general convulsions or violent rotational movements, were unable to walk straight, and often collapsed dead. Many jumped into the sea to drown, and eventually cats were no longer seen in the area.

Eventually human bodies that ingested seafood containing methylmercury started to exhibit similar symptoms: they randomly convulsed, lost consciousness, and generally began acting in strange ways due to damages the toxin caused to the brain and nervous system. Children who developed along with methylmercury within their mother's wombs were born with mental retardation, deformities of the limbs, hyper-salivation, trouble with muscle coordination, impaired speech, among many other troubling ailments (Harada, 1995: 8). The source of these monstrous effects took years to uncover, and people who themselves or had family members exposed to the neurotoxin found themselves in an extremely precarious situation as neither the company nor the Japanese government were willing to take responsibility for the *konran* and suffering wreaked on their everyday lives. If people did want to seek compensation from Chisso, they needed to take on the label of 'victim,' which would automatically pit them against community or family members working at the chemical complex. Acknowledging the presence of methylmercury in one's body or family member's body might also bring shame to oneself or one's family, or lead to a decrease in fish sales as speaking up might publicize the possible contamination of seafood with Chisso's effluent (Kada et al., 2006).

Regardless of the many drawbacks of speaking out, many of the villagers exposed to methylmercury did fight back through protest and the judicial system—where they faced ruling texts head-on. However, the court battles for compensation have been brutally painful and time consuming. In fact, decisions on compensation were still being made in March 2011, and continue until today. Even six decades on, gaining financial compensation for all sufferers—particularly those not 'officially' recognized—remains unclear (Keiji Hirano, 2016; Jobin, 2014; Kyodo News, 2011a; Marran, 2011). It was also in March 2011, after years of attempts to revitalize Minamata through tourism, that the city was named 'Environmental Capital of Japan' (see FutureCity Initiative, n.d.; Kada et al., 2006; Saigusa, 2011). Thus, the same month TEPCO's nuclear disaster began unfolding, Minamata City was being reborn—the

ghostly hauntings of its own industrial ruination erased from its image through its rebirth as an ‘environmental capital.’

However, anyone who has viewed the photography and writings of W. Eugene Smith and Aileen Mioko Smith (Figures 7 and 8) or the video footage provided by Tsuchimoto Noriaki (1971) quickly realize there is something missing from discussions focusing merely on Minamata’s judicial battles and environmental rebirth. Providing a glimpse into the everyday lives of people living within Chisso’s industrial ruins, their images not only visually portray the monstrous state of human bodies entangled with Chisso’s methylmercury, but the very vigilant forms of long-term care involved in living within these very real, vital and vicious sociomaterial entanglements.

While the court cases are often valorized in historical reflections into the industrial overflow, they provide only one piece of the story; many of the people suffering from methylmercury poisoning require full-time nursing care, care that is often provided entirely by family members (Harada, 2005). Thus, while people’s monstrous entanglements within textually-mediated ruling relations and industrial toxins both require attentive care, the latter is often overlooked in stories about these happenings. One reason might be that these stories are less exciting than those discussing “‘trials of strength’” of ‘victims’ versus their ‘oppressors’ (Haraway, 2016: 41-3). While these ‘trials of strength’ are important for attempting to rewrite legal texts in a way that acknowledges multiplicity and sociomaterial entanglements with toxic industrial overflows, as Haraway (2016) points out, they alone are no longer adequate for dealing with the messes we find ourselves in living in the industrial ruins of the Capitalocene.

Here, telling more entangled stories which reveal sociotechnical disasters as both ‘matters of concern’ and ‘matters of care’—as opposed to purely ‘matters of fact’ that can be categorized and controlled—seems to be an important first step (de la Bellacasa, 2011; Latour, 2005).²¹⁶ However, seriously attending to ‘matters of care’ involves the somewhat uncomfortable task of attuning the messy, monstrous entanglements Haraway (2016) describes in her conceptualizations of the Chthulucene. And it is not only attunement to care that is difficult, but the backlash one might face through paying

²¹⁶ Also see Section 3.3.2.2.



Figure 7 Photograph by W. Eugene Smith. Copyright: Aileen Mioko Smith (Aileen Archive). From the book *Minamata* by W. Eugene Smith and Aileen M. Smith (1975).



Figure 8 Photograph by W. Eugene Smith. Copyright: Aileen Mioko Smith (Aileen Archive). From the book *Minamata* by W. Eugene Smith and Aileen M. Smith (1975).

attention—seen in the ways in which W. Eugene Smith was not only targeted, but physically beaten so badly that it was difficult for him to continue his work as a photographer (Nabi, 2014: 197), or in the ways bodies not following the autopoietic, single-reality-wielding stories of what I will go on to characterize as the ‘transnational nuclear assemblage’²¹⁷ are categorized away as ‘irrational’ or suffering from ‘psychological distress.’ How to deal with simple, autopoietic coordination efforts that are blind to messy, sympoietic sociomaterial entanglements? It must begin with noticing these very complex, messy and situated sociomaterial entanglements ruling texts overlook and, thus, mute—an attunement, I argue, can be developed with sensibilities from institutional ethnography and material semiotics.

4.5 A reflection on monstrous sociomaterial entanglements: “We are all lichens,” “We are all *hibakusha*,” and we all participate in textually-mediated ruling relations

As the previous sections illustrate, attending to historical industrial overflows reveals many of the vicious sociomaterial entanglements humans and more-than-humans find themselves relating within when living in industrial ruins. However, given the terrifying nature of many of these entanglements, questions arise on the best ways to attend to them. According to the editors of the book *Arts of Living on a Damaged Planet* (Tsing et al., 2017: M7), this work must begin with the simple act of noticing. However, as mentioned, noticing is not always easy, and can even be painful and uncomfortable, especially when exploring monstrous sociomaterial entanglements with toxins and all of their vibrant and vicious qualities and enactments.

In attuning to monstrosity, thinking through lichens and mushrooms might help. The last line of a paper authored by Gilbert and colleagues (2012: 336), “We are all lichens,” is a statement that attempts to attune researchers to the symbiotic

²¹⁷ I use the term ‘transnational nuclear assemblage’ to refer to the vast institutional complex of scientists, governments and organizations involved in managing radiological overflows from nuclear weapons and nuclear disasters as well as paving the textual path forward for the further proliferation of nuclear technologies. The development of the transnational nuclear assemblage is discussed in detail in Chapter 5.

entanglements that participate in enacting living organisms.²¹⁸ In the way Latour's book *We Have Never Been Modern* (1993) challenges readers to rethink modern society's self-description as dominant and disentangled from the natural world, the subtitle to the article by Gilbert et al.—“We Have Never Been Individuals”—highlights how a number of findings in the biological sciences are challenging conceptualizations of organisms as ‘biological individuals,’ instead revealing organisms—including humans—to be ‘holobionts’ (Gilbert et al., 2012: 325-6).²¹⁹

First introduced by Zilber-Rosenberg and Rosenberg (2008), and born out of the work of Lynn Margulis (1993), the term ‘holobiont’²²⁰ has been defined by biologist Scott Gilbert (2017: M73) as “an organism plus its persistent communities of symbionts.” Haraway (2017: M26, original emphasis) offers a more tangled description: “Like Margulis, I use *holobiont* to mean symbiotic assemblages, at whatever scale of space or time, which are more like knots of diverse intra-active relatings in dynamic complex systems than like the entities of a biology made up of preexisting bounded units (genes, cells, organisms, etc.) in interactions that can be conceived only as competitive or cooperative.” These symbiotic entanglements, Haraway (2017: M26) goes on to describe, do not only refer to the nice “mutually beneficial,” vital interactions, but include the terrifyingly vicious as well.

As someone whose research explores radioactivity, in reading Gilbert and colleagues' statement “We are all lichens,” I was immediately reminded of the Lapp reindeer who enjoy feasting on lichens and mushrooms—*both* symbiotic biota, and *both* efficient accumulators of radionuclides. Named ‘Lapp’ because of their symbiopoietic²²¹

²¹⁸ I first learned about this statement from reading Tsing (2015: 142), Haraway (2016) and Tsing and colleagues (2017).

²¹⁹ This ‘new biological paradigm’ is being referred to as the “postmodern synthesis”—as opposed to the “modern synthesis” (see Mcfall-Ngai, 2017).

²²⁰ The term is based on ‘the hologenome theory of evolution’ (see Margulis, 1993).

²²¹ Gilbert and colleagues (2010: 672) have proposed the term “symbiopoiesis” to describe how holobionts are developed through “codevelopment of the holobiont.” Haraway (2017: M25) has also proposed the term ‘holoent’ to engage all ‘critters,’ abiotic and biotic. Haraway (2016: 60) proposes the term ‘holoent’ be used as a sympoietic-infused alternative to autopoietically enacted ‘units’ or ‘beings.’ I will sometimes borrow the term ‘critters’ from Haraway (2016: 169, n1) who uses it to “promiscuously” refer “to microbes, plants, animals, humans and nonhumans, and sometimes even to machines.”

entanglements with the indigenous Sámi herders—also known as the Lapp people—some of these reindeers have been found to have high levels of cesium-137 in their bodies since the expansion of nuclear weapons testing in the 1950s. The Chernobyl nuclear disaster in 1986 and overflows from nuclear fuel reprocessing plants—such as Sellafield in England and La Hague in France—have also been implicated in these increased radioactivity levels (see Gómez-Guzmán et al., 2011). Even now, levels of radioactivity have not ‘stabilized’ in the bodies of reindeer. For example, in 2014 the amount of radioactivity measured in the bodies of reindeer living in Central Norway suddenly skyrocketed following a vibrant mushroom season. Scientists singled out the reindeers’ “mushroom snacks” as the culprit for the higher-than-expected levels of radionuclides in their bodies (Hooper, 2014). While some parts of the so-called “lichens-reindeer-human food chain”²²² may be monitored by government authorities and translated into ruling texts which can then be deployed in an attempt to coordinate the activities of humans—that is, to prevent human bodies from eating foods categorized as ‘over the limit,’ which is designated as reindeer meat over 3,000 Becquerels per kilogram (Bq/kg)²²³ in Norway²²⁴—little can be done to help the reindeer ‘choose’ their mushrooms, or the lynx ‘choose’ which reindeer they eat (Skuterud et al., 2005). The same goes for the wild boar who lavishly dine on mushrooms and truffles in the forests of Germany. To this day many of them—the boars and their snacks—are too radioactive to be considered ‘safe’ for ingestion by human bodies—600 Bq/kg according to German law (Huggler, 2014).²²⁵ In Japan, there are many animals living in the most contaminated areas near TEPCO’s nuclear disaster; monkeys roaming the Fukushima forests have become one of the many objects of

²²² See Skuterud and Thørring (2015: 3145).

²²³ While there are a number of possible units for measuring radioactivity, radioactivity in food is often measured in Becquerels per kilogram (Bq/kg) or liter (Bq/l). 1 Bq represents a rate of radioactive decay equal to 1 disintegration per second (US Nuclear Regulatory Commission, 2017).

²²⁴ See Liland and Skuterud (2013) for a discussion on reference levels for radionuclides in food following the Chernobyl disaster. Gralla and colleagues (2014) point out that there are various reference limits for radionuclides in food in effect across Scandinavia and Europe.

²²⁵ According to the news article, hunters are required to have the wild boars inspected for radioactivity. If the wild boar meat is found to be over a certain limit—and, thus, classified as ‘radioactive’—it must be disposed of. Again, we see how sociomaterial entanglements with toxins lead to further entanglements with textually-mediated ruling relations.

scientific investigations into the effects of ionizing radiation on living organisms (Hayama et al., 2013).

The bioaccumulation of radionuclides by mushrooms and lichen has also been observed in Japan following previous overflows of radionuclides, as well as following TEPCO's nuclear disaster.²²⁶ And, of course, fungi, bacteria, plants and animals are not the only ones who do not 'follow the rules' when it comes to regulating their intake of radionuclides. In August 2012, two elderly couples living in Fukushima Prefecture, who continued to eat homegrown food following the onset of TEPCO's nuclear disaster, were discovered and their bodies measured with a device called a 'whole body counter'—a device that is only able to measure the gamma radiation being emitted by a body, not alpha or beta particles possibly harbored within.²²⁷ Each of the four Fukushima residents had over 6,500 Bq/kg of measurable gamma emissions from cesium-134 and cesium-137 radiating from their bodies. One of the men's bodies was emitting 19,507 Bq/kg of cesium-134 and cesium-137. He and his wife had been eating locally grown *shiitake* mushrooms, bamboo shoots (*takenoko*) dug up near their home, and dried persimmons. The *shiitake* mushrooms themselves measured over 140,000 Bq/kg. After calculating the measured gamma emissions into an estimated whole-body effective dose,²²⁸ the examining doctor assured the four people, and the press, that "these are not levels that will cause damage to health, but I would like you to measure before eating home grown vegetables and other such things" ("Fukushima Daiichi," 2012). The textual mediation of these monstrous entanglements could, again, be smoothed over through activating dose estimates devised by organizations active within the transnational nuclear assemblage.²²⁹

²²⁶ See, for example, Kuwahara et al. (2005), Nakashima et al. (2015), Ohnuki et al. (2016), Orita et al. (2017), Sugiyama et al. (2008; 2000) and Yamada (2013).

²²⁷ Ochiai (2015) discusses the difficulty in measuring internal radiation—as mentioned, whole body counters are only able to pick up gamma radiation, not the possible internal activity of alpha or beta particles. See Section 5.2 for more details on these different types of ionizing radiation.

²²⁸ This is discussed in Section 5.4.1.

²²⁹ Dose estimates in radiation protection are discussed in detail in both Chapter 5 and Chapter 6.

What do stories of radioactive lichens, reindeer, mushrooms, wild boars, lynxes, monkeys or elderly gardeners tell us about monstrous sociomaterial entanglements within radiological overflows? Attuning to the ‘unregulated,’ free-flowing movements of radionuclides within socioecological assemblages not only reveals the limits of modernist ontologies and their stories of ‘control’ when it comes to the overflow of unstable and invisible radionuclides, but how we have all become mixed-up within these monstrous entanglements since the onset of nuclear weapons testing in the 1940s.²³⁰ Once we begin to recognize our lichen-like qualities, that we are “holobiont by birth,”²³¹ we are faced with the startling realization that, as Terry Tempest Williams (1995, emphasis added) puts it, “We are all *hibakusha*” in one way or another.²³²

4.6 Conclusion: Noticing sociomaterial entanglements beneath the chorus of ‘rebirth’ and ‘revitalization’

In this chapter, I have situated TEPCO’s nuclear disaster within Japan’s long history of industrial overflow and ruination. When revisiting these historical industrial overflows using sensibilities from both the fields of institutional ethnography and material semiotics, we do not only notice experiences of *konran*, but also how overflows of industrial toxins are often accompanied with textually-mediated ruling relations used to define human and more-than-human sociomaterial relationality within industrial ruins.

²³⁰ See the brilliant video made by artist Hashimoto Isao (2003) showing the 2,053 nuclear explosions conducted around the world between 1945 and 1998. Also see Hirano and colleagues (2016) for Assistant Professor Koide Hiroaki’s comparison of TEPCO’s nuclear disaster to the fallout from nuclear weapons testing.

²³¹ See Gilbert (2017).

²³² *Hibakusha*—literally “explosion-affected people”—is the Japanese term used to refer to the survivors of the US atomic bomb attacks in Hiroshima and Nagasaki (see Lindee, 1994: 5-10; T. T. Williams, 1995: 661). However, in recent years, its use has expanded to refer to all survivors of nuclear fallout from nuclear weapons, nuclear weapon tests, and even disasters at nuclear power plants, as well as exposures from mining, transportation and other processes involved in producing nuclear weapons and nuclear energy (IPPNW, 2014). Author and photo journalist Toyosaki Hiromitsu (1997: 348, emphasis added) describes some of the ways people become entangled with radionuclides and, thus, might take on the label of *hibakusha*: “[P]eople all over the world have become *hibakusha* as a result of exposure to radiation that is produced in all the stages of nuclear arms productions and nuclear power generation such as uranium ore mining and refining, uranium enrichment, the production of nuclear armaments and nuclear testing, production of nuclear fuel and nuclear power generation, reprocessing of spent nuclear fuel, and treatment and disposal of nuclear waste.”

A historical analysis reveals how ruling relations have been attempting to coordinate people's disentanglement from their situated sociomaterial relations, instead working to enact pure citizen bodies that will participate in military and economic projects.

Though overflows of industrial toxins remind people of their situated sociomaterial entanglements and disrupt stories of purity and perpetual progress, ruling texts continue to ignore, and attempt to mute, these very vital and vicious entanglements. Using sensibilities from both institutional ethnography and material semiotics, we are able to notice these entanglements: beneath the deafening chorus of 'rebirth' and 'revitalization' are many humans and more-than-humans attempting to carefully enact their lives within TEPCO's industrial ruins.

Simultaneously entangled in toxins and ruling texts, people living in industrial ruins are burdened with the enormous task of carefully enacting their lives alongside industrial toxins—and their monstrous enactments and effects—while also finding the time to take on textually-mediated ruling relations in judicial battles. Taking seriously both forms of entanglement is essential when dealing with industrial overflows: while ruling texts attempt to mute toxins and pave the way for more progress projects, people continue to carefully enact their lives in relation to these toxins. In the following chapters, I will turn my focus to TEPCO's nuclear disaster, where I will employ sensibilities from institutional ethnography to explicate textually-mediated ruling relations that participate in enacting my participants' experiences of *konran*, while also using sensibilities from material semiotics to highlight people's very real sociomaterial entanglements with TEPCO's radionuclides.

5 The uneven history and ghostly hauntings of radiation protection standards: From the atomic bombings of Hiroshima and Nagasaki, to the crafting of Japan's 100 Becquerel per kilogram reference limit for radionuclides in food²³³

5.1 Introduction

On Friday, March 11, 2011, Yamaguchi Chiho (pseudonym) and her husband were living in the Kansai region and had just heard some exciting news from the doctor: Chiho was pregnant with their first child! The excitement permeated Chiho's day until she got home and turned on NHK news²³⁴ to see the devastation of the earthquake and tsunami in the Tōhoku region. She had never thought much about nuclear power until she saw one of TEPCO's nuclear reactors explode a day later.

While she remembers feeling a bit shaken by the news of the nuclear disaster, she settled back into life as usual, only occasionally receiving reminders of the disaster's aftermath when turning on her TV:

On TV I heard spinach over the 500 Becquerel limit was found, but it did not really hit home. The news said it was okay, the newscasters were saying it was okay, the TV was also saying it, so at that time I figured it was okay. Well, I figured that eating just a little would be okay, the government was also saying it was okay. [The news] said Becquerels were found. They did not explain the extent of the danger. At that time, I don't think they said anything about whether or not it was dangerous. It was the first time I had heard the word 'Becquerel.' And when they said 500, I had no idea exactly how much it really was.

²³³ Some parts of this chapter have been included in a forthcoming publication based on my research that I co-authored with my supervisors Katharine Legun and Hugh Campbell (see Burch et al., forthcoming).

²³⁴ NHK stands for *Nippon Hōsō Kyōkai* (Japan Broadcasting Corporation) and is the national public broadcasting news organization in Japan.

Chiho explained that she ate a lot of cucumbers at that time, and when she went to the supermarket in April and May, all of the cucumbers being sold were from Fukushima Prefecture. She bought and ate them. She also bought lettuce from Ibaraki Prefecture.

It was so cheap! Really. And even though it's really close [to TEPCO's nuclear disaster], in my head I didn't clearly understand that. I remember thinking that Ibaraki was in Kantō, not Tōhoku. I bought it.

She did not notice any differences in marketing or labeling among foods from Fukushima and those from other prefectures until July and August:

Fukushima peaches were being sold like crazy! I saw the Fukushima governor's face with "It's safe [anzen]" written. [...] "Not detected [kenshutsu genkai]," something like "below the standard [kijunchi ika]" was also written. The limit, the particular numbers were not written. "It was tested safe [anzen], so it's okay" was written.

Regardless of these intermittent reminders of the ongoing nuclear disaster, Chiho admitted that she did not start thinking much about radioactivity in food until she heard Koide Hiroaki,²³⁵ former Assistant Professor at Kyoto University's Research Reactor Institute, on the radio.

He said a number of things that were not being said on TV. It was amazingly detailed, but easy to understand. It was even easy to understand for people like me who had no knowledge. [...] He spoke about food. He said that before the disaster, when rice, when Japanese rice was measured it was below 0.1 Becquerels. When I heard that, I understood just how high 500 or 100 Becquerels was.

When I asked how she reacted to hearing this, she replied:

²³⁵ See Hirano and colleagues (2016) for a translated and transcribed interview with Assistant Professor Koide which includes many of the points discussed by Chiho, the dissolution of the radio program *Tanemaki* (or 'sowing seeds') *Journal* that Chiho heard him speak on, a discussion as to why he remained an Assistant Professor throughout his tenure at Kyoto University due to his stance on nuclear power's safety, his own censorship, among numerous other topics.

Shock, I was shocked. Because I was pregnant.

In coping with *konran* regarding everyday eating and feeling very uncomfortable shopping at the supermarket, Chiho decided to join a food cooperative (*seikyō*) that was testing food for radiation down to about 10 Bq/kg and eventually joined a citizen radiation measuring station (CRMS). I met her at one of the café-times at her local CRMS.

As time went on, Chiho had heard about the new reference limits for radionuclides in food on the news, and also from Assistant Professor Koide who she had been listening to weekly on the radio.

The radio announcer asked Koide-san what he thought about reducing [the reference limits] to 100 Becquerels. He said, if you compare it to 0.1 Becquerels, how many thousands? It's about 1,000 times that. It is really easy to understand when you compare how many times [higher it is].

Five years after TEPCO's nuclear disaster, Chiho was still being careful about radionuclides in food, and questioned the ability of the government to adequately ensure the safety of the food circulating throughout the country. As she and her husband own a small restaurant, they have been struggling to maintain a profitable business while also serving food that they themselves would feel comfortable eating and feeding to their child.

The proposed 'new standards' put into effect on April 1, 2012 established 100 Bq/kg²³⁶ as a "magic number"²³⁷ indicating the government's commitment to public health and safety, as well as its competency in managing the presence of radionuclides in the agrifood assemblage through the application of Science.²³⁸ For all of my participants,

²³⁶ 100 Bq/kg became the reference limit put in place to ensure the chosen standard—represented as a dose of radionuclides absorbed by human bodies—would not be exceeded. This will be covered in detail later in this chapter.

²³⁷ I borrow the term "magic number" from Higuchi (2016) who borrowed it from Radiation Council member Kai Michiaki (see Radiation Council, 2012a).

²³⁸ I capitalize 'Science' here because the terms 'science' (科学, *kagaku*), 'scientific' (科学的, *kagakuteki*) or 'safe'—in an objective or technical sense—(安全, *anzen*) are often thrown

however, the numbers were much more mystical than magic, generating many more questions than answers. What is a Becquerel? Why are both 500 and 100 Becquerels considered safe? Where do these numbers come from? Why should they be trusted?

When asked, most of my participants wanted the reference limits to be much lower—usually down to 10 or even 1 Bq/kg. However, government proclamations about the safety of 100 Bq/kg made such suggestions seem ill-informed or unscientific. The experience of Takano Miki (pseudonym), a mother of a young girl with a severe dairy allergy who was living in the Kansai region at the time of TEPCO's nuclear disaster, illustrates:

Miki: I researched myself about the 500 Becquerel [limit]. Before my daughter entered elementary school, for school lunch, because she has an allergy she still brings a bento. But I thought about what would happen if she was eating school lunch. I called the Board of Education. Then, for the time being, [my] city had a standard lower than the country's. They had determined a standard, a standard limit for school lunch. But I thought even that was high.

Karly: The government standard was 500 at the time?

Miki: Yes, that was when it was 500 Becquerels. Then, um, vegetables. For the time being, the [data] was being made public. I looked at [the vegetables] and sardines, sweet potatoes and such. The numbers were like 8 and 11. It was made public that they were contaminated and they were used in school lunch. Well, they were used a few times. At that time there was stock that was several times divided and used in school lunch. Those values were much lower than the standard limit. If that was the case, I asked, "Isn't it possible to lower the standard?" They told me that kind of [lower] value has no scientific basis.

around as a basis for why the government's standards for radionuclides in food are adequate, without actually providing much information on the situated scientific processes or historical episodes involved in devising these standards. This chapter is an attempt to explore the processes, historical and scientific, from which these standards emerge.

As various numbers ranging from 10 to 8,000 Becquerels have been officially referred to as ‘safe’ following the onset of TEPCO’s nuclear disaster, many of my participants began questioning the scientific basis of these various limits which were being devised and decided in extra-local places far beyond their control. My focus group session with three volunteers at a CRMS in the Kansai region—Chiaki Daiki (pseudonym), Mukai Kazuki (pseudonym) and Hashizume Maiko (pseudonym)—highlights questions that were arising about the scientific basis for these various legal standards for radiation protection which had been fluctuating since the onset of the nuclear disaster.

Daiki: Is this safe [anzen]? If it’s below this is it safe [anzen], or not safe [anzen]? There is no reason for it to be safe [anzen]. After all, until this point, we have been eating food at this level.

Daiki pointed to a chart on the wall which showed that foods measured before TEPCO’s nuclear disaster contained 0.1 Bq/kg of cesium-134 and cesium-137 on average.

Daiki: Well, this level, it couldn’t be helped, so we put up with this level.²³⁹ Why 100 Becquerels? There is no basis. No basis. There is no basis...

Kazuki: There is no basis. That’s why it’s a hazardous level, for children who eat such food.

Daiki: Yes.

Maiko: Also, did you see the lead container [outside]? The things you enclose inside of there. It’s 100.

Daiki: Yeah, it’s 100.

Maiko: Formerly, the values we are eating now, formerly [things containing] those values needed to be enclosed within that kind of container. Now we are eating it.

²³⁹ He later described the 0.1 Bq/kg as the *gaman* (endurance, 我慢) level for radionuclides in food.

Kazuki: Yes. Previously, people could not enter. Really, only people holding a license were supposed to look after those things. Now they are being sold in the supermarket.

Daiki: Things over 100 Becquerels had to be properly and strictly stored, properly put into a lead container, properly managed. However, now things up to 8,000 Becquerels are okay.²⁴⁰ Now it is okay to incinerate things under 8,000 Becquerels. It's also okay to dispose of them.

Maiko: And then it's possible to use as building materials. So if there are 8,000 Becquerel trees, those chips and whatnot. If it's rocks, they are mixed into cement. From now on living in a newly built house is really risky [riskī].

My interviews and focus group sessions uncovered that there were unmistakably many questions regarding the origin and scientific basis for the various reference limits for

²⁴⁰ Here, Daiki and the others are pointing to the increase in Japan's exemption levels for what is legally considered 'nuclear waste.' Following TEPCO's nuclear disaster, the Japanese government increased the exemption level for what is considered nuclear waste from around 100 Bq/kg to 8,000 Bq/kg of cesium-134 and cesium-137. In fact, according to new laws, things measuring under 8,000 Bq/kg of cesium-134 and cesium-137 can be disposed of in the same way as general household wastes. Japan disposes of waste through incineration. Because radiation levels increase through the process of incineration, the law also changed to allow ashes up to 100,000 Bq/kg of cesium-134 and cesium-137 to be disposed of in landfill sites (Ministry of the Environment, 2011). During my interviews, the 8,000 Bq/kg exemption limit was an issue of particularly high concern because there was a decision allowing for the re-use of soils containing under 8,000 Becquerels/kg of cesium-134 and cesium-137 in public works projects (see Watanabe, 2016). Collected in decontamination projects, the soil has been piling up in black 'furikon' bags throughout Fukushima Prefecture, and can be found on farmlands and even people's back yards. The bags, which are supposed to be containing TEPCO's radionuclides, have not only been broken open through the "auto-rewilding" (Tsing, 2017b) activities of plants growing inside of them, but microbial activities have also been disrupting control measures—for example, photos at an exhibition I attended in the Kansai region in 2016 showed how when the piles of bags were covered with a tarp, it filled up with so many gases from microbial activities that it looked like a balloon ready to burst. The bags continue to provide a visual reminder of the nuclear disaster, so quickly removing them has been a priority of reconstruction and revitalization efforts. However, their removal from Fukushima Prefecture means that the soil will be transported and used in public works and other construction projects throughout the archipelago of Japan (see Igarashi, 2017), something that concerns many of my study's participants who do not want any more of TEPCO's radionuclides overflowing into their situated sociomaterial entanglements.

radiation protection that have been activated and designated as ‘safe’ by the media and government documents since March 2011. It is these very questions that direct me to a vital string to follow in explicating the coordination of everyday eating in the aftermath of TEPCO’s nuclear disaster: tracing the origin of Japan’s safety standards for radionuclides in food which my participants continue to grapple with in 2016.

Recommended standards for radiation protection have originated within a complex, transnational network of scientists, industry and government actors—and their human and more-than-human objects—with its own political, philosophical and economic foundations. Following TEPCO’s nuclear disaster, these recommendations were to be translated into numerical ‘reference limits’ and deployed throughout the agrifood assemblage in an attempt to direct activity and command a single, ‘correct’²⁴¹ way for people to conceptualize and enact their relationship with a newly re-galvanized actor: the radionuclide.²⁴²

Radionuclides are unstable isotopes that release energy or particles to transform themselves into a more stable state. This process of emission (the activity of radionuclides) is referred to as *radioactivity* or *radioactive decay*. The particles or energy released in the process of radioactivity are termed *radiation*. Through their activity, radionuclides do not simply disappear, but continue to transform themselves into different (‘daughter’) isotopes, a process that ranges from seconds to millions of years. *Ionizing radiation* is the type of radiation that has the power to damage living tissue, making the radionuclides that emit ionizing radiation those of most concern following a nuclear disaster. What complicates the management of radionuclides, however, is their imperceptible nature: they cannot be seen, smelled or tasted, so require very sensitive technical equipment able to identify them through their activity.²⁴³

²⁴¹ The word *tadashī* (‘correct,’ ‘accurate’) is often used in Japanese to describe the information on the relationship among radionuclides, food and human bodies the government regards as most scientifically sound. See, for examples, Government of Japan (2007b: Article 2(1)), Consumer Affairs Agency (2012: 6) and Ministry of Education (2011).

²⁴² See Callon (1991) for a discussion on how numerical standards are often used in standardizing translations and processes as a way to reduce transaction costs and foster cooperation among actors within a network.

²⁴³ See Martin and Harbison (1996) and Grupen (2010).

Within the four units of TEPCO's Fukushima Daiichi Nuclear Power Plant, the activity of radionuclides was harnessed to heat fuel rods, which boiled water to produce energy that was transported from the rural towns of Futaba and Ōkuma in Fukushima Prefecture to the metropolis of Tokyo. However, when released into the wild, TEPCO's radionuclides travelled with weather patterns around the globe, with some of the highest concentrations deposited into the Pacific Ocean and onto areas of north-eastern Japan (Stohl et al., 2012). TEPCO's radionuclides may become lodged in soil, travel up into plants, and into the bodies of livestock animals. They may travel through the ocean where fish and seafood incorporate the unstable actors into their bodies. Vegetables, meat and seafood possibly containing these unstable isotopes are then harvested and shipped around the country, and around the globe, to be made into meals where they have the potential to enter eaters' bodies. In short, radionuclides move fluidly and imperceptibly through a range of mediums and can easily wind up in a variety of foods.

The 'overflow'²⁴⁴ of TEPCO's radionuclides destabilized Japan's agrifood assemblage, complicating government attempts at managing the 'safety' of foods it circulates. However, radionuclides are also particular in their reputation, instability and that they are generally imperceptible except when manifesting as malaise or disease. Thus, while people rely on technologies to produce numbers to make the activities of radionuclides knowable, these numbers also become active in organizing activities within what appears to be a closed and controllable agrifood 'system.' However, the overflow of radionuclides disrupts such stories of control, revealing the drawbacks of such an oversimplified categorization.

In this chapter, I employ sensibilities from both institutional ethnography and material semiotics to explore the institutional complex and other sociomaterial entanglements from which food safety standards for radiation protection emerge, following the numbers from their historical beginnings, to their intended role in guiding policy, to how they are currently being deployed and activated within Japan's agrifood assemblage. By following the numbers through the institutional complex of radiation protection, I hope to illustrate how the political, economic and philosophical values

²⁴⁴ Again, I borrow the concept of 'overflow' from Callon et al. (2009). Also see Section 2.6.4.

embedded within the numbers are intended to enact a ‘single reality’²⁴⁵—a single, ‘correct’ way of relating to radionuclides deployed through a stable, redemptive narrative that attempts to smooth over difference and allow for the procession of business as usual. However, the making of these standards has been much more uneven, coarse and turbulent than the seemingly solid and neutral numbers may indicate. In fact, behind these numbers lurk many ghostly and monstrous presences, the ‘absent presence,’ which—though often obfuscated by stories of stability, progress and control—continue to haunt them to this day.

Following the ‘logic of oscillation,’ I will attend to the endless wavering between multiplicity and singularity, emphasizing the “multiple absence” of heterogeneous relationality lying behind the “singular presence” of seemingly stable numerical standards (Law, 2002: 9). What results is a narrative that opens up the history and current application of radiation protection standards in a way that highlights and holds their inherent tensions, multiplicities and contingencies—the ‘multiple pasts’ that haunt the present of many of my participants and others living in the industrial ruins of TEPCO’s nuclear disaster.

5.2 The historical beginnings of radiation protection: In search of a ‘safe’ dose in the ruins of the United States’ atomic bombings of Hiroshima and Nagasaki

Following Wilhelm Röntgen’s discovery of the x-ray in 1895, Henri Becquerel’s observation of uranium’s ability to emit radiation in 1896, and Marie Curie’s discovery of polonium, a number of scientists excitedly joined in the effort to study the mysterious phenomenon of radioactivity (see R. H. Clarke & Valentin, 2009; Magill & Galy, 2005). However, injuries stemming from x-ray use grew in tandem with the progress of this research, and soon the dangers of x-rays and other forms of ionizing radiation were being revealed on human bodies in the form of burns, blotches, blisters, the loss of limbs, and even painful death (see Boudia, 2007; Taylor, 1971). It was clear the unbridled activity of radionuclides needed to be both investigated and tamed before humans could interact with these materials without suffering pain and physical harm. The development of radiation protection standards was proposed as a way forward for

²⁴⁵ See Mol (2002: 87), Law (2002) and Section 3.3.

protecting scientists, medical practitioners and their patients from the possible negative effects of working or being treated with ionizing radiation.

An initial challenge to setting recommendations for radiation protection, however, was the lack of shared measurements, units and ways of quantifying radiation doses among scientists (Taylor, 1971). To overcome this hurdle, the International Commission on Radiation Units and Measurements (ICRU) was established in 1925. Three years later, the International Committee on X-Ray and Radium Protection (ICXRP) was formed and given the responsibility of extracting from available scientific data recommendations on how to protect human bodies from the *deterministic effects*²⁴⁶ of ionizing radiation (see Boudia, 2007; R. H. Clarke & Valentin, 2009; Cooper, 2012). The group was formed in order to find a “tolerance dose” for radionuclides below which administration of radioactivity would pose little harm to human health (Taylor, 1971: 13-16).

The field of radiation protection²⁴⁷ emerged as a multidisciplinary form of science that borrowed units from physics and applied them to biology with the goal of evaluating how unstable radionuclides interact with active human bodies (Taylor, 1971: 22). As noted, this new field also adopted concepts such as ‘tolerance dose’ developed in toxicology. While multi-disciplinarity is usually viewed in a positive light, there were, and remain, some fundamental obstacles to combining the disciplines of biology and physics. According to Whittemore (1986: 9):

The complex variety of functions of various bodily parts was at odds with the uniform units contained in the basic definition of dose. More significantly the use of concepts from physics fostered the popular

²⁴⁶ Deterministic effects can be lethal and acute and usually involve the “killing or gross malfunction of cells. These effects have a dose threshold below which they do not occur and above which the severity of the effect increases with dose” (Cooper, 2012: 82). The International Commission on Radiological Protection (ICRP) (2007: 20)—the descendant of the ICXRP—defines deterministic effects as “[i]njury in populations of cells, characterised by a threshold dose and an increase in the severity of the reaction as the dose is increased further. Also termed tissue reaction.”

²⁴⁷ The field of research is also referred to as health physics (see Taylor, 1971: 22).

belief that analysis of radiation should result in a single, quantifiable ‘safe’ limit.²⁴⁸

In short, translating and inscribing complex science into concrete numerical values may be useful for regulatory purposes, but risks invisibilizing the uncertainty that existed, and continues to exist, in the always evolving field of biology (see Goodhead, 2010).²⁴⁹ The first ‘tolerance dose’ for radiation workers was set by the ICXRP in a 1934 meeting, with the uncertainty of the underlying science explained with qualifiers and assumptions that were not, however, visible within the numbers themselves: “The evidence available at present *appears to suggest that under satisfactory working conditions a person in normal health can tolerate exposure to x-rays to an extent of about 0.2 international roentgens (R)*²⁵⁰ per day” (ICXRP, 1934: 1; Taylor, 1971: 16, emphasis added). The activities of the ICXRP and their ability to collectively evaluate and update their standards were put on hold from 1937 to 1950 in the midst of World War II, though the dawn of the nuclear era ensured that a vast population of humans and more than-humans would be coming into contact with a variety of newly-materialized anthropogenic radionuclides.

Nuclear fission created a new breed of anthropogenic radionuclides that humans, plants, animals, microbes, fungi and a range of other microscopic critters²⁵¹ had not previously been in relation with. However, the top-secret nature of military-directed nuclear programs kept questions about the widespread dispersal of radionuclides in the environment concealed until the first overtly murderous overflow of the atomic age: the dropping of the atomic bombs on the Japanese cities of Hiroshima and Nagasaki in 1945. The attacks by the US military killed hundreds of thousands of people, instantly

²⁴⁸ For his doctoral dissertation, Whittemore (1986) conducted a study on the development of radiation protection standards in the United States between 1928 and 1960.

²⁴⁹ As mentioned in Section 4.5, the newest findings in biology are no longer able to fit within conceptual and theoretical confines of the ‘modern synthesis.’ Thus, scientists who take seriously symbiosis and understand organisms as ‘holobionts’ (Gilbert et al., 2012) are, instead, forging paths within the ‘postmodern synthesis’ (see Gilbert, 2017; Haraway, 2017; Mcfall-Ngai, 2017; Swanson et al., 2017)

²⁵⁰ Roentgens—named after Wilhelm Röntgen—are units that represent the intensity of gamma rays or x-rays (see Grupen, 2010: 314; Martin & Harbison, 1996: 23).

²⁵¹ As mentioned in Chapter 4, I borrow the term ‘critters’ from Haraway (2016: 169, n1) who uses the term to “promiscuously” refer “to microbes, plants, animals, humans and nonhumans, and sometimes even to machines.”

changing the identity of survivors exposed to the bombs' ionizing radiation to *hibakusha*.²⁵²

During the hiatus of the ICXRP, the United States National Committee on Radiation Protection and Measurements (US NCRP)²⁵³ began preparing its own radiation protection recommendations. Unlike the ICXRP whose membership was reserved only for scientists, the US NCRP's membership was composed of scientists, government officials and industry representatives (see Boudia, 2007: 392; Taylor, 1971: 23). At a meeting in 1946, the US NCRP divided itself into nine subcommittees which focused on different areas of radiation protection, including the subcommittees for permissible *external* dose (Subcommittee 1) and permissible *internal* dose (Subcommittee 2) (Taylor, 1971: 24-5; US NCRP, 1954: III).

In the United States, the field of radiation protection emerged in 1943 alongside the Manhattan Project—the project responsible for assembling the atomic bombs dropped on Hiroshima (made of uranium) and Nagasaki (made of plutonium).²⁵⁴ Karl Z. Morgan, one of the founding scientists in the field of radiation protection in the United States, headed the US NCRP's Subcommittee 2 for permissible internal dose. In his memoir, Morgan describes how it was his responsibility to set standards for radiation protection for a heterogeneous assortment of anthropogenic radionuclides, each emitting different combinations of four types of ionizing radiation: alpha, beta, gamma and neutron. Reflecting back on his work in the 1940s, Morgan (1999: 15-7, emphasis added) clarifies the differences among the four types of ionizing radiation he tried to create standards for:

²⁵² See Section 4.5.

²⁵³ The Committee was first referred to as the Advisory Committee on X-ray and Radium Protection and was later renamed the National Council on Radiation Protection and Measurements, which it remains today. Both the National Committee and the National Council share the same acronym: NCRP (see Sheetz, 2015).

²⁵⁴ The nuclear bomb dropped on Hiroshima was called 'Little Boy.' It contained uranium-235 produced at the Oak Ridge National Laboratory in Tennessee, United States. The nuclear bomb dropped on Nagasaki was named 'Fat Man.' It contained plutonium-239 produced at the Hanford Nuclear Facility in Washington State, United States (K. Brown, 2013; Morgan & Peterson, 1999: 39-52).

Alpha particle emitters do not present a problem if kept outside the body, since the alphas can penetrate less than 1 millimeter of soft tissue. However, alpha emitters present a serious threat if inhaled or ingested—a real possibility because they attach to dust, food, and clothing. Once alpha-emitting radionuclides enter the body, they cause severe local damage to tissue because they deliver all their energy to relatively few human cells, which may then become cancerous. *Beta particles* present similar risks, even though they can penetrate only a little more than 1 centimeter of soft tissue. *Gamma* or *X-ray radiation* can penetrate the entire body and alter chromosomes in cells along their tracks. Fast *neutrons* penetrate deeply into the body, but their dangers were not fully appreciated until thirty years later, when we discovered that their doses in energy units cause at least thirty times more human damage than gamma rays that deliver the same amount of energy.

Morgan and his subcommittee were expected to translate the inherent messiness and heterogeneity of radioactivity and biological processes into clear recommendations to protect people and the environment from potentially dangerous exposures.²⁵⁵ In 1947, another US government organization, the Atomic Bomb Casualty Commission (ABCC)—later renamed the Radiation Effects Research Foundation (RERF)²⁵⁶—was set up in Japan to collect data on the biological effects of ionizing radiation exposure being experienced by *hibakusha* in Hiroshima and Nagasaki. Set up during the United States' occupation of Japan from 1945 to 1952, the Atomic Bomb Casualty Commission was initially financed through the US National Research Council²⁵⁷ with funds from the US Atomic Energy Commission (US AEC)—an institution born out of

²⁵⁵ See Morgan (1992) for a reflection on some of the challenges of working in the field of radiation protection (what he refers to as health physics) which demanded scientists to keep up with overflows of radionuclides from military and industry projects.

²⁵⁶ The group was renamed in 1975 and would be funded equally by Japan and the United States (Lindee, 1994: 245). The renaming removed the history and ghostly hauntings of the atomic bombings of Hiroshima and Nagasaki from the group's title.

²⁵⁷ The National Research Council is an agency of the US National Academies of Sciences, Engineering, and Medicine.

the Manhattan Project (Lindee, 1994: 32-36; Morgan & Peterson, 1999 39-52; B. L. Walker, 2015).

In her book *Suffering Made Real: American Science and the Survivors at Hiroshima*, Susan Lindee (1994: Chapter 2) describes the Atomic Bomb Casualty Commission's research as a form of "colonial science,"²⁵⁸ where the United States used its powers as occupying force to organize and control a human study on the biological and genetic effects of ionizing radiation—exploiting the work (broadly defined)²⁵⁹ of *hibakusha*, local Japanese scientists, Japanese midwives and others, without recognizing or acknowledging their important contributions. Although the *hibakusha* of Hiroshima and Nagasaki were described by the Atomic Bomb Casualty Commission's director, Robert Holmes, as "the most important people living,"²⁶⁰ they were not always treated as such. The *hibakusha* of Hiroshima and Nagasaki became the objects of the project's data collection efforts, though the United States' "no treatment policy" meant that any suffering the victims of the US atomic bombs experienced was set aside for people to deal with on their own (Lindee, 1994: 117-42). And it was not only the suffering of the *hibakusha* that went ignored, any suffering experienced by scientists was also left out of these studies—though has not been completely expunged. Lindee (1994: 257) explains:

suffering was explicitly excluded from the scientific study. [...] [H]owever, the emotional meaning of the survivors remained, stubbornly, refusing to disappear, lingering in the margins of [US] AEC directives and calculations of exposure levels. The screen through which the survivors' experiences were filtered was imperfect.

And not only were these scientific techniques limited in their ability to study the complex suffering and torment afflicting people living and working in the ruins of the

²⁵⁸ While the author points out many forms of colonial science, in her book she refers to "science, conducted by outsiders, that depends on local knowledge, particularly when that knowledge is invisible to the colonizers themselves" (Lindee, 1994: 20).

²⁵⁹ See Section 3.3.1.3.

²⁶⁰ This quote was taken from Lindee (1994: 5).

atomic bomb blasts, but many other aspects of the project were riddled with uncertainty and ambiguity from the study's commencement.

Trying to conduct a study that extracts concrete, evidence-based conclusions from extremely chaotic and heterogeneous happenings poses its challenges, and this was especially the case when dealing with an experience as tragic and horrifying as the dropping of the atomic bombs in 1945. In an attempt to extract data on the biological effects of exposure to ionizing radiation on the first large-scale cohort of human subjects, the Atomic Bomb Casualty Commission organized three types of studies. The epidemiologist Steven Wing²⁶¹ and his colleagues (1999: 137) explain:

Three types of studies among A-bomb survivors can be distinguished: studies of inherited genetic effects among children whose parents had been exposed to A-bomb radiation; studies of various effects of fetal irradiation; and studies of long-term effects of postnatal exposure to radiation. This last study, called the Life Span Study (LSS), has primarily addressed cancer as an outcome and is the main source of cancer risk coefficients that are widely used to estimate the impact of radiation on cancer among workers and other exposed populations.

Still an important foundation for radiation protection standards today, the Life Span Study was initiated in 1950, five years after the nuclear bombs were dropped. This time lag has been a point of debate among scientists—such as Alice Stewart²⁶²—due to

²⁶¹ Steven Wing and his colleagues evaluated the onset of cancer following the 1979 Three Mile Island nuclear disaster in Pennsylvania, United States. Their findings disputed other studies which claimed there were no increases in cancers for those people living near the disaster (see Wing & Richardson, 2000; Wing, Richardson, & Armstrong, 1997a; Wing et al., 1997b).

²⁶² Alice Stewart was a female epidemiologist and physician who discovered the danger of x-raying fetuses in the mid 1950s and who fought her entire career to prevent pregnant women from receiving x-rays. Stewart and colleagues' (1958; 1956) studies implicating x-rays as possible contributors to the onset of childhood cancer were brashly attacked by male colleagues (for example, Court Brown & Doll, 1957; Court Brown, Doll R, & Bradford Hill, 1961; Court Brown, Doll, & Bradford Hill, 1960). As with Assistant Professor Koide, her concerns about the 'safety' of ionizing radiation stunted her scientific career. On the other hand, Richard Doll, one of the scientists who vehemently attacked Stewart's work, had an extremely prestigious career—not only was he knighted, but he also became famous for proving the link between cancer and smoking. Opposition from Stewart's male colleagues meant that pregnant women

concerns that the sample of research participants, chosen through the 1950 census, only represent *hibakusha* robust and healthy enough to survive the initial five years—thus ignoring enormous amounts of death and suffering that occurred between 1945 and the study’s commencement.²⁶³

The development of a system of dosimetry—estimations of radiation doses received by each survivor—has also been a point of contention. In order to study the genetic and biological effects of ionizing radiation on their human subjects, Atomic Bomb Causality Commission researchers needed to somehow uncover the exact quantities of radiation that each *hibakusha* received from the blasts of the bombs. This was foundational to the work of the Atomic Bomb Casualty Commission since without precise estimates of the radiation doses received by each survivor, it would be impossible to quantify ‘radiation risk.’²⁶⁴ To extrapolate the estimated doses received by *hibakusha*, researchers would interview the survivors, asking about their exact position at the time of the blasts—including information on surrounding buildings, walls, anything that could have possibly shielded their bodies from the bomb’s discharges—as well as a number of details about what they did or ate following their exposures. Cram (2015: 799, original emphasis) explains the research process: “researchers were asking the *hibakusha* to reconstruct the rubble of Hiroshima and Nagasaki in their minds, to translate moments of fractured reality for which no words existed into exact descriptions that could be used for statistical analysis.” Through these processes, the ‘objective’ data extracted from the memories and bodies of *hibakusha* was filtered through the Atomic Bomb Casualty Commission and translated back to members of the US NCRP, and eventually the international community, to inform

continued to receive x-rays for almost two decades after her first paper was published. Stewart continued her work in the face of adversity and eventually her ever-expanding scientific database convinced official medical bodies to stop the x-raying of fetuses, but not until the 1970s (see Greene, 2011a). For more on Alice Stewart’s pioneering efforts and struggles see Greene (2011b; 2017).

²⁶³ See Stewart (1978: 1260, original emphasis) for a commentary on how the atomic bomb survivors “*must* have been selected for fitness to outlive the initial blasts (and other early effects of the radiation).” Also see Stewart (1982).

²⁶⁴ As Imanaka and Hasai (2008: 297) explain, the “ABCC started developing radiation dosimetry able to estimate radiation dose for individual survivors, without which quantitative evaluation of radiation risk was impossible.”

radiation protection recommendations—particularly risk coefficients for estimating cancer from exposure to ionizing radiation.

In the late 1940s, it became clear that the vast expansion of the use and global dispersion of radionuclides required that radiation protection extend its recommendations from covering only medical practitioners, patients and radiation workers, to the public at large. Back in the United States, the US NCRP's Subcommittee 1 on permissible external dose met in 1948 and began deciding on its own radiation protection standards. Instead of a 'tolerance dose,' members began discussing, and eventually adopting, a "maximum permissible dose" for external radiation—and eventually internal radiation—as well as "maximum allowable radioactive contents" for water and air (Taylor, 1971: 25-6). The more precise designations were intended to express the newfound scientific understanding that there is no certifiably 'safe' dose of ionizing radiation, but instead an "acceptable risk" that should be determined through a risk-benefit philosophical approach (Taylor, 1971: 25-6; US NCRP, 1954: 20-2; S. J. Walker, 2000: 11). In addition, Subcommittee 1 chose to use calculated radiation doses to blood forming organs, the skin, gonads and eye lenses (defined as 'critical tissues' or 'critical organs') as the units for calculating these doses (US NCRP, 1954). That is, permissible external—and eventually internal—doses would be calculated based on the potential detrimental effects to a number of 'critical tissues' in a model human body.

This move to break the body down to study it in pieces—rather than sympoietic, or even symbiopoietic assemblages—remains the basis for radiation protection standards today.²⁶⁵ It requires sophisticated forms of modeling to extrapolate permissible doses for human bodies, and human populations, from models estimating doses received by isolated, atomized body parts. By 1949, a representative, model body—the "Standard

²⁶⁵ To reiterate what has been mentioned in Sections 4.5, Gilbert (2010: 672) and his colleagues have proposed the term "symbiopoiesis" to describe how holobionts are also developed through "codevelopment of the holobiont." Again the concept of the holobiont views biological organisms as sympoietic assemblages—as opposed to individual, atomized units that can be broken down into even smaller, manageable units for analysis. Thus, a distinction has been made between the 'modern synthesis' in biology—with its atomized individuals and units—and the 'postmodern synthesis'—with its holobionts, symbiosis, sympoiesis, symbiopoiesis and symbiogenesis (Gilbert, 2017; Haraway, 2017; Swanson et al., 2017).

Man²⁶⁶—was designed to help in estimating permissible doses. Organ and tissue weights from real human bodies were averaged together to provide the basic biological and physiological parameters for the Standard Man—later renamed the ‘Reference Man,’ now referred to as the ‘Reference Person.’²⁶⁷ Though their bodies may not have fit to his standard form, data extracted from the bodies of male, female and child *hibakusha* of Hiroshima and Nagasaki would eventually inform the Standard Man and his successors (see Cram, 2015).

While various permissible doses for external radiation were discussed by the US NCRP’s Subcommittee 1 in 1948, with a draft written in 1949, the values were not officially published until September 1954 (Taylor, 1971: 24-5; US NCRP, 1954: 61-73). On the other hand, the complexity involved in studying internal radiation exposure meant that the first full report of Subcommittee 2 on internal radiation was not published until 1953 (US NCRP, 1953). The 1953 report provided numerical values to indicate the maximum permissible doses for human bodies and maximum permissible concentrations in air and water for over seventy-five radionuclides (Taylor, 1984: 5; US NCRP, 1953). These reports were not only confined to the US NCRP, but shared with and developed through the input of other US-allied nations. Beginning in 1949, the US Atomic Energy Commission organized the first of three Tripartite Conferences with representatives from the United States, England and Canada (Taylor, 1984). Draft reports of the US NCRP’s Subcommittee 1 on external radiation, and eventually Subcommittee 2 on internal radiation, were circulated during these meetings and eventually provided the basis for internationally accepted radiation protections standards (Taylor, 1971: 37).

Since the 1940s, the genetic threats of low-level ionizing radiation presented by geneticist Hermann Muller²⁶⁸ were widely recognized, and it became clear that radiation protection standards must address both *deterministic* and *stochastic effects*²⁶⁹

²⁶⁶ The Standard Man was first discussed at the Tripartite Conference in 1949 (see Taylor, 1984).

²⁶⁷ See Section 5.4.1 for more on the ICRP’s Reference Person.

²⁶⁸ Muller’s research from the 1920s on fruit flies “indicated that reproductive cells were highly susceptible to damage from even small amounts of radiation” (S. J. Walker, 2000: 3).

²⁶⁹ Stochastic effects “may occur at lower doses. These effects include cancer and heritable effects, and are assumed to result from the mutation of cells following damage to DNA caused

for the nuclear workforce and members of the public at large—though not much attention was given to all the other more-than-humans who would be forced to relate with these unstable materials. While radiation protection until that point had been largely able to deter the onset of deterministic effects from high doses of ionizing radiation, protecting people from difficult-to-measure stochastic effects from low-level exposures has been much more challenging. When reflecting back on a 1952 meeting held by the US NCRP’s Subcommittee 1 on external exposure, Lauriston S. Taylor (1971: 25)—the then president of the US NCRP—explained how deciding on a per-capita ‘dose’ of radiation for the public which took into account the uncertainty of stochastic effects “was clearly a controversial subject and one involving a great deal of basic philosophy in addition to basic science.” This meant that along with scientific data, a procedure or philosophy for making decisions in the face of uncertainty was necessary. The US NCRP’s Subcommittee 1 on external exposure admitted to using a policy of consensus and omission to deal with the uncertainty: “[a]s a matter of committee policy any controversial questions were debated and argued out until agreement was reached; when agreement could not be reached the item at issue was omitted” (Taylor, 1971: 25).

The difficulty in quantifying stochastic effects of exposure to ionizing radiation was initially an obstacle for those in charge of finding a ‘safe’ dose of ionizing radiation for human bodies. Nevertheless, expansion of military and energy projects required scientists to provide reliable answers even in the face of glaring uncertainty. Eventually, uncertainty in the science of radiation protection became manageable through the adoption of a number of assumptions to compensate for gaps in understanding. However, overflows of radionuclides into the ‘wild’ caused disturbances in the lives of humans and more-than-humans around the world and continued to call the uncertainties and assumptions behind the radiation protection standards into public debate. In the next section I will discuss some of these overflows and how they were contained within the developing transnational institutional and textual entanglements I refer to as the transnational nuclear assemblage.

by ionizing radiation” (Cooper, 2012: 82). The ICRP (2007: 49) describes stochastic effects as “cancer and heritable effects involving either cancer development in exposed individuals owing to mutation of somatic cells or heritable disease in their offspring owing to mutation of reproductive (germ) cells.”

5.3 Containing overflows through standards and texts: The making of a transnational nuclear assemblage

In the 1950s Lauriston S. Taylor, as one of the only two surviving original members of the ICXRP and head of the US NCRP at the time, was asked to help in reestablishing the ICRU and the ICXRP. In order to expand its relevance to issues of the time, the ICXRP changed its name to the International Commission on Radiological Protection (ICRP). The newly resuscitated ICRP not only included many of the US NCRP's members, but adopted the group's subcommittee structure and eventually adopted its philosophy for managing uncertainty (Taylor, 1971). The United States—simultaneously testing nuclear weapons which violently and murderously disrupted the lifeways of humans and more-than-humans as it worked toward developing a 'peaceful' nuclear power industry—would play a major role in developing internationally applicable standards for radiation protection.

While science on radiation protection had been developing over the twentieth century, the nebulous interaction between an unstable material and active human bodies continued to hamper the establishment of clear guidelines for 'safety.' The post-World War II dream of propagating 'peaceful' nuclear technologies was being threatened by incessant overflows of radionuclides into the wild, causing concerns not only among people directly exposed, but also those who recognized that radionuclides could travel via food or weather patterns into their own situated sociomaterial entanglements. Thus, the containment of 'socio-activity'²⁷⁰ became a major goal of militaries and industries wanting to use these technologies. In this section, I will retell stories of some of the overflows and subsequent textually-mediated containment strategies developed over the 20th century, and how these overflows have participated in the development and expansion what I refer to as the transnational nuclear assemblage.

To begin, nuclear hydrogen bomb tests had been continuing throughout the world since the dropping of the atomic bombs in Hiroshima and Nagasaki, and one controversial overflow in particular both visualized the dangers of ionizing radiation and brought it

²⁷⁰ See Callon et al. (2009: 109) and Section 2.6.4.

directly to Japanese dinner tables.²⁷¹ On March 1, 1954, a Japanese fishing boat was caught in the fallout of a US hydrogen bomb test in the Marshall Islands,²⁷² resulting not only in the visible illness of many of the young male crew members, but in the contamination of Japan's air, water and food (T. Higuchi, 2008; Lapp, 1958). In particular, the presence of anthropogenic radionuclides in tuna raised concerns and became a symbol of the overflow. The controversy, named the 'Lucky Dragon incident' after the name of the ship,²⁷³ created a public uproar and release of anti-nuclear sentiment among people in Japan, especially housewives who had to confront the possible presence of radionuclides in their everyday shopping and food preparation routines—leading some to begin carefully avoiding foods which might harbor the US's radionuclides. The tuna industry had been revived following the end of the US occupation of Japan in 1952, and the possible presence of radionuclides in food also caused a “tuna panic” among US importers who wanted “proof of no contamination”

²⁷¹ In the words of Whittemore (1986: 514): “Radiation safety had left the laboratory and landed on the dinner table.”

²⁷² While I am unable to go into the grave and horrendous suffering of the people of the Marshall Islands in this thesis, I do highly recommend the work of Barbara Rose Johnston (2007; 2010; 2013), Holly Barker (2013)—including their collaborations (see Johnston & Barker, 2008)—as well as Martha Smith-Norris (1997; 2016) for shedding light the experiences of the Marshallese people. The United States dropped sixty-seven nuclear weapons on the Marshall Islands between the years of 1946 and 1958, with an estimated total equivalence of over seven thousand 'Little Boys'—the name of the atomic bomb dropped on the city of Hiroshima (these bombs are also referred to as 'Hiroshima bombs' or 'Hiroshima equivalents') (Johnston, 2013). Just to put it in perspective, the US military's Castle Bravo test conducted on March 1, 1954 is said to have been equivalent to approximately one thousand 'Little Boys' (see Smith-Norris, 1997: 1-2). The legacy of these tests do and will continue to wreak havoc on the everyday activities of the Marshallese people who must live their lives 'intra-acting' with—literally 'becoming-with'—the US's radionuclides for thousands of years to come. Not only have the islands been covered with the US's radionuclides, but they are now the home to a US nuclear waste dump—a blasted lagoon that has been retrofitted into what is now a leaking nuclear waste dump. The nuclear waste dump, covered by a thin concrete shell already ridden with cracks and 'auto-rewilding' with vines, has been abandoned by the United States and continues to leak radionuclides into its surroundings—materials the lagoon supposedly contains have been found floating in the waters of the South China Sea (Gerrard, 2015). The documentary *Nuclear Savage: The Islands of Secret Project 4.1* (Horowitz, 2011) provides an excellent portrayal of the deep suffering of the Marshallese people, and how they live their lives entangled with the US's radionuclides. For more on 'auto-rewilding' see Tsing (2017b).

²⁷³ The ship was called the *Daigo Fukuryu Maru* (Lucky Dragon Number 5, 第五福竜丸). Both Fukushima ('lucky island,' 福島) and the ship share the *kanji* character for 'luck' (*fuku*, 福), a painful irony pointed out by some of my study participants.

(T. Higuchi, 2011: 36).²⁷⁴ As it would again do in 2011, the Japanese government decided to deploy numerical standards to reassure the public and importers of the safety of consuming the US's radionuclides. In the midst of the unfolding controversy, the Japan Scientific Council decided on a testing regime using Geiger counters²⁷⁵ to measure beta and gamma radiation emitting from tuna.

The numerical reference limit was to be 100 counts per minute (cpm) *over natural background radiation*.²⁷⁶ However, when using a Geiger counter in unconfined, wild environments, distinguishing between 'natural' and 'anthropogenic' ionizing radiation was a challenge. Moreover, as Higuchi (2011: 39) points out, the Geiger counters being used to test tuna were hurriedly gathered and may not have been properly calibrated prior to their use. Additionally, Geiger counters are only able to convert the energy they detect into audible sounds and counts per minute, and do not indicate which radionuclides are actually being picked up in the measurement.²⁷⁷ Not only were the Geiger counters producing discomfoting audible translations of the activity of natural and anthropogenic radionuclides in the fish being measured, but large numbers of tuna fished after the Lucky Dragon incident were being found over the 100 cpm limit, causing a huge shock in the tuna industry. To add to the turmoil, at the time of the Lucky Dragon incident, the Japanese government had been busy allocating part of the national budget to build the country's first nuclear reactor (Aldrich, 2013; P. Pringle & Spigelman, 1981). Thus, from the position of the Japanese government, the overflow

²⁷⁴ It was not only the tuna fished by the Lucky Dragon Number 5 that contained the US's radionuclides, but other fish swimming in the Pacific Ocean—within which radionuclides from the US's hydrogen bomb tests were freely flowing. Watch Hashimoto's (2003) video to see the locations of the hydrogen bomb tests conducted between 1945 and 1998. While both the Soviet Union and the United Kingdom were testing nuclear weapons in 1954, their tests were taking place in the Soviet Union or in Australia, not as close to the Japanese archipelago as the US tests.

²⁷⁵ A Geiger counter (also referred to as a G-M counter or a Geiger-Müller counter) is a device "that gives a clicking sound and a sharp electrical pulse (discharge) when struck by an ionizing particle, such as an electron [—beta particle—] or photon—gamma ray—or sufficient energy to produce an electrical discharge" (Morgan & Peterson, 1999: 199).

²⁷⁶ According to a 1960 report titled "Fish and Radioactivity," "[t]he acceptable level was arbitrarily set as a value less than 100 counts per minute as measured with an end window G-M counter placed 10 cm from the surface of the fish. Fish of higher counts were discarded and usually buried" (Seymour, 1960). Also see Higuchi (2008; 2011).

²⁷⁷ The limits to using a Geiger counter to measure for radionuclides was something many of my study's participants discovered following the onset of TEPCO's nuclear disaster in 2011.

not only needed to be contained in order to save the tuna industry, but to advance and ensure the smooth establishment of the country's nuclear industry—its newest industrial progress project. The United States' plans to continue its nuclear testing in the Pacific added another dimension to the Japanese government's considerations as it found itself trying to curb public concern about radionuclides in food and rain, while also maintaining stable relations with US allies (T. Higuchi, 2008).

Through discussions with the US government and taking into consideration possible economic consequences for the fishing industry, in 1956 the Japanese Ministry of Health and Welfare (hereafter Ministry of Health)²⁷⁸ decided to revise its safety standards. Instead of simply banning all tuna measuring 100 cpm above 'natural' levels, the new standards adopted new calculations which shifted the allowable limit upward.²⁷⁹ The new standards additionally loosened the requirements for reporting intermittent cases of high fallout measured in food and rain. Though the numerical standards were based on the 'maximum permissible concentrations' of the time—which recognized the impossibility of setting a clear threshold for 'safety'—once in the wild, the values began to operate beyond their original intent and "in effect 'normalized' the presence of human-made radionuclides in foods below the threshold as 'safe'" (T. Higuchi, 2008: 344-5). Ultimately, the use of these new numerical standards created an "illusion of certainty"²⁸⁰ in which the layers of uncertainty known by scientists were no longer accessible in the numerical standards themselves.

As overflows of radionuclides proliferated, so did the institutional complex for textually taming and containing them. By the 1960s there were a number of new committees and organizations that became involved in developing radiation protection

²⁷⁸ While the Japanese Ministry of Health and Welfare active in 1956 and the Japanese Ministry of Health, Labour and Welfare active in 2011 are organizationally different, I refer to both of them as Ministry of Health in this chapter (see Section 5.5).

²⁷⁹ The allowable limit changed from 100 cpm to 0.1 microcuries (μc) or 222 disintegrations per minute (dpm) per liter. Higuchi (2008: 364-5, n62) explains: "One microcurie is equal to 2,220,000 dpm. The conversion of dpm into cpm depends on the efficiency of Geiger-Muller survey meters, which affects the accuracy of readings." The unit of dpm has been replaced by the Becquerel (disintegration per second), the unit my participants wrestle with today (T. Higuchi, 2011: 37, n17).

²⁸⁰ See Whitemore (1986: 5).

recommendations, and the ICRP became entangled within a whole new range of political and economic actors. In 1955, the British Medical Research Council and the US National Academy of Science both undertook studies on the possible medical consequences of radioactivity. Data collected for the US National Research Council's study—named the Biological Effects of Ionizing Radiation (BEIR)—would eventually be used by the ICRP to inform its recommendations for handling TEPCO's nuclear disaster in 2011 (Boudia, 2007; ICRP, 2007). The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) was created in the same year with the goal of studying the health effects of nuclear weapons testing (Taylor, 1971: 47). In 1956, the ICRP received non-governmental organization status with the World Health Organization (WHO) which offered to translate ICRP materials into multiple languages to be used to guide radiation protection projects, and the proliferation of nuclear energy and weaponry, throughout the world (Boudia, 2007). The following year, the International Atomic Energy Agency (IAEA) was created within the United Nations Atoms for Peace program²⁸¹ to help in promoting the 'peaceful' use and proliferation of nuclear energy (Roehlich, 2016).

The ICRP began interacting with all of these agencies by the early 1960s and also set up a more permanent financial plan for itself.²⁸² By 2010, the ICRP was being "financed mainly by voluntary contributions from national and international bodies with an interest in radiological protection" (ICRP, 2011: 4).²⁸³ In short, the overflows of

²⁸¹ Originating in the United States, the program was announced to the world by US president Dwight D. Eisenhower in a speech to the United Nations on December 8, 1953 (see Eisenhower, 1953).

²⁸² The ICRP initially received assistance from the International Society of Radiology, the World Health Organization, the Ford Foundation and the Rockefeller Foundation (Boudia, 2007).

²⁸³ In 2010 the ICRP (2011: 33) received grants from: the IAEA; the Organisation of Economic Cooperation and Development (OECD's) Nuclear Energy Agency (NEA); the Japan Atomic Energy Agency; the US Nuclear Regulatory Commission; the US Environmental Protection Agency; the Australian Radiation Protection and Nuclear Safety Agency; the Canadian Nuclear Safety Commission; the Chinese Society of Radiation Protection; France's Institut de Protection et de Sûreté Nucléaire; South Korea's Korea Nuclear International Cooperation Foundation; the Commission of European Communities; the International Radiation Protection Association; the International Society of Radiology; Argentina's Autoridad Regulatoria Nuclear de Argentina; Denmark's Statens Institut for Strålehygiejne; Finland's Säteilyturvakeskus; Germany's Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit; Iceland's Geislavarnir Ríkisins; Norway's Statens strålevern; Russia's

radionuclides in the 1940s and 1950s were met with the establishment and expansion of what I will refer to as the transnational nuclear assemblage. This institutional complex—within which memberships mingled and overlapped, and finances flowed freely—would establish itself as expert in all aspects of radiation protection. The proliferation of ‘safe’ and ‘peaceful’ nuclear technology would be made possible through cooperation among these entangled organizations, and overflows would no longer be a threat as they could be filtered and contained through their vast textual archives.

The establishment of this transnational nuclear assemblage was paired with, or rather paved the way for, the proliferation of nuclear energy in countries around the world. In Japan, the establishment of the nuclear industry was a long and arduous process (see Aldrich, 2008), though the crusaders of the project were ultimately successful in overcoming what was termed Japan’s “nuclear allergy” (*kaku arerugi*)—a term used to refer to the country’s aversion to nuclear weapons and, as a result, other forms of nuclear technologies (Aldrich, 2013). The country’s first commercial nuclear reactor went online in 1966 in Ibaraki Prefecture’s Tokai-mura (Tokai-village). By 1970 the country had four nuclear reactors, but that number jumped to twenty-two by 1980, thirty-nine by 1990, and finally fifty-four by 2010 (see Figure 1). While expansion of the nuclear industry was initially driven by slogans of ‘peace’ and ‘safety’—what is now referred to as the ‘myth of safety’—in the 1990s, following a number of oil shocks, the industry was re-branded as ‘green’ for its alleged ability to curb global warming (Sugiman, 2014).²⁸⁴

Burnasyan Federal Medical Biohysical Center; Russia’s Federal Medical Biological Agency; Spain’s Consejo de Seguridad Nuclear; and Sweden’s Miljödepartementet.

²⁸⁴ Nuclear power’s marketing as ‘green’ or ‘carbon neutral’ is only possible if the carbon emissions resulting from uranium mining and refinery, transport of materials as well as reactor construction are omitted from calculations. These claims also overlook the dangers of nuclear weapon proliferation, nuclear disasters, the storage of nuclear waste, and questions about the ability of nuclear reactors to remain ‘safe’ during the unprecedented weather events and changes in sea level that are predicted to accompany climate change—what is now being referred to as ‘climate chaos’ (see Girardet, 2007; Jacobson & Delucchi, 2011; Lenzen, 2008; Sovacool, 2008).

As the Japanese nuclear industry forged forward and began establishing itself physically in small, often marginalized and financially distressed towns and villages throughout country, overflows continued to challenge and disrupt attempts at unconstrained, limitless progress. Large-scale nuclear disasters—for example, the 1979 Three Mile Island nuclear disaster in Pennsylvania, United States; the 1986 Chernobyl nuclear disaster in the former Soviet Union; and the 1999 Japan Nuclear Fuel Conversion Co. (JCO) nuclear criticality disaster in Tokai-mura, Ibaraki, Japan²⁸⁵—seemed to slow the unfettered expansion of the country’s nuclear industry (see Aldrich, 2013; Sugiman, 2014). However, at the same time, the extensive and intricately connected transnational nuclear assemblage of councils, committees, commissions, agencies, academies and organizations working in the fields of nuclear power, nuclear weaponry, nuclear medicine and radiation protection had developed the capacity and authority to translate overflows—confining their messiness and the suffering they cause to humans and more-than-humans within its vast and ever-expanding textual archive.

One example of this form of textual containment can be found following the Chernobyl nuclear disaster. In the same way that the chaotic, messy and traumatic experiences of the *hibakusha* of Hiroshima and Nagasaki were translated into quantitative equations and models for setting standards for radiation protection, the vast and chaotic aftermath of the 1986 Chernobyl nuclear disaster was translated into reports and statistical data by a number of institutions in the transnational nuclear assemblage. Evolutionary biologists Møller and Mousseau (2013b: 18-9)²⁸⁶ describe how the haphazard and chaotic nature of the 1986 disaster has been translated into the reports of organizations active in the transnational nuclear assemblage:

²⁸⁵ The JCO nuclear criticality disaster took place on September 30, 1999 and was considered the worst radiological disaster connected to nuclear power in Japan before the onset of TEPCO’s nuclear disaster in 2011. It occurred at a uranium processing facility in Tokai-mura, Ibaraki Prefecture that was operated by JCO, one of the subsidiaries of the Sumitomo Metal Mining Co. On September 30th, the activities of three workers set off a ‘nuclear criticality’—also described as a “limited uncontrolled nuclear chain reaction”—while they mixed uranium oxide to produce fuel for one of Japan’s experimental nuclear reactors. Two of the workers died after their exposures (World Nuclear Association, 2013).

²⁸⁶ Both Møller and Mousseau have been studying the biological effects of ionizing radiation on animals and insects in Chernobyl, and are now also working in Fukushima (for example, Mousseau & Møller, 2014; 2016; 2017; Møller & Mousseau, 2013a; Møller et al., 2012).

Unfortunately, the chaotic events in Chernobyl in 1986, with the evacuation of thousands of inhabitants, were not used for selecting a random cohort that would have allowed quantitative assessment of public health effects. Today close to 1 million Ukrainians collect pensions linked to the effects of Chernobyl contamination. [...] In the official reports by the International Atomic Energy Agency (IAEA), United Nations and several other organisations released on the 20th anniversary of the accident in 2006, the total number of excess deaths was estimated to be very low. An additional conclusion in these reports was that negative health effects were likely to be due to psychological stress associated with worrying about the effects of low-dose radiation rather than being directly caused by biological effects. Interestingly, we can show strong negative effects on birds and other animals, and it is certain that neither birds nor free-living animals are known to worry about the negative effects of low-dose radiation. The official reports were restricted to effects recorded in highly contaminated regions of Ukraine, thereby excluding vast contaminated areas in Russia and Belarus. Several official representatives from these countries refused to sign the final documents. Subsequent research in Ukraine has shown extensive negative effects of low-dose radiation on many different medical conditions.

Thus, not only has the IAEA-sponsored Chernobyl Forum focused its study on the areas of highest fallout to determine the consequences of the nuclear disaster, but when heterogeneous health-effects experienced by people exposed to low-doses of ionizing radiation do not fit within the clear, linear quantifications put forth by the IAEA and other organizations in the transitional nuclear assemblage, they are simply compartmentalized away—in this case, said to be caused purely by ‘psychological distress.’ Radically different, Møller and Mousseau (2013b: 16) situate their studies within a messier “patchwork” of fallout, taking seriously the heterogeneity and diversity in biological effects from low-doses of ionizing radiation revealed on the bodies of barn swallows and other animals and insects living within a “haphazard

distribution of radiation.” Møller and Mousseau (2013b: 19, original emphasis) point out what they see as a major flaw in the IAEA’s approach:

In effect, the Chernobyl Forum took the position that if risks could not be *measured* because of relatively low frequencies, then they should not be *estimated* either. [...] [E]ven if the probability of a negative health outcome for an individual is small, if a large population is exposed, then a correspondingly large number of individuals are likely to be affected.

Recognizing the difficulty in measuring the biological effects of low-level ionizing radiation exposure on humans, the authors suggest a different approach, one that acknowledges and takes seriously the heterogeneity and stochastic nature of these exposures:

A better perspective on the effects of low-dose radiation is perhaps achieved by investigating organisms with short lifespan[s] such as birds, rodents or even insects, many of which [...] are now in their 25th or greater generation. Unfortunately, the negative effects of low-dose radiation from Chernobyl documented for these organisms are much worse than what is reported for humans.

5.4 Assumptions and philosophies for managing uncertainty and heterogeneity

Creating regulations to assert international consensus when findings refuse to fit within manageable, linear categories poses its challenges. Over time, ICRP members have come to a consensus on a number of assumptions and quantitative tools to manage uncertainties they see in the science of radiation protection, as well as a philosophy to address the ethical implications of making policy decisions that affect the lives and livelihoods of both radiation workers and the public at large. Termed ‘Recommendations,’ the ICRP’s consensus reports provide an overview of agreements decided upon by the Commission’s members.²⁸⁷ By 2011, the ICRP had produced over

²⁸⁷ Examples of these Recommendations can be found in *Publication 6* (1955), *Publication 9* (1966), *Publication 26* (1977), *Publication 60* (1991a) and *Publication 103* (2007) which are issued among a vast number of other publications designed for supplementary guidance.

117 major publications, with *Publication 103* published in 2007 providing the most current recommendations on radiation protection at the time of TEPCO's nuclear disaster (ICRP, 2007). According to *Publication 103*, the aim of the ICRP's recommendations for radiation protection were "to contribute to an appropriate level of protection for people and the environment against the detrimental effects of radiation exposure without unduly limiting the desirable human actions that may be associated with such exposure" (ICRP, 2007: 41). The 'detrimental effects' include both *deterministic effects*—which are thought to have a threshold and, thus, be more easily preventable—and *stochastic effects* (or probabilistic effects)—which are thought to have no clear threshold and therefore can only be limited.

As mentioned, the possible genetic effects of ionizing radiation became known in the 1940s, and by 1952 excess cases of leukemia were being found among *hibakusha* in Hiroshima and Nagasaki.²⁸⁸ In response, the ICRP—borrowing directly from the US NCRP—admitted its inability to set a threshold for stochastic effects from exposure to ionizing radiation.²⁸⁹ Fast-forward to 2007, and the same assumptions provide the backdrop of the ICRP's Recommendations. Finding an "appropriate level of protection" is therefore not only based on scientific knowledge, but "value judgements about the relative importance of different kinds of risk and about the balancing of risks and benefits" (ICRP, 2007: 41). But who would be making these value judgements? And on what basis would they be made?

To cope with the innumerable ethical issues behind setting standards for radiation protection, the ICRP has not only developed a number of assumption and philosophical approaches, but has also moved away from recommending concrete numerical standards, to what the group terms a "System of Radiological Protection." Through this 'System,' the ICRP includes recommendations not only for risk assessment, but also

²⁸⁸ See Atomic Bomb Casualty Commission (1974) and Lindee (1994: 244-5).

²⁸⁹ Recognizing the inability to set a threshold for absolute 'safety,' the ICRP's 1955 Recommendations instruct: "Whilst the values proposed for maximum permissible doses are such as to involve a risk which is small compared to the other hazards of life, nevertheless, in view of the incomplete evidence on which the values are based, coupled with the knowledge that certain radiation effects are irreversible and cumulative, it is strongly recommended that every effort be made to reduce exposure to all types of ionizing radiation to the lowest possible level" (ICRP, 1955: 10). Also see ICRP (2007: 35).

risk management, where numerical reference limits become just one of the many aspects considered when setting standards for radiation protection. In the following sections I will explicate some of the major assumptions and philosophical underpinnings which provide the basis for the ICRP's recommendations in an attempt to highlight how this 'System' is intended to operate when dealing with overflows of radionuclides into the wild.

5.4.1 *Stabilizing uncertainty*

One of the earliest assumptions adopted to compensate for the uncertainty of the onset of stochastic effects following exposure to ionizing radiation is the linear-non-threshold (LNT) model, a theoretical model which assumes that "in the low dose range, radiation doses greater than zero will increase the risk of excess cancer and/or heritable disease in a simple proportionate manner" (ICRP, 2007: 26). Here the 'low dose range' is defined as "below about 100 mSv" (ICRP, 2007: 51).²⁹⁰ Described as "the philosophical and practical foundation for risk assessment and management of exposures in the environment and workplace," (Mossman, 2012: 190) the linear-non-threshold model provided the basis for the recommendation printed in the ICRP's *Publication 60* (1991a). In 2007, the ICRP continued to advocate the importance of this assumption in the development of its Recommendations, arguing that using "this so-called linear-non-threshold (LNT) model is considered by the Commission to be the best practical approach to managing risk from radiation exposure and commensurate with the 'precautionary principle.'" (ICRP, 2007: 43).²⁹¹ The adoption of the linear-non-threshold model is viewed as precautionary due to the 'uncertainty' the ICRP asserts as present within not only current, *but also future* investigations into the biological effects of low-dose ionizing radiation.²⁹²

²⁹⁰ The unit mSv stands for millisieverts and is a unit for measuring an estimated effective dose to the whole human body, or an estimated equivalent dose to an individual organ. These doses will be discussed in more detail later in this chapter.

²⁹¹ The document sites a report on the precautionary principle by the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) (2005), published by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

²⁹² The ICRP (2007: 51, emphasis added) explains its position: "whilst the LNT model remains a scientifically plausible element in its practical system of radiological protection, biological/epidemiological information that would unambiguously verify the hypothesis that underpins the model *is unlikely to be forthcoming.*"

Providing support for its use of the linear-non-threshold assumption, *Publication 103* cites UNSCEAR (2000a; 2000b) the US NCRP (2001) and the US National Research Council (2006). Although the ICRP points out one report from the French Académie des Sciences²⁹³ which is described as supporting an alternative “practical threshold for radiation cancer risk,” *Publication 103* continues to maintain the linear-non-threshold assumption based on an analysis presented in *Publication 99* in 2005:

from an analysis conducted by the Commission [...], the Commission considers that the adoption of the LNT model combined with a judged value of a dose and dose rate effectiveness factor (DDREF) provides a prudent basis for the practical purposes of radiological protection, i.e., the management of risks from low-dose radiation exposure. (ICRP, 2005; 2007: 51)

Here the ICRP brings up another important aspect of the linear-non-threshold model: it depends on a ‘judged value’ used to extrapolate the potential risk of cancer below ‘around 100 mSv,’ referred to as the ‘dose and dose-rate effectiveness factor (DDREF).’ The ICRP (2007: 21) defines the DDREF as a “judged factor that generalises the usually lower biological effectiveness [or biological injury] (per unit of dose) of radiation exposures at low doses and low dose rates as compared with exposures at high doses and high dose rates.” That is, the factor is used to account for possible “cellular adaptive responses”—or the potential, assumed ability of the body to repair damage caused by ionizing radiation—following low-dose exposures to ionizing radiation that may not be possible at higher doses.²⁹⁴

²⁹³ The French report was written by Tubiana and Aurengo (2005). In addition to them, there are a number of other scientists who argue against the linear-non-threshold model, instead advocating for a ‘supra-linear dose model’ (Morgan, 1992; Sawant et al., 2001) or possibly a ‘linear response model’ (Møller & Mousseau, 2013b).

²⁹⁴ As mentioned in Section 5.2, the ICRP’s (2007: 52) data on “the risk of organ-specific cancer” is based on the somewhat questionable data collected through the Life Span Study conducted on *hibakusha* from Hiroshima and Nagasaki (for example, Preston et al., 2007; Preston et al., 2003) as well as studies by UNSCEAR (2000a; 2000b) and the US National Research Council (2006). The ICRP (2007: 52) says that it borrowed the DDREF from UNSCEAR as a tool “to project cancer risk determined at high doses and high dose rates to the risks that would apply at low doses and low dose rates.” Mossman (2012: 193) also explains its importance in estimating health ‘risks’ from exposure to low doses of radiation: “Dose and dose-rate effectiveness factors (DDREF) are used to adjust LNT-derived risk coefficients to account for biological repair. The extent of repair is an important determinant of risk.”

The assumptions underlying these estimates continue to evolve over time, with some scientists contending that, based on recent studies on low-dose radiation, the ICRP's current estimates are not conservative enough.²⁹⁵ Regardless, the ICRP (2007: 53) cites 'uncertainty'—or lack of “statistical precision”—in the literature as the reason for using “broad judgements” in deciding on factors such as the DDREF:

In principle, epidemiological data on protracted exposure, such as those from environmental and occupational circumstances, should be directly informative on judgements of DDREF. However, the statistical precision afforded by these studies and other uncertainties associated with the inability to adequately control for confounding factors (see Annex A), do not allow for a precise estimate of DDREF at this time. Accordingly the Commission has decided to continue to use broad judgements in its choice of DDREF based upon dose-response features of experimental data, the LSS, and the results of probabilistic uncertainty analysis conducted by others.

Along with the DDREF, another extremely important assumption underlying the linear-non-threshold model is what Tsuda et al. (2017) refer to as the “100 mSv threshold assumption.” In their paper addressing the ethical issues concerning the unquestioned adoption and proliferation of the assumed ‘100 mSv threshold’ for radiation-induced cancer, the authors point out how the assumptions and uncertainty in the science behind this numerical threshold is often erased as the value is reproduced in scientific and government reports, the media, and recommendations for radiation protection. In *Publication 103*, the ICRP (2007: 173) describes the logic behind its adoption of the ‘100 mSv threshold assumption’ in spite of ongoing contention and debate:

In formulating Recommendations for protecting humans against the tumorigenic effects of radiation, the Commission is required to consider a very broad span of biological data and concepts; many of these are subject to ongoing debate and, in some cases, contention. There is, however, general agreement that epidemiological methods used for the estimation of cancer risk do not have the power to

²⁹⁵ For example, see Tsuda et al. (2017), Imanaka and Hasai (2008), and Morgan (1992).

directly reveal cancer risks in the dose range up to around 100 mSv. Accordingly there is a growing role for biological data in the development of ICRP Recommendations and, where there is uncertainty and/or contention, there is a need to arrive at a scientifically balanced judgement based upon peer-reviewed data.

The ‘power’ being discussed, as pointed out by Tsuda et al. (2017), refers again to “statistical power” mentioned in the ICRP’s Recommendations (2007: 186, emphasis added) some pages later: “As already noted, direct estimation from epidemiological studies of cancer risks from doses below a few hundred mSv is difficult, largely for reasons of *statistical power*.” However, Tsuda et al. (2017) point out the lack of epidemiological evidence and citation in the ICRP’s statement, listing a number of studies published since 1956 which indicate possible carcinogenic effects appearing in absorbed doses lower than 100 mGy (which translates to an effective dose²⁹⁶ to the human body of about 100 mSv). Here, what worries Tsuda and colleagues is the uncertainty of radiation-induced cancers, along with other non-cancerous outcomes, that occur below the 100 mSv threshold, but are easily written off by scientific and government authorities as ‘uncertainty,’ or, worse, erroneously translated to an assumption that “there is no excess cancer risk under 100 mSv” (Tsuda et al., 2017: 3). That is, while ‘uncertainty’ may be acknowledged within the vast textual complex of the ICRP and other organizations within the transnational nuclear assemblage, the rounded and seemingly stable numerical value of 100 mSv has the potential to make invisible the important historical evolution and assumptions imbued within this metric.

The overall purpose of devising calculations for biological damage from low-dose exposure to ionizing radiation is to determine dose coefficients of estimated *equivalent* and *effective doses* to guide the setting of radiation protection standards. *Equivalent dose* refers to an estimated dose of ionizing radiation received by a specific ‘critical tissue’ or ‘critical organ’ of the body, while *effective dose* refers to an estimated dose of radiation to the whole body—calculated as the “tissue-weighted sum of the equivalent

²⁹⁶ “Effective dose expresses biological damage to an individual” following exposure to radiation (Martin & Harbison, 1996: 28). The effective dose “takes into account the type of radiation and the sensitivity of particular tissues and organs to that radiation” (Grupen, 2010: 291).

doses in all specified tissues and organs of the body” (ICRP, 2007: 23).²⁹⁷ According to the ICRP’s *Publication 103* (2007: 49-59), effective dose is risk-informed because it is based on estimates of the risk of deterministic and stochastic effects extracted from studies on *hibakusha* in Hiroshima and Nagasaki (for example, Preston et al., 2003; 2007) and other ‘exposed’ populations (for example, UNSCEAR, 2000a; 2000b). Because these doses represent ionizing radiation absorbed by different bodily tissues or organs, they cannot be directly measured and are instead obtained through complex calculations and modeling using ‘voxel reference phantoms’ to determine equivalent and effective doses for a Reference Person.²⁹⁸ *Publication 103* explains:

For adults, equivalent doses will be calculated by sex-averaging of values obtained using male and female phantoms. Effective dose will then be calculated using revised age- and sex-averaged tissue weighting factors, based on updated risk data and intended to apply as rounded values to a population of both sexes and all ages. Effective dose is calculated for a Reference Person and not for an individual. (ICRP, 2007: 13)

Again, the Reference Person was originally designed as a tool to allow for conveniently standardizing assumptions involved in establishing estimated doses for radiation protection that could be sweepingly applied to all members of the public.²⁹⁹ The purpose of the original Standard Man, later Reference Man, was to provide a “set of

²⁹⁷ More specifically, effective dose “expresses biological damage to an individual” human body following exposure to radiation (Martin & Harbison, 1996: 28) and “takes into account the type of radiation and the sensitivity of particular tissues and organs to that radiation” (Gruppen, 2010: 291). As such, effective dose is also described as “a risk-related quantity based upon the consequences of whole body exposure” (ICRP, 2007: 311).

²⁹⁸ According to *Publication 103* (ICRP, 2007: 31), reference phantoms are “[v]oxel phantoms for the human body (male and female voxel phantoms based on medical imaging data) with the anatomical and physiological characteristics defined in the report of the ICRP Task Group in Reference Man” (see ICRP, 2002). At the time of the report, reference phantoms for different aged children, pregnant women and fetuses were only being planned, not yet developed (ICRP, 2007: 69). See Hoseinian-Azghadi et al. (2014) and Kim et al. (2016) for some of the newest developments.

²⁹⁹ Eckerman and Cristy (1995: 1) explain: “The well-defined reference individual enabled health physicists to compare and check their calculations without tedious enumeration of assumptions and without minor differences in these assumptions obscuring the basic agreement or disagreement of their estimated doses.”

biological parameters which would be accepted for calculating permissible levels for work with radioactive nuclides” (ICRP, 1975: 1-2). Having a single, reference body seemed to be the perfect answer for dealing with messy “biological variability” among the bodies of radiation workers; the Reference Man’s body provided the perfect tool for taming the heterogeneity and messiness inherent in biological idiosyncrasies (US NCRP, 1954: 8).³⁰⁰ Thus, the art of averaging became an important tool for ensuring universal application of radiation protection standards—intended mostly for a male nuclear workforce at the time. But it came with a twist: though the Reference Man was designed through an averaging of real human characteristics and parameters, the recommended doses could only be used to set standards applicable to protect an abstract ‘human population’ and could not be used to make epidemiological predictions regarding individual human bodies. This remains a basic tenet of radiation protection standards today.

While dose coefficients were initially designed for the body of a Standard or Reference *Man*,³⁰¹ eventually biological parameters of women were considered, managed by adding female organs to the carefully atomized body of the Reference Man and creating a hermaphroditic ‘Reference Individual.’³⁰² Given the different radio-sensitivities of male and female bodies, some have suggested using dose coefficients for a ‘Reference Female’ to deal with problems of “radioactive gender inequality” in the setting of radiation protection standards (Cram, 2015: 801).³⁰³ By 2007, the ICRP’s Recommendations moved away from the hermaphroditic model, instead calling for the calculation of equivalent dose separately for both males and females, and then “sex-

³⁰⁰ The US NCRP’s Subcommittee 1 clarifies its stance: “‘biological variability’ [...] makes it necessary to deal with averages rather than with the individual. Since the factors that cause such variations are unknown, it is impossible to predict how a given individual will respond to a dose that is known to produce a certain effect on the average” (US NCRP, 1954: 8).

³⁰¹ In ICRP *Publication 23*, the Reference Man was described as a young man “20-30 years of age, weighing 70 kg, is 170 cm in height, and lives in a climate with an average temperature of from 10 to 20 C. He is a Caucasian and is a Western European or North American in habit and custom” (ICRP, 1975: 4).

³⁰² See Cram (2015) for a discussion on the sexual evolution of the ICRP’s Standard Man.

³⁰³ In the case of cancer, data on the increased radio-sensitivity of woman and children are made clear in the BEIR VII Phase 2 report by the US National Research Council (2006: 311-2). Some of the data from this report, which visually portray the difference in radio-sensitivity in the case of lung and other cancers, have been plotted by Li et al. (2011: 409).

averaging” to obtain equivalent or effective doses suitable for a more gender-neutral ‘Reference Person’ (ICRP, 2007: 12).³⁰⁴ Thus, instead of creating doses based on the most radio-sensitive members of a population, the ICRP (2007: 69-70) advocates radiation protection standards to be based on a single sex-averaged value: “[f]or the purposes of radiological protection, it is useful to apply a single value of effective dose for both sexes.” As it was at the invention of the Standard Man, averaging remains an important tool for translating the heterogeneity of active human bodies into a homogenous Reference Person—a model that is used to smooth over messy ‘biological variability’ through quantitative risk assessments.

Again, while current dose coefficients estimated for an ‘idealized’ Reference Person are used in setting radiation protection standards applicable to all members of an exposed population, the ICRP makes clear that—because the doses were designed for a Reference Person and not a specific human body—they are merely “protection quantities which are used for limiting stochastic effects at low doses” and should never be used in epidemiological investigations, cancer projections or risk assessments involving *real* people (ICRP, 2007: 13 & 64).³⁰⁵ Thus, while the Reference Person can aid in making decisions about ‘acceptable’ doses of ionizing radiation for *all* members of the public, it cannot be held accountable for any detrimental effects that may result from these doses. Here, the role of the Reference Person exposes the inherent tensions between the messy heterogeneity of human bodies with the homogeneity of models and statistics behind radiation protection standards, and thus the policy recommendations they are based upon.

³⁰⁴ ICRP *Publication 103* defines the Reference Person as “[a]n idealised person for whom the organ or tissue equivalent doses are calculated by averaging the corresponding doses of the Reference Male and Reference Female. The equivalent doses of the Reference Person are used for the calculation of the effective dose by multiplying these doses by the corresponding tissue weighting factors” (ICRP, 2007: 31).

³⁰⁵ The ICRP (2007: 51) explains its position: “Because of this uncertainty on health effects at low doses, the Commission judges that it is not appropriate, for the purposes of public health planning, to calculate the hypothetical number of cases of cancer or heritable disease that might be associated with very small radiation doses received by large numbers of people over very long periods of time.”

In reading through the ICRP's Recommendations, it becomes clear that 'uncertainty' is an important tool for maintaining flexibility in setting recommendations for radiation protection. In categorizing all possible negative effects of effective doses of ionizing radiation below 100 mSv as 'uncertain,' any attempts to link low-dose ionizing radiation to malaise or disease are also easily compartmentalized away, recognized only as "noise"³⁰⁶ or "scatter"³⁰⁷ in statistical analyses. The word "trivial" can also be found in ICRP documents to describe low-dose exposures that do not fit into its statistical models (ICRP, 2007: 13 & 76).³⁰⁸

Ultimately, the linear-non-threshold model, and its accompanying assumptions, serves as an important pillar in the ICRP's attempt to stabilize uncertainty as a tool for containing overflows of radionuclides from their confined spaces within the transnational nuclear assemblage into the wider environment. Even one of the most inherent tensions within the model—its acknowledgement that there is no 'safe' dose of ionizing radiation—is managed through the stabilization of uncertainty. ICRP *Publication 103* (2007: 43, emphasis added) explains how the uncertainty of stochastic effects, combined with the analytical possibilities afforded by the linear-non-threshold model, create a situation where standard-setting institutions, as well as members of the public, must "assume" and thus *accept* any possible detrimental effects from exposure to low-level ionizing radiation that is "deemed acceptable":

The probabilistic nature of stochastic effects and the properties of the LNT model make it impossible to derive a clear distinction between 'safe' and 'dangerous', and this creates some difficulties in explaining the control of radiation risks. The major policy implication of the LNT model is that *some finite risk, however small, must be*

³⁰⁶ In *Publication 99* the ICRP (2005: 27, emphasis added) writes: "At low and very low radiation doses, statistical and other variations in baseline risk tend to be the dominant sources of error in both epidemiological and experimental carcinogenesis studies, and estimates of radiation-related risk tend to be highly uncertain because of a *weak signal-to-noise ratio* and because it is difficult to recognise or to control for subtle confounding factors. At such dose levels, and with the absence of bias from uncontrolled variation in baseline rates, positive and negative estimates of radiation-related risk tend to be almost equally likely on statistical grounds, even under the LNT theory."

³⁰⁷ See Gonzalez et al. (2013: 510).

³⁰⁸ The ICRP (2007: 13 & 76) refers to these as "trivial individual doses" or "trivial exposures."

assumed and a level of protection established based on what is deemed acceptable.

Here, uncertainty is used as a tool to abdicate the ICRP of the responsibility of taking seriously the messiness and heterogeneity of the effect of low-level exposure to ionizing radiation, instead translating it from a technical problem that needs to be solved, to a “problem of social acceptance” (T. Higuchi, 2011: 6).³⁰⁹ However, how ‘acceptable’ doses and radiation protection standards are decided remains a highly contentious ethical issue. Over time, the ICRP has developed basic principles to help in guiding the application of its Recommendations in an attempt to smooth over ethical questions implicit in its scientific foundation and intended applications.

5.4.2 *The fluidity and mutability of radiation protection values*

The philosophy of the ICRP is embodied in its three guiding principles of ‘justification,’ ‘optimization of protection’ and the ‘application of dose limits’ which are to be used to inform either ‘practices’—“human practices increasing exposure”—or ‘interventions’—“human actions that decrease exposure.”³¹⁰ These three principles are to be employed differently depending on the type of exposure situation—‘planned,’ ‘emergency,’ or ‘existing’ (ICRP, 2007: 82-3). According to the ICRP, while ‘justification’ and ‘optimization’ are applicable in all three situations, the ‘application of dose limits’ is only recommended for use in planned situations where doses can be controlled (for example, work to be completed within a functioning nuclear power plant). As mentioned in Section 5.4, the uncontrollable nature of nuclear disasters, according to the ICRP, *requires* that people accept higher doses of ionizing radiation in the event of an ‘unplanned’ radiological overflow.³¹¹

³⁰⁹ As Higuchi (2011: 6) puts it: “Subscribing to the linear non-threshold (LNT) hypothesis, radiation protection experts have long insisted that the risk of low-level radiation is not a technical fact but a problem of social acceptance.”

³¹⁰ This was first introduced in ICRP (1991a), quoted in ICRP (2007: 81-2).

³¹¹ In referring back to Perrow’s (1999) work on ‘normal accidents’ in Section 2.6.6, the particular design of nuclear reactors guarantees the technology may not easily cope with even small, predictable disruptions. Thus, overflows can never be referred to as ‘unexpected,’ ‘accidental’ or even ‘unplanned’ as the very design of these reactors guarantees an overflow is likely to occur.

The 2007 ICRP Recommendations explain that in an emergency situation, the principle of ‘justification’ becomes:

the process of determining whether [...] a proposed remedial action [...] is likely, overall, to be beneficial, i.e., whether the benefits to individuals and to society (including the reduction in radiation detriment) from introducing or continuing the remedial action outweigh its cost and any harm or damage it causes. (ICRP, 2007: 25)

Correspondingly, during an emergency the principle of ‘optimization of protection’ is described as a “process of determining what level of protection and safety makes exposures, and the probability and magnitude of potential exposures, *as low as reasonably achievable, economic and societal factors being taken into account*” (ICRP, 2007: 28, emphasis added).³¹² The term ‘ALARA’—the acronym for ‘as low as reasonably achievable’—is used to describe the recommended process for choosing an acceptable radiation dose for the public that takes into account not only the health of humans, but other societal and economic considerations.³¹³ The ICRP makes sure to emphasize that “[o]ptimisation of protection is not minimisation of dose”—a nuance the Commission would later blame the Japanese government of ignoring in the setting of its ‘new reference limits’ for radionuclides in food in April 2012 (González et al., 2013; ICRP, 2007: 92).³¹⁴

Both principles require making judgements that affect the lives of “exposed individuals,” whether they be the public (“general individuals”), workers (“informed individuals”), or patients and their caregivers (ICRP, 2007: 24). The ICRP’s recommendations expect government officials will be in charge of employing these principles and making judgements during emergency situations. Therefore, while the ICRP does recommend that in some cases decisions on ‘justification’ should be “informed by a process of public consultation” and ‘optimization’ “may often include the participation of relevant stakeholders rather than radiological protection specialists

³¹² The principle of ‘optimization’ is expanded upon in *Publication 101* (ICRP, 2006).

³¹³ See Hansson (2013) for a reflection on the ALARA approach in radiation protection.

³¹⁴ This will be discussed further in Section 5.6.

alone” (ICRP, 2007: 90-3), the choice of who to include and how the inclusion takes place is awarded to governing authorities.³¹⁵

The ICRP additionally provides guidance in the form of numerical recommendations for setting *reference levels*—or dose limits—in ‘planned,’ ‘existing’ and ‘emergency situations’ (ICRP, 2007: 14). The values are represented as a recommended *annual effective dose*—measured in millisieverts per year (mSv/year)—for both workers and the public. In its Recommendations, the ICRP translates equivalent and effective doses into *reference levels* to guide the setting of radiation protection standards. In an emergency situation, the ICRP advises government officials to choose a numerical *reference level* which represents the chosen “restriction on dose or risk, above which it is judged to be inappropriate to plan to allow exposure to occur, and below which optimisation of protection should be implemented” (ICRP, 2007: 44). According to *Publication 103*, *reference levels* are always situation-dependent, allowing for flexibility in the setting of radiation protection measures—for example, the numerical reference values for a planned exposure situation would not be considered applicable in an emergency situation. The ICRP (2007: 95-8) stipulates that, in an emergency situation, the inability to know the extent of a radiological overflow *a priori* means that deciding on an appropriate reference level involves *a posteriori* calculation of estimated *projected*, *residual* and *averted doses*.³¹⁶

The *residual dose* represents the difference between the estimated *projected dose* of ionizing radiation people may receive in an emergency and the estimated *averted*

³¹⁵ The philosophical underpinnings of these principles have been described as both *utilitarian*—there is an effort to judge benefits and costs to find a level of protection judged as best for society at large—and *deontological*—concerned with a moral duty of taking into account the importance of reducing individual doses to a level as low as reasonably achievable (Valentin, 2013: 27).

³¹⁶ According to *Publication 103*: “The overall exposure, which is projected to occur as a result of the emergency exposure situation, should no protective actions be employed, is called the *projected dose*. The dose that would result when a protection strategy is implemented is called the *residual dose*. In addition, each protective measure will avert a certain amount of exposure. This is referred to as *averted dose*, and is the concept for the optimization of the individual protective measures as given in *Publication 63* [...] that will make up the overall protection strategy” (ICRP, 2007: 109, original emphasis). *Publication 63* was published by the ICRP in 1991 (see ICRP, 1991b).

dose—the reduction in dose expected to result from a particular intervention. Thus, it becomes the responsibility of governing authorities to calculate the *projected dose* people may be exposed to, to decide on an intervention strategy, to estimate the dose that would be *averted* through that strategy, and to estimate the *residual dose* that people would still be exposed to following the intervention. According to the ICRP (2007: 15), *residual dose* “should be below the reference level” as it represents the “dose remaining after implementation of protection strategies.” The principle of ‘optimization’ would be employed to ensure the *cost* of the intervention strategy would result in a *residual dose* “as low as reasonably achievable, economic and societal factors being taken into account” (ICRP, 2007: 28).³¹⁷ While estimated *residual dose* is calculated for a single intervention, the *total residual dose* takes into account the total dose (absorbed through all pathways) that is expected to remain following various interventions. Thus, the *reference limits* chosen for an emergency situation should “be expressed as the *total residual dose* to an individual as a result of the emergency that the regulator would not plan to exceed” (ICRP, 2007: 96, emphasis added).

Publication 103 advises that choosing a protection strategy in an emergency situation means government officials must take into account the “multiple exposure pathways” through which radionuclides enter the body (ICRP, 2007: 15). In the case of food, internal exposure must be calculated. However, the complex and heterogeneous nature of the interaction between myriad unstable radionuclides and active human bodies complicates attempts at estimating these doses. *Publication 103* (ICRP, 2007: 77) explains:

In general, it can be said that uncertainties of assessments of radiation doses from internal exposures, including the biokinetics of radionuclides, are larger than those from external exposures. The degree of uncertainty differs between various radionuclides.

The ICRP’s recommendations for *reference levels*—measured in mSv/year—are broken into three “bands” to help in the setting of radiation protection standards. The first band of *1 mSv/year or less* is recommended for a “usually planned” exposure

³¹⁷ In short, “[e]mphasis on optimization using reference levels in emergency and existing exposure situations focuses attention on the residual level of dose remaining after implementation of protection strategies” (ICRP, 2007: 15).

situation in which people “are exposed to a source that gives them little or no individual benefit but benefits to society in general.” The second band recommends setting reference levels between *1 to 20 mSv/year* for exposure situations in which people “will usually receive benefit from the exposure situation but not necessarily from the exposure itself.” The third band recommends a reference level between *20-100 mSv/year* for exposure situations in which people are “exposed by sources that are not controllable, or where actions to reduce doses would be disproportionately disruptive” (ICRP, 2007: 97, emphasis added).

According to *Publication 103*, reference levels chosen for emergency situations—such as TEPCO’s nuclear disaster—should fall into this third band of *20-100 mSv/year*, granting governing authorities the power to judge and define what is considered ‘disproportionately disruptive’ (ICRP, 2007: 98). Again, while it would be ‘unacceptable’ to knowingly expose people to between 20 and 100 mSv/year of ionizing radiation in ‘normal’ circumstances, following a nuclear disaster the public is expected to accept much higher levels of exposure simply because the situation is categorized as ‘not controllable.’

Again, according to the protocol laid out in *Publication 103*, government authorities managing the safety of food must use the process of ‘optimization’ to decide on an appropriate *reference level* (ICRP, 2007). Though previous and current publications differ in their recommended approaches—previous publications recommended using the process of ‘optimization’ to decide on specific *intervention levels*, while newer publications recommend using ‘optimization’ when deciding on the entire protective strategy using *reference levels* (ICRP, 2007: 117)³¹⁸—*Publication 103* continues to include recommended *intervention levels* specifically for managing radioactivity in food. *Publication 63* recommends setting an *intervention level* of 10 mSv/year for food,

³¹⁸ The authors of *Publication 103* (ICRP, 2007: 109, original emphasis) explain “each protective measure will avert a certain amount of exposure. This is referred to as *averted dose*, and is the concept for the optimisation of the individual protective measures as given in *Publication 63* [...] that will make up the overall protection strategy. The Commission now recommends focusing on optimisation with respect to the overall strategy, rather than the individual measures. However, the levels of averted dose recommended in *Publication 63* for optimisation of protection in terms of individual protective measures may still be useful as inputs to the development of the overall response.”

which would result in reference limits³¹⁹ between 1,000-10,000 Bq/kg for some radionuclides (ICRP, 2007: 117).³²⁰

Here, the concepts of NORM and ‘normal’ discussed in *Publication 103* may help to better contextualize how the process of ‘optimization’ is used in setting *reference levels*. NORM—the acronym for “naturally occurring radioactive material”—is defined as “[r]adioactive material containing no significant amounts of radionuclides other than naturally occurring radionuclides” (ICRP, 2007: 29). According to the ICRP (2007: 29), NORMs are excluded from calculations of “public exposure.”³²¹ The word ‘normal,’ on the other hand, is used to describe processes that operate by the books³²² as well as the flow of economic and societal activities prior to any disruptive ‘non-controllable’ overflow of radionuclides. *Publication 103* (ICRP, 2007: 109) expounds:

In emergency exposure situations particular attention should be given to the prevention of severe deterministic health effects as doses could reach high levels in a short period of time. In case of major emergencies an assessment based on health effects would be insufficient and due considerations must be given to societal,

³¹⁹ While estimated radiation doses absorbed by human bodies are measured in millisieverts (mSv), reference limits are presented in the “convenient form” of “activity concentration” measured in Becquerels per kilogram (Bq/kg) or liter (Bq/l) (ICRP, 1991b: 26).

³²⁰ *Publication 63* (ICRP, 1991b: 17) recommends “[f]or any single foodstuff, an intervention level that is almost always justified is an averted effective dose of 10 mSv in a year.” According to *Publication 63*, “[f]or radionuclides with low values of dose per unit intake (e.g. most beta and gamma emitters), the optimized intervention levels for various foods would be expected to lie in the range from 1-10kBq/kg [1,000-10,000 Bq/kg]. For radionuclides with high values of dose per unit intake (e.g. alpha emitters) the optimized intervention levels would be in the range 10-100 Bq/kg” (ICRP, 1991b: 17-8). To decide on the appropriate intervention level, *Publication 63* recommends using a cost-benefit analysis. That is, an ‘optimized’ intervention level should take into account whatever is judged to be the costs and benefits of putting restrictions on food. It should also take into account the potential *effective dose* to be endured by the population as a whole, as well as the potential cost of replacing the supply of food (ICRP, 1991b: 26).

³²¹ The ICRP (2007: 29) defines *public exposure* as: “Exposure incurred by members of the public from radiation sources, excluding any occupational or medical exposure and the normal local natural background radiation.”

³²² For example, the ICRP (2007: 105) refers to “normal operations” at nuclear power plants, or what has been documented as “normal exposures” to the workforce or public in controlled situations.

economic and other consequences. Another important objective is to prepare, to the extent practicable, for the resumption of societal and economic activities considered as ‘normal’.

Nuclear disasters are inherently messy happenings which may not only lead to disruptions in the health of members of the public, but in the smooth and ‘normal’ functioning of economic and societal activities. While the ICRP’s recommendations rely on quantitative equations and linear models to design reference limits (activity concentrations) for radionuclides in food which should be set based on calculations of *projected*, *averted* and *residual doses*, precise estimates of dose are not always able to be gauged and calculated in the chaos of an overflow. Thus, policymakers require flexibility in the setting of radiation protection standards during an overflow; they require numerical reference values—usually considered solid and immutable—to be mutable.

In this section, I have explicated how the ICRP’s philosophical approaches—such as the principle of ‘optimization’ and situation-dependent recommendations—enact the seemingly immutable numerical standards for radiation protection as mutable, fluid and flexible. While the mutability of these numbers may create flexibility for policymakers attempting to get economic and societal flows back to ‘normal’ as soon as possible following a radiological overflow, it simultaneously exposes them to be ‘matters of concern’—as opposed to authoritative, black-boxed ‘matters of fact.’ As Chiho’s story highlights, the numerical reference limits for radiation protection deployed within Japan’s agrifood assemblage were treated as immutable mobiles with the authority to direct people on how to ‘correctly’ enact their relationship with unstable radionuclides. However, shift-shaping of numerical values from immutable, to mutable and back again undoubtedly raises concerns among people being asked to ingest TEPCO’s radiological overflow—including many of my research participants who, like Chiho, were asked to trust in first the 500 Bq/kg and then the 100 Bq/kg numerical reference limits set by the Japanese government. Chiho’s story also reveals how the meaning of the term ‘safe’ remains mutable throughout this process, shifting depending on what is considered ‘normal’ to the governing agencies in charge of implementing radiation protection. In the next section, I will explore the processes and institutional texts involved in the crafting of Japan’s 100 Bq/kg reference limit for cesium-134 and

cesium-137 in food, and how mutable values and interpretations of ‘safety’ were translated back into immutable mobiles in an attempt to coordinate the activities of human actors in the agrifood assemblage.

5.5 Setting reference limits for radionuclides in Japan’s agrifood assemblage

Given the inherent perplexity of establishing guidelines for setting ‘acceptable levels’ of radionuclides within secluded spaces, it is no surprise that the need to expedite standards after TEPCO’s 2011 overflow was a considerable challenge. Following the onset of TEPCO’s nuclear disaster, the Japanese government undertook its assigned role of translating radiation protection recommendations into numerical reference limits in an attempt to stabilize the agrifood assemblage and ensure the ‘safety’ (*anzen-sei*) of the food it circulates in accordance with the Food Sanitation Act (Government of Japan, 2007b). While the logic of the ICRP’s system of radiation protection and the consensus met by its members may have seemed stable and consistent within the textual complex of the transnational agrifood assemblage, once in the wild, the group’s underlying philosophies and assumptions were forced to engage with other philosophies and regulations active within Japan’s agrifood assemblage. In this section, I will describe how reference levels—dose limits—and their corresponding reference limits for radionuclides in food were decided in the messiness of the aftermath of TEPCO’s overflow, and how seemingly consistent radiation protection principles published in the ICRP’s *Publication 103* were put in tension with other actors, philosophies and ruling texts active within Japan’s agrifood assemblage.

According to the Japanese Food Sanitation Act, the government is legally liable for ensuring that food harmful to human health is not consumed by citizens (Government of Japan, 2007b; MHLW, 2011g). Japan’s Food Safety Basic Law of 2003 (hereafter the Basic Law) was created following the outbreak of bovine spongiform encephalopathy (BSE) in 2001 (Government of Japan, 2006). The Basic Law represented an overhaul of previous food safety laws, using a risk analysis framework to prove to eating bodies that foods circulating in the agrifood assemblage are both *anzen* (safe in a technical, objective sense) and *anshin* (safe in a psychological,

subjective sense) (Tanaka, 2008).³²³ Under the framework set forth by the Basic Law, management of food safety became the role of government ministries, and food safety laws were to be based on scientific assessments conducted by a new, independent body: the Food Safety Commission. In short, the establishment of the Basic Law in 2003 advanced science as a governance tool to ensure food ‘safety’ and to rebuild people’s trust in the agrifood assemblage in the face of TEPCO’s destabilizing overflow.

In the days following TEPCO’s nuclear disaster, the Ministry of Health, Labour and Welfare (MHLW, hereafter Ministry of Health) had the responsibility of managing radiation in the agrifood assemblage. However, with no pre-existing standards in place, the government needed to quickly decide on how to manage radionuclides in the domestic food supply. In the chaos of the aftermath of the disaster, the Ministry of Health did not have time to consult with the Food Safety Commission—as stipulated in the Basic Law—before deciding on allowable limits for radionuclides in food. Instead, as specified under the Act on Special Measures Concerning Nuclear Emergency Preparedness (Government of Japan, 2007a), the Ministry of Health consulted with the Nuclear Emergency Response Headquarters, receiving permission to act swiftly without consultation. On March 17th, five days after the first explosion at TEPCO’s nuclear power plant, the Ministry of Health announced its chosen ‘provisional reference limits’ for radionuclides in food and drink (MHLW, 2011b; 2011g).³²⁴ Most of the values were adopted from the Nuclear Safety Commission of Japan’s ‘Indices Relating to Limits on Food and Drink Ingestion’—originally developed in 1980 following the 1979 Three Mile Island nuclear disaster in the United States, and updated in 2010 (NSCJ, 2010).³²⁵ The provisional reference limits would use radionuclides cesium-134, cesium-137 and iodine-131 as indicators for radioactivity in food. The Nuclear Safety Commission’s guidelines were based on a recommended *annual effective dose* of radioactive cesium-134 and cesium-137 amounting to 5 mSv/year and an *annual equivalent dose* to the thyroid of radioactive iodine-131 up to 50 mSv/year. These numbers were published in the ICRP’s *Publication 40* (1984a: 21) and a World Health

³²³ See Sternsdorff-Cisterna (2015), Hall (2010) and Chapter 6 for more on the terms *anzen* and *anshin*.

³²⁴ Fish was not added to these regulations until April 5, 2011 (MHLW, 2011i).

³²⁵ Also see Umeda (2013).

Organization Report (1988) as the lowest recommended intervention limits to be applied during the first year of a nuclear disaster.³²⁶

While recommended effective or equivalent doses represent estimated doses of radiation to the whole body or the ‘critical tissues’ within model human bodies, designing intervention strategies involves calculating the ‘activity concentration’ of radionuclides in food and deciding on a numerical quantity that should prevent these doses from being exceeded. These ‘activity concentrations’—measured in Bq/kg or Bq/l in Japan—also need to take into account the different radio-sensitivities of members of the public (i.e. that there are more vulnerable members of the population, including women and children, who are more sensitive to the effects of ionizing radiation than men).³²⁷ To ensure the chosen effective dose, the provisional reference limits for cesium-134 and cesium-137 were set at 200 Bq/l for drinking water and milk, and 500 Bq/kg for other foods. For iodine-131, an equivalent dose limit for the thyroid was set at 300 Bq/kg for drinking water and milk,³²⁸ and 2,000 Bq/kg for vegetables and fishery products (FSCJ, 2011d; 2011c).³²⁹

From the outset, the numbers were contentious, in part because they appeared much higher than the international consensus of what constituted dangerous levels of radioactivity. As mentioned by Daiki, Kazuki and Maiko, at the time of TEPCO's nuclear disaster, the International Atomic Energy Agency's (2004: 13) recommendations for managing the disposal of low-level radioactive waste had an exemption level for radioactive cesium-134 and cesium-137 set at 100 Bq/kg.³³⁰ While the logic of these numbers may have made sense within the transnational nuclear assemblage, it was difficult for my participants and other Japanese citizens to understand why the Japanese government claimed it was acceptable for citizens to

³²⁶ The Japanese recommendations remained at those levels in 2010, even though by 1991 the ICRP (1991b: 17) began recommending an *annual effective dose* of 10 mSv/year as an “intervention level that is almost always justified” for a single foodstuff.

³²⁷ See Section 5.4.1 for more on questions of sex in radiation protection.

³²⁸ Milk used for powdered baby formula was not to exceed 100 Bq/l.

³²⁹ For an overview of post 2011-Japanese food safety regulations see Hamada, Ogino and Fujimichi (2012) and Hamada and Ogino (2012).

³³⁰ That is, anything over 100 Bq/kg required regulatory control (and was thus classified as radioactive), while anything under 100 Bq/kg was no longer classified as radioactive.

consume foods containing up to 500 Bq/kg of these radionuclides—this appeared to be levels of cesium-134 and cesium-137 five times higher than the materials stored in drum cans labelled as nuclear waste.³³¹

Given the ambiguity of the numbers and their conflicting interpretations, establishing new guidelines presented a significant challenge. From March 2011 to February 2012, debates on the provisional limits ensued amongst factions of the Japanese government and included two opportunities for public comment. Upon setting the provisional reference limits, on March 20th the Ministry of Health followed the protocols of the Basic Law and requested that the Food Safety Commission (2011d)—referred to as the “risk assessor”—conduct an investigation into the adequacy of the chosen standards. On March 29th, the Food Safety Commission issued an interim *Emergency Report* and then convened a working group to discuss the standards.³³² The report engaged with a number of publications by organizations active within the transnational nuclear assemblage, some dating back to the 1970s.³³³ In its March 29th *Emergency Report*, the Food Safety Commission (2011c: 10) also cited the ‘100 mSv threshold,’ stating “in terms of information available at this point, there are very limited data on effects exerted on human body by low-dose radiation below 100 mSv.”³³⁴ In the end, the report conceded that an effective dose of 5 mSv/year was not only sufficient, but “considered as highly conservative in terms of preventing radiation exposure caused by food and securing human health,” especially when compared to the ICRP’s (1991b: 17)

³³¹ A book published by Mothers Revolution Network [*Okāsan Kakumei Nettowāku*] (2013) outlines the struggle of mothers who actively contested the application of the provisional food safety restrictions where the activity of radionuclides in a canister of nuclear waste was directly compared to the activity of radionuclides they were expected to consume and feed to their families. As mentioned, these comparisons were also made by many of my participants during interviews and focus group sessions.

³³² See Food Safety Commission (2011c) for the report in English, Food Safety Commission (2011b) for Japanese.

³³³ For example, the ICRP (1977; 1984b; 1984a; 1991a; 1991b; 1999; 2000; 2007), the US National Academy of Sciences (see Kahn & Kleinerg, 1977), the World Health Organization (1988), the International Atomic Energy Agency (1994; 1996), UNSCEAR (2011), Codex Alimentarius (1995), the US Food and Drug Administration (1988), among others.

³³⁴ This quote was taken from the English translation of the document. See Food Safety Commission (2011b) for the original Japanese version.

recommendation of 10 mSv/year for a single foodstuff (FSCJ, 2011c: 26).³³⁵ When it came to the 50 mSv/year equivalent dose to the thyroid, the report concluded that, at present, the level seemed “to be sufficiently safe for prevention of radiation exposure from food” (FSCJ, 2011c: 24).

At the same time, however, the report is adamant in specifying that these values are only suitable for *emergency situations* and should not be considered applicable in *normal circumstances*:

It should be clearly heeded that this *Emergency Report* is not appropriate as a basis for risk management measures under normal circumstances. All parties concerned are needed to lay out appropriate risk communication so as to prevent confusing emergency response with non-emergency response. (FSCJ, 2011c: 26, original emphasis)

Finally, acknowledging that the *Emergency Report* was hurriedly compiled, the Food Safety Commission (2011c: 28) recommended assessments continue, including a recommendation that the role of radioactive strontium as an internal emitter be investigated further.³³⁶

On April 4th, after discussions with both the Food Safety Commission and the Nuclear Safety Commission, the Ministry of Health—named the “risk manager” (FSCJ, 2011d)—decided to go along with the provisional reference limits. In order to keep the international community informed on the status of the safety of Japan’s food, Koizumi Naoko (2011a; 2011b; 2011c), then chairperson of the Food Safety Commission, wrote

³³⁵ I find it interesting that while the Food Safety Commission refers to its own 5 mSv/year effective dose limits as “conservative” as compared to the ICRP’s 10 mSv/year recommendation, they point out that they were not able to find evidence supporting the 10 mSv/year limit. The report notes: “ICRP is an international organization in the field of radiological protection, and its recommendations are considered as evidenced to certain degree, thus being a reference for risk management measures in emergency situations. Such evidences, however, could not be confirmed from the available materials” (FSCJ, 2011c: 26).

³³⁶ Strontium is a beta emitter and is, thus, difficult to measure as most devices for measuring radionuclides in food are only able to detect gamma emissions. As a result, strontium is often left out of measuring schemes as the pace of measurement does not keep up with the pace of the market. See Section 6.5 for more on the measurement of radionuclides.

a number of English-language letters directed at ‘those concerned overseas.’ In her first letter published on April 8th, Koizumi (2011a) represented the provisional food safety measures differently from the way they were presented in the *Emergency Report*, describing them as being “a bit too stringent,” and therefore “effective enough to ensure the safety of vegetable, seafood and other foodstuffs placed in domestic markets and exported abroad from Japan.” However, by leaving out the important point that these values are only intended for, and could only possibly be considered stringent in, emergency situations, Koizumi’s message seems to misrepresent the meaning and purpose of the provisional values—her confidence and enthusiasm erase the scientific uncertainty and philosophies imbued within the provisional reference limits. Actors within both domestic and global agrifood assemblages were expected to accept the values as ‘safe’ without receiving proper information on what they really represented—‘safe’ for the first year following a nuclear disaster.³³⁷

After issuing its *Emergency Report* on March 29th, the Food Safety Commission convened a working group to perform further science-based risk assessments and deliberate over the provisional reference limits. The working group met between April 21st and July 26th and released a draft report that was opened for public comment from July 29th to August 27th (FSCJ, 2011a). According to Koizumi’s (2011b) second English-language letter, the draft report included a literature review of over 3,300 sources. It also included a review of various radiation protection recommendations and insights from experts in toxicology³³⁸ and radiation protection,³³⁹ among others.

One major point made in the draft report was the potentially higher radio-sensitivity of children compared to adults when it comes to both thyroid cancer and leukemia. Another major point made in the draft report concerned the Food Safety Commission’s take on the ‘100 mSv threshold assumption.’ The point was clearly underscored in Koizumi’s (2011b) July 26th English-language correspondence in which she described the ‘100 mSv threshold assumption’ as a “conservative as well as rough value based on

³³⁷ See Chapter 6 for further discussion on Koizumi’s letters and the multiple enactments of ‘safe food’ following TEPCO’s nuclear disaster.

³³⁸ For example, the Agency for Toxic Substances and Disease Registry (ATSDR).

³³⁹ For example, the ICRP, UNSCEAR, the World Health Organization, and the International Atomic Energy Agency, among others.

major-scale epidemiological studies.” She goes on to illustrate how the draft report positions itself with other texts in the transnational nuclear assemblage, basing its evaluation on an assumption that a *cumulative effective dose*³⁴⁰ of more than “around 100 mSv” (not including NORMs) could potentially be detrimental to human health (Koizumi, 2011b: 2). At the same time, however, the draft report explicitly abandons the concept of a ‘threshold’ due to glaring uncertainty in the science. Koizumi (2011b: 2) summarizes: “100 mSv can not be threshold level, because threshold value is a level at which a substance starts causing toxicity, although it is nontoxic under that level.” While the Food Safety Commission says it has abandoned 100 mSv as an indicative threshold for the onset of deterministic effects, it continues to activate the value as a legal limit above which government intervention is not deemed necessary, but below which scientific uncertainty allows for fluid interpretation and application of reference limits.

Ultimately, in explaining the uncertainty in predicting health effects for exposures under 100 mSv, the Food Safety Commission recused itself from the responsibility of defining such risks. In other words, because of the inability to draw a clear line between ‘safe’ and ‘unsafe’ levels of exposures below 100 mSv, uncertainty about lower doses was compartmentalized from the discussion and erased from public processes as there was no ‘sound scientific evidence’ within the textual complex of the transnational nuclear assemblage to prove otherwise. Even after receiving 3,089 comments in the first public commenting period, mostly from people calling for stricter standards (see FSCJ, 2011e), the Food Safety Commission went along with its initial recommendations, presenting its final *Risk Assessment Report* to the Ministry of Health on October 27th.³⁴¹ In her letter describing the final assessment, Koizumi (2011c) makes sure to reemphasize that the Food Safety Commission does not view 100 mSv as a threshold above which exposures would necessarily damage health, and below which no damage would occur. Instead, both Koizumi’s letter and the report refer a quantity of “around 100 mSv” representing “the value which the risk management ministries

³⁴⁰ Cumulative effective dose is an estimated effective dose received over a person’s lifetime.

³⁴¹ See Food Safety Commission (2011g) for the full report in Japanese. See Food Safety Commission (2011f) for the report’s abstract in English.

have to consider for appropriate management” (FSCJ, 2011f; 2011g: 9 & 215; Koizumi, 2011c: 4).

Once receiving the final *Risk Assessment Report* from the Food Safety Commission (2011f; 2011g), the Ministry of Health sprang into action. In fact, just one day after receiving the report, Minister Komiyama Yoko from the Ministry of Health publicly announced that the government aimed to decrease the standards by April 2012 (see MHLW, 2011d)—a move which angered members of the Ministry of Education, Culture, Sports, Science and Technology’s (MEXT’s) Radiation Council (hereafter Radiation Council) who had yet to have their say in the setting of the proposed reference limits (see T. Higuchi, 2016). On the same day, the Ministry of Health consulted with the Pharmaceutical Affairs and Food Sanitation Council and its Food Sanitation Subcommittee to begin working out the new reference limits (MHLW, 2011a).

The Food Sanitation Subcommittee’s Radioactive Material Response Working Group (hereafter the Working Group) submitted its proposed ‘new reference limits’ on December 22nd, recommending a decrease in the *annual effective dose* of cesium-134 and cesium-137 in food from 5 mSv/year to 1 mSv/year (MHLW, 2011a). To ensure this effective dose, the proposed changes calculated 100 Bq/kg as the reference limit for cesium-134 and cesium-137 in ‘general foods.’ Baby food and milk would be reduced by half (to 50 Bq/kg), drinking water by one tenth (to 10 Bq/l). Iodine-131 would no longer be included in the standards due to its short half-life.

In setting these standards, the Working Group did not follow the ICRP-prescribed system of radiation protection. Instead, they adopted standards from a number of different international organizations, some active within the transnational nuclear assemblage. For example, the 10 Bq/l limit for water was adopted from the World Health Organization (2004), while the 1 mSv/year limit was borrowed directly from Codex Alimentarius (1995). According to the Codex (1995: 33) regulations, 1 mSv/year represents an “intervention exemption level” for international food trade—that is, the lowest recommended level for protection, below which regulatory intervention is not justified. By enforcing an intervention level of 1 mSv/year, Japan would be able to maintain its international trade relationships, making it possible to

legally challenge trading partners trying to restrict imports based on concerns about radiation within the framework of the World Trade Organization.³⁴² The standards would not only be useful as legal tools to reprimand ‘irrational’ trade partners (Kyodo News, 2016c), but also prevent Japanese citizens from requesting a lower intervention level. In the words of Higuchi (2016: 125), adopting standards based on 1 mSv/year “would not only reassure consumers with a stricter standard but also allow the government to balk at a demand for further reductions.” The 1 mSv/year limit seemed to be so conservative that any controversy that plagued the provisional standards would most certainly subside.

While the Ministry of Health was eager to enforce the proposed ‘new reference limits,’³⁴³ many people, including a number of radiation protection experts, did not share the same enthusiasm. The various numbers seemed to illuminate, or possibly provoke, deepening divisions between those wanting lower standards and those wanting more flexibility. When looking at responses from the second public comment period from January 6 to February 4, 2012, over seventy-five percent of the commenters (approximately 1,449 out of 1,877) demanded even stricter reference limits (MHLW, 2012a). On the other hand, experts within the Radiation Council, some of whom were members of the ICRP, felt that the new standards were unnecessarily stringent.

The Radiation Council, which was not consulted by the Ministry of Health until December 27, 2011 (MHLW, 2011c), held six meetings to discuss both technical and regulatory aspects of the proposed new standards. Many members of the Radiation Council objected to the more stringent standards and the fact that the 1 mSv annual effective dose (and subsequent reference limit of 100 Bq/kg for cesium-134 and cesium-137) had been brought to the mass media before the group had a chance to

³⁴² So far this strategy has proved to be useful in challenging trade restrictions for Japanese food in South Korea (Miles, 2015). In Taiwan, import restrictions have been challenged with accusations of the bans being ‘unscientific’ (Kyodo News, 2016b) or ‘irrational’ (Kyodo News, 2016c).

³⁴³ See Ministry of Health (2012b) for an overview (in English) of the ‘new standards’ effective on April 1, 2012. Though the standards were put into place on April 1st, exceptions were made for beef and rice (enforceable in October 2012), soy beans (enforceable in January 2013) and foods processed before April 1, 2012 (not enforceable).

deliberate the proposed numbers (see T. Higuchi, 2016). Under immense pressure to accept the 1 mSv limit, the Radiation Council tried to, at the very least, increase the reference limits for baby food and milk from the reduced 50 Bq/kg to 100 Bq/kg, but was ultimately unsuccessful in its attempts (Kimura, 2012: 16; Kojima, 2012). In the end, after much debate and some complaints that the proposed standards were “too strict,” the Radiation Council finally accepted the new standards following their final deliberative meeting on February 16, 2012 (Radiation Council, 2012b). The result of these new dose limits and their corresponding reference limits being institutionalized was that all ‘general food’ below 100 Bq/kg of cesium-134 and cesium-137 would legally be determined ‘safe’ (*anzen*) for human consumption. The ‘magic number’ would be used to coordinate activity within the agrifood assemblage beginning in April 2012.

5.6 Contested translations

In the end, it appeared that not only were the concerns of the public as well as politicians’ desires to stabilize the agrifood assemblage confusing the intended meaning of recommended radiation protection standards set by the ICRP, but there was a fundamental clash in the philosophies of Japanese governmental agencies and the ICRP regarding the process of ‘optimization.’ According to a memorandum on TEPCO’s nuclear disaster written by members of the ICRP:

The philosophy of the [Food Safety Commission] implies that the regulatory food limits even for radioactive materials should be decided independently of the exposure situation, since there is no difference in the criteria for protecting health effects between emergency and planned situations. [...] [T]he risk-based philosophy of radiological protection has not prevailed even in the academic field of chemical toxicity with non-radiation experts who seem unlikely to take a risk-informed approach. (González et al., 2013: 557)

As mentioned in Section 5.4.2, 1 mSv/year is recommended by the ICRP’s *Publication 103*, but represents an annual recommended dose to the public in ‘planned’ exposure situations and is not the recommended limit for ‘emergencies’—situations where dose limits are assumed ‘not controllable’ (ICRP, 2007). The ICRP members’ memorandum

goes on to describe this discrepancy and what they view as an inappropriate use of radiation protection standards, as 1 mSv should *not* be applicable in an emergency situation:

The current recommendations are to select a reference level between 100 and 20 mSv year⁻¹ for emergency exposure situations and between 20 and 1 mSv year⁻¹ for existing exposure situations. [...]
The public and others do not completely understand the reasons why different dose levels are recommended for different exposure situations, in large part because they believe, incorrectly, that a ‘safe’ dose is below 1 mSv year⁻¹, independent of the exposure situation. [...]
The use of crude numbers without the philosophy behind them unsurprisingly resulted in disastrous confusion. (González et al., 2013: 545-6, emphasis added)

This ‘confusion’ was also confounded by the mutable meaning of ‘safety’ used throughout the standard-setting process. Turning back to the experience of Chiho, people in Japan were being bombarded with news about ‘Becquerels’ and ‘safety’ following the disasters. That is, instead of being taught the philosophy behind the numerical values, the people of Japan were seeing numerical reference limits for cesium-134 and cesium-137—first 500 and then 100—and being told these were ‘safe (*anzen*).’ The use of the word ‘safe’ also distorts the expectation that, following a nuclear disaster, members of the public are expected to *accept*, without question, exposure to ionizing radiation that would not be considered acceptable under ‘normal’ circumstances. The authors of the memorandum explain their view:

After an accident occurs, people hold a natural but equivocal expectation of being better protected than before the accident. It is difficult for them to recognise that, because an accident has unfortunately occurred, they will obviously be subjected to higher risks. Whatever good the wishes of the authorities, better protection might simply be unfeasible: while in planned exposure situations authorities may be very conservative in their protection strategies, during the aftermath of an unplanned emergency they have to deal

with the situation as it is and apply the best protection they can under the prevailing circumstances. (González et al., 2013: 548)

This view, also explained in the ICRP *Publication 103*, not only reveals the strong influence of utilitarian philosophy in the ICRP's Recommendations for radiation protection, but how what may seem 'obvious' and 'acceptable' within the transnational nuclear assemblage may not be clearly translated or deemed acceptable to actors in the agrifood assemblage (see ICRP, 2007: 43). While the fluid use of numerical values and the relative meaning of the term 'safe' may be stabled and unquestioned within the textual complex of the transnational nuclear assemblage, once translated into Japan's agrifood assemblage these same numbers and terms lose their nuance. Thus, attempts to translate and activate them as pure immutable mobiles become distorted as each interaction reveals an oscillation between mutable and immutable, ghostly absence and seemingly pure presence, multiple and singular. The authority of these values remains contingent as they succumb to the ever-flowing 'logic of oscillation.'

5.7 Moving beyond numerical reference values

Just thirteen days after the first explosion at TEPCO's nuclear power plant, Professor Yamashita Shunichi from Nagasaki University stood before a crowd of people in Fukushima City, approximately 60 kilometers north-west of TEPCO's nuclear disaster. Yamashita had built his career through studying the *hibakusha* from Hiroshima and Nagasaki and people exposed to fallout from the Chernobyl nuclear disaster. His mother was said to have been a survivor of the Nagasaki bombings herself. These experiences earned him the respect of being considered one of the leading Japanese experts on the medical consequences of exposure to ionizing radiation. Standing before the crowd in Fukushima City, Yamashita (2011) argued for what he saw as bright opportunities that could arise from the onset of TEPCO's nuclear disaster:

From now on, the name Fukushima will be well known throughout the world. Fukushima, Fukushima, Fukushima, it's all Fukushima. This is amazing you know. Hiroshima and Nagasaki have already lost. The name Fukushima is already unparalleled globally in its reverberations. A crisis is a chance. A great chance. [...] How to make use of it. First revitalization [*fukkō*]. Offer your sincere

condolences to the people who died in the earthquake and tsunami, then at the same time that you respond to those people it is essential to quickly recover [*fukkō*] from the nuclear disaster.

After explaining the human body's ability to combat exposure to doses of radioactivity under 100 mSv (earning him the nickname Mr. 100 mSv), Yamashita (2011) went on to make what would become a widely known and circulated statement about the importance of smiling and general positivity in warding off the negative effects of exposure to ionizing radiation: "In reality, the effects of radiation will not come to those people who smile. They will come to those people who fret. We know this definitively based on animal experiments." Promptly receiving a position at Fukushima Medical University in 2011, Yamashita went on to lead the Fukushima Health Management Survey until he stepped down in March 2013. The survey was launched with three major objectives: to estimate radiation doses received by Fukushima's over 2 million residents, to conduct screening for thyroid cancer in children,³⁴⁴ and to study the effects of the disaster on the mental health of Fukushima's residents (see Brumfiel, 2013).³⁴⁵

During my fieldwork in 2016, I attended an event where a different story was being told about the science of radiation protection. At a gathering following one of the court cases where nuclear refugees faced off against TEPCO and the Japanese government, a journalist stood before the group to tell us about his recent meeting with second-generation *hibakusha* from Hiroshima and Nagasaki. "The *hibakusha* are mad," he said. He went on to explain that this anger comes from the fact that data extracted from their

³⁴⁴ There has been a proposal to drop the thyroid screening program, even though tests from October 2011 to 2016 "indicated 20-61-fold excess thyroid cancer cases" (Tsuda et al., 2017: 6).

³⁴⁵ Regardless of the vast uncertainty that exists in the science of radiation protection and the substantial advances—and subsequent ontological reframings—in the field of biology, the medical survey remains extremely narrow in its focus and curiosity about the possible negative effects of low-level exposure to TEPCO's radionuclides. The survey does not seem to engage with any of the newest research in the postmodern synthesis or the latest findings regarding exposures to low levels of ionizing radiation presented by Møller and Mousseau (2013b) discussed in Section 5.3. Instead of investigating heterogeneous, stochastic effects, 'mental health' plays a major role in this study, as following the Chernobyl disaster, where concerns about stochastic effects were discounted *a priori* as 'anxiety' or 'psychological distress' (see Section 5.3).

own bodies, and the bodies of their family members and friends, are currently being used prove it is ‘safe’ for children to live in areas where external exposure from cesium-134 and cesium-137 amount to as much as 20 mSv/year—a 20-fold increase from the usual 1 mSv/year limit for members of the public recommended by the ICRP.³⁴⁶ Though the suffering of the *hibakusha* of Hiroshima and Nagasaki and their descendants continues, these realities are not reflected in the radiation protection standards themselves. The concerns raised by *hibakusha* are a stark reminder to the many ghostly-hauntings that lurk in the shadows of seemingly stable standards for radiation protection that are enacted to coordinate a single, ‘correct’ way for human bodies to relate with unstable radionuclides. Such stories are a reminder that, regardless of the efforts involved in concealing these ghosts, the ‘logic of oscillation’ ensures complete control and smoothing over of heterogeneity and multiplicity is impossible.

Through traversing the vast textual and institutional complex of the transnational nuclear assemblage, I have attempted to tell a story of how radiation protection standards have emerged out of complex histories of overflow, containment, controversy and consensus—processes that contribute to the establishment of numerical standards, though are often invisible within numbers themselves. While numerical reference limits are not able to manage the activity of radionuclides, they are deployed in an attempt to guide actors in the agrifood assemblage on the ‘correct’ ways of both conceptualizing and relating to the imperceptible isotopes. Beginning in March 2011, numerical reference limits were deployed throughout Japan in an attempt to manage the activities of people producing, exchanging, buying and ingesting foods possibly containing radionuclides. My analysis has uncovered the ways in which assemblage thinking allows for attuning to and taking seriously the agency of these numbers and the ruling texts that contain them, as well as myriad other actors acting and being enacted within the agrifood assemblage—from spinach, to radios, cesium-137, texts, *hibakusha*,

³⁴⁶ The annual effective dose for external radiation for the Japanese public was raised to 20 mSv/year following the onset of TEPCO’s nuclear disaster. 20 mSv/year is usually the legally allowable limit of external exposure for radiation workers—for example, workers in nuclear power plants. As mentioned, it is also one of the ICRP’s recommended reference levels to be used during an emergency situation. See Higuchi (2016) and Hirano and colleagues (2016) for more on the increased standards for external exposure to radiation implemented following the onset of TEPCO’s nuclear disaster.

Geiger counters, hydrogen bombs, thyroids, nuclear power plants and tuna, among countless others.

I have also argued that numerical standards and reference limits both historically and currently play an important role in ruling relations, attempting to black-box the complexity, unevenness and ghostly presences folded into radiation protection science, translating messy and contentious histories and scientific uncertainty into uncontroversial ‘matters of fact’ which can be deployed as ‘immutable mobiles’ (or ruling texts) to coordinate the activities of actors situated across the vast agrifood assemblage. The mutable meaning of the word ‘safety’ derived from a stabilization of uncertainty regarding the effects of receiving doses of ionizing radiation lower than 100 mSv is a tool for smoothing over difference and paving the way for further progress and advancement of institutions and industries within the transnational nuclear assemblage. The expansive effort to deploy this ‘single reality’ has assisted in the proliferation of nuclear technologies. It has been the vigilant propagation of this single reality that has transformed ‘lethal atoms’ into ‘friendly atoms,’ ‘peaceful atoms,’ ‘safe atoms,’ ‘green atoms’ and even ‘edible atoms.’ However, inherent inconsistencies in the numbers mean that stabilization of the agrifood assemblage and enacting food as ‘safe’ requires much more effort than simply drawing up and attempting to coordinate activity using numerical reference limits. Exactly what is involved in enacting the object of ‘safe food’ will be explored in the following chapter.

6 ‘Safe food’ multiple

6.1 Introduction

Kahoru, whose story I shared in Chapter 1, was planning to participate in an event about TEPCO’s nuclear disaster in the Kansai region in late 2011. Prior to the event, she received an email from the organizers which left her in an unexpected state of *konran* and discomfort. She shares her experiences:

They said that at the venue they would be distributing apples grown by farmers in Fukushima that were tested. Well, they just all of a sudden said they would have them. In any event, I was surprised. If they want to do it at this kind of gathering, they need to accurately tell us the minimum detection limit [kenshutsu kagenchi]. Even more than telling us clearly how many Becquerels was in it, or if [radiation] was not detectable. Well, I thought they have to accurately share their awareness about internal radiation, and should show the kind of data [they have] along with distributing [the apples]. I said something like that. And then the organizer was surprised. What’s more, the thing I wrote [about my concerns], she forwarded it just like that directly to the farmer. The farmer said to the anti-nuclear activists: “We face so many hardships. We try so hard and sweat blood to raise those apples, you know? Just like that harmful rumors [fūhyōhigai] spread about and we aren’t able to distribute [the apples] anymore.” Then, from the side of the organizer, they didn’t know what to do, they said the distribution [of apples] was cancelled. That’s the way it was all determined. In the end, it was me and the farmer who were divided [against each other]. [...] In any event, it was a terrible mess [konran], you know? It was standard, common practice to share data on the minimum detection limit [kenshutsu kagenchi]. But at that time, that didn’t seem to be understood.

As Kahoru’s experience illustrates, the term *fūhyōhigai*, which literally translates to ‘harm caused by rumors,’ has been playing a particular role in discussions about radionuclides in post-2011 Japan, particularly in discouraging people from discussing

concerns about radiation and food.³⁴⁷ And it was not only Kahoru who found herself in messy situations upon trying to discuss food and radiation following TEPCO's nuclear disaster. The term was well known by all of my participants, many of whom kept quiet about their concerns regarding radiation and food to avoid such conflicts as Kahoru experienced.

Yoshikawa Aimi (pseudonym), a mother of two who had been living in Kansai at the time of TEPCO's nuclear disaster, described her experiences in discussing her concerns related to radiation in food—or more precisely, her experiences in hiding her concerns about food and radiation:

I've basically become really skilled at avoiding [conversations about food and radiation], but even that, you know. How to say? Not to stand out. People who don't know continue not knowing. Even though it's not a conflict. [...] Even though is much more comfortable for oneself to avoid [talking about the issues]. If no one earnestly faces it or says their ideas, nothing will change.

Nakajima Katsunori (pseudonym), was living in Ibaraki Prefecture both during the JCO nuclear criticality disaster in Tokai-mura, Ibaraki Prefecture in 1999 and TEPCO's nuclear disaster in 2011. He relocated to the Kansai region due to his concerns about radiation and was particularly concerned about radiation and food. He shared some of the responses he receives when trying to discuss his concerns with others:

They say "Aren't you caring too much? If you complain so much, you'll have nothing to eat!"

It turned out that Katsunori was already accustomed to hearing the term *fūhyōhigai* living in Ibaraki following the onset of the JCO nuclear criticality disaster. He reflected on the term and its use following both of the nuclear disasters during our interview:

But even now that kind of word is being used, fūhyōhigai. It was like, "things grown in Ibaraki are dangerous so don't buy them." Dried

³⁴⁷ See Kimura (2016a) for a discussion on *fūhyōhigai* as a tool for food policing, especially of and among women. See Yamaguchi (2016) for a discussion on the role of the term in post-2011 social control. The term will also be discussed further throughout this chapter.

sweet potato, dehydrated sweet potatoes are a local specialty of that area. It was like, “It is best not to buy them.” [...] But now comparing to the problems in Fukushima, it seems to have clearly been fūhyōhigai. But, well, you really can’t say “rumor [fūhyō],” can you? Because, in actuality, it is not clear whether it is safe or not. That’s the problem with radiation.

Another participant, Yanagi Nanami (pseudonym), a mother of a nine-year-old who had been living in the Kansai region since before 2011, describes her understanding of the term *fūhyōhigai*.

The word fūhyōhigai works very effectively, doesn’t it? I personally think so. But, I don’t really know, but if you talk about radiation, it’s an image as if you are being heartless toward people in Fukushima Prefecture. That’s the side being circulated. I don’t really understand. I don’t really understand, but for some reason it seems like I care too much.

While numerous farmers living within 260 kilometers, or more, of TEPCO’s nuclear disaster have been forced to relate with TEPCO’s radionuclides in their everyday farming practices (see Figure 1), farmers in Fukushima Prefecture have faced great hardship because their produce gets labeled with the name of the prefecture which, unluckily, shares the same name as TEPCO’s damaged nuclear power plant. Thus, while the hardship of farmers is undeniable, the deployment of terms such as *fūhyōhigai*, along with the plotting of consumers against producers in ruling texts and discourses remains questionable, especially as these terms are activated in everyday discussions, further pluralizing people based on the ‘perspective’ each person activates.

For all of my participants, merely discussing the issue of food and radiation following TEPCO’s nuclear disaster has been a challenge, plotting people with different ‘perspectives’ against each other and causing disorder in how they enact their everyday relations with other people. Supermarket food labels in Japan are not legally required to provide information on radiation measurements, though labels on fresh foods—fruits, vegetables, seafood, meat and rice—are required by law to indicate the food’s prefecture or country of origin (see MAFF, 2009). For all of my participants, these

labels of origin became one of the only pieces of information available to them as they attempted to decipher between foods that may contain TEPCO's radionuclides and those that may not.³⁴⁸ However, not agreeing with the 100 Bq/kg reference limit and, instead, choosing food based on prefecture of origin would label you as a propagator of 'harmful rumors [*fūhyōhigai*].' What is a person concerned about consuming radionuclides to do? It is from within the troubling experiences of my participants, all of whom would be categorized as propagators of *fūhyōhigai* based on their shopping practices, that I identify another string to lead me into the institutional complex of Japan's post-2011 ruling relations. This chapter represents my attempt to explicate how people's experiences of *konran* related to everyday eating emerged from inconsistencies that surface when textually-mediated ruling relations pushing to coordinate singularity interact within tangles of myriad other humans and more-than-humans acting and being enacted within Japan's agrifood assemblage.

As explored in Chapter 5, in Japan first the 'provisional' and then the 'new' numerical reference limits for radionuclides in food and drink (hereafter food) were deployed as 'immutable mobiles' in an attempt to coordinate heterogeneous actors in the agrifood assemblage based on a 'single reality' born out of the transnational nuclear assemblage. Through this single-reality-based coordination effort, agrifood assemblage actors are expected to participate in enacting, purchasing and ingesting what appears to be a single object: 'safe food.' In this chapter I will explore the various techniques used in these coordination efforts which work to stabilize the messiness and multiplicity exposed by the overflow of unstable and imperceptible radionuclides into the agrifood assemblage. Specifically, I will explore the multiplicity of the seemingly single object of government certified 'safe food,' while also attuning to how the seemingly single object participates in coordinating activities based on a single reality regarding anthropogenic radionuclides, bodies and food where 'perspectivalism' seems to be the only option for dissent and debate.³⁴⁹

³⁴⁸ People would need to use information they had about areas possibly contaminated with TEPCO's radionuclides—for example by studying radiation contour maps like the one made by Professor Hayakawa (see Figure 1).

³⁴⁹ See Section 3.3.1.4.

In this chapter I argue that Japan's standards for radionuclides in food—born out of the transnational nuclear assemblage and tinkered with by actors within Japan's agrifood assemblage—present a single way of understanding and enacting one's relations with unstable anthropogenic radionuclides. In this way, the single reality may be debated by multiple, pluralized perspectives—as in the case of Kahoru being plotted against the farmer regarding her questions about apples tested for radiation—but the reality itself and its ontological grounding remain intangible and unmovable. How to break out of perspectival debates? Both institutional ethnography and material-semiotic sensibilities offer a very different opportunity for grappling with single-object-single-reality structurations. As Mol (2002: 6, original emphasis) eloquently explains: “*ontology* is not given in the order of things, [...] instead, *ontologies* are brought into being, sustained, or allowed to wither away in common, day-to-day, sociomaterial practices.” Thus, one opportunity for breaking free from the confines of perspectivalism is through focusing on practices and enactments, taking seriously heterogeneity, multiplicity, and all of their political and ethical implications.

In the spirit of both institutional ethnography and material semiotics, in this chapter I engage in ontological politics in an attempt to both elucidate and interfere with the established system of perspectivalism which structures most discussions regarding human exposure to anthropogenic radionuclides in post 2011-Japan. Throughout the chapter, I borrow sensibilities from institutional ethnography, where I again enter the institutional textual complex of Japan's post-nuclear disaster food safety regulations, this time exploring the prescribed practice for enacting different versions of government certified ‘safe foods’ that, in line with Japan's Food Sanitation Act (Government of Japan, 2007b), are legally permitted to circulate in Japan's agrifood assemblage and fill supermarket shelves visited by my participants. Guided by material-semiotic sensibilities, I direct my focus away from epistemological knowledge debates about ‘radiation and food safety,’³⁵⁰ to the processes that enact the object of ‘safe food.’ In doing so, ‘safe food’ is exposed as being multiple,³⁵¹ not a black-boxed

³⁵⁰ Some very intriguing insights into these epistemological debates have been made by Yamaguchi (2016), Reiher (2016), Kimura (2016a) and Morris-Suzuki (2014). Kimura and Katano (2014: 109) also discuss various perspectival “schisms” between farmers and consumers, as well as among family members following TEPCO's nuclear disaster.

³⁵¹ As mentioned, in her study of the disease termed ‘atherosclerosis,’ Mol (2002) turns away from epistemological debates in medicine, to an empirical focus on the multiple enactments of

‘matter of fact,’ but heterogeneous sociomaterial entanglements, or ‘matter of concern’ (Latour, 2005). In noticing these heterogeneous sociomaterial assemblages—or ‘matters of concern’—a further step can be made to attend to the *care* involved in living within these entanglements, thus exposing them as “matters of care” (de la Bellacasa, 2011). Thus, instead of participating in epistemological and perspectival debates about how to understand ‘food safety,’ I follow Mol (2002) and other scholars in the field of material semiotics to explore how multiple ‘versions’ of government certified ‘safe food’ are enacted through situated, entangled processes of relational materiality.³⁵² In exploring multiplicity, I also follow Mol (2013) in playing with “ontonorms,” borrowing the concept as a methodological tool for detecting the normativities that participate in not only enacting government certified ‘safe food,’ but also the bodies of people who are intended to purchase and ingest them.³⁵³

Drawing on government texts, media articles and the experiences of my study’s participants, in the following sections I will explore the enactment of government certified ‘safe food’ as it is prescribed within government texts and discourses, as well as its role in attempting to coordinate the everyday eating of my participants. At the same time, I will use media articles to untangle some of the ways in which these prescribed procedures are enacted by actors within the agrifood assemblage, each acting within their own specific sociomaterial entanglements. Beginning with discourse and working my way down through metrics, to everyday ‘tinkerings’³⁵⁴ with radiation measurement devices, I explore how Japan’s food screening system, that was put in place to enact the single object of ‘safe food,’ actually enacts multiple versions of ‘safe food’ which are sometimes put in tension with each other.

the disease itself, including an exploration of how these multiple enactments interact and clash with each other in practice. That is, while in many cases multiple enactments may precariously ‘hang together’ and appear to be stable and singular, new enactments can exacerbate tension and lead to ‘interference’ (Mol, 2002: 121).

³⁵² I borrow the term ‘versions’ from Mol (2012: 120-1) to refer to multiplicity of seemingly singular objects. See Section 2.6.4.

³⁵³ See Section 2.6.6.

³⁵⁴ Again, I borrow the term ‘tinkering’ and corresponding insights about ‘care’ from Mol (2008b; 2010b) and Mol and colleagues (2010a).

6.2 Enacting ‘safe food’ through discourse: Setting the stage for perspectivalism and providing a language for discussing ‘safe food’ as a single object

As explored in Chapter 5, reference limits for radionuclides in food translate ‘mutable’ recommendations curated by institutions within the transitional nuclear assemblage into ‘immutable mobiles’ used to enact government certified ‘safe food’—food that is legally permitted to circulate within the agrifood assemblage. However, the reference limits themselves tell us little about the true status regarding the ‘safety’ of food in circulation. That is, for the activity of radionuclides to be perceptible, foods must be measured using highly sensitive (and highly expensive) technological devices. Thus, producing ‘safe food’ requires that these numbers be ‘activated’³⁵⁵ in situated practice. As discussed in Section 5.5, the ‘provisional reference limits’ for radionuclides in food were established on March 17, 2011, five days after the first explosion at TEPCO’s nuclear power plant. The reference limits played two major roles in enacting food as ‘safe’: First, they set legally binding limits for food safety in accordance with the Food Sanitation Act; Second, they set out prescribed practices for inspecting foods possibly containing TEPCO’s radionuclides.³⁵⁶

According Article 1 of the Food Sanitation Act, in the case of “sanitation hazards” it is the role of the government “to ensure food safety and thereby to protect citizens' good health” (Government of Japan, 2007b: 1-2).³⁵⁷ Article 6 goes on to explain how the government must ensure that foods posing any risk to human health “shall not be sold” or circulated within the agrifood assemblage until they are proven to “involve no risk to human health.” In 2011, TEPCO’s radionuclides were classified as a ‘sanitation hazard’ which, according to Article 6 (ii) of the Food Sanitation Act, needed to be prevented from entering the agrifood assemblage. Article 6 (ii) describes such ‘sanitation hazards’:

Articles which contain or are covered with toxic or harmful substances or are suspected to contain or be covered with such substances; provided, however, that this shall not apply to cases where the Minister of Health, Labour and Welfare specifies that such

³⁵⁵ See Smith (1999: 148-51), Campbell (2003: 15), DeVault (2002: 765) and Section 3.3.1.2.

³⁵⁶ See Government of Japan (2007b) and Ministry of Health (2011g; 2011f).

³⁵⁷ Also see Ministry of Health (2011g: 1).

articles involve no risk to human health. (Government of Japan, 2007b: 4; MHLW, 2011g: 1)

This legal framework for defining ‘safe food’ reveals many important aspects regarding the object’s enactment, at least within Japanese government texts. For one thing, according to Article 5, the objects of focus in Article 6 are “[f]ood or additives which are provided for sales” (Government of Japan, 2007b: 4). Thus ‘safe food’ is a commodity, but not just any commodity—it is a commodity that has been recognized to “involve no risk to human health” by the Minister of Health (Government of Japan, 2007b: 4; MHLW, 2011g: 1). Thus, according to legal texts, ‘safe food’ is an object that has been legally established by the Minister of Health to cause ‘no risk’ to human bodies that purchase and ingest it. The enactment of ‘safe food’ within the legal system already clashes here with its enactment within the transnational nuclear assemblage, which claims that there is no ‘safe’ dose of exposure to radiation based on the linear-non-threshold model it adopts (see Section 5.4.1). And what about the bodies of the people intended to ingest legally certified ‘safe food’? They are not only ‘citizens’ who should be kept in ‘good health,’ but ‘consumers’ of the food being circulated in the agrifood assemblage.

By March 2011, however, it was no longer the sole responsibility of the Minister of Health to define these ‘risks to human health.’ Since the introduction of Basic Law in 2003 (Government of Japan, 2006), it had become the responsibility of the Food Safety Commission to perform as “risk assessor” to assist the Ministry of Health which, along with the Ministry of Agriculture Forestry and Fisheries (MAFF, hereafter Ministry of Agriculture) and the Consumer Affairs Agency (CAA), must fulfill its legal obligations as “risk manager” (FSCJ, 2011d; T. Yamaguchi, 2016: 70). With the outbreak of BSE in 2001 leading to a severe questioning of the abilities of the Ministry of Health to maintain the safety of food, ‘Science’ has been employed as the major tenet and technique to guide the Food Safety Commission’s risk assessments, which strive to enact food as being both *anzen* (safe in a technical, objective sense) and *anshin* (safe in a psychological, subjective sense) (see Tanaka, 2008; T. Yamaguchi, 2014). Thus, ‘safe food’ following the 2011 nuclear disaster would need to be proven to be *anzen* while also instilling a feeling of *anshin* in the consumer bodies who would be buying and ingesting this matter. But what if bodies do not feel *anshin* when it comes to ingesting

TEPCO's radionuclides? As the Food Sanitation Act (2007b: Article 2(1)) explains, the government will disseminate to these bodies "correct knowledge concerning food sanitation through educational activities and PR activities." Thus, while the Basic Law (Government of Japan, 2006: 3) discusses how proving food is *anzen* involves conducting "objective, neutral and fair" risk assessments based on what is considered to be "state-of-the-art scientific knowledge of the time," the feeling of *anshin* is expected to be achieved through risk communication of this 'state-of-the-art scientific knowledge.'³⁵⁸

Within its March 29, 2011 *Emergency Report* to the Ministry of Health, the Food Safety Commission (2011c: 26) confirmed the appropriateness of the effective (whole body) dose of 5 mSv/year for cesium-134 and cesium-137, an equivalent dose of 50 mSv/year to the thyroid for iodine-131, and the subsequent reference limits chosen to represent activities of these radionuclides that could adequately ensure these doses. These legally binding 'provisional reference limits' were the numbers deployed in public discourse to enact 'safe food,' and as intervention levels to coordinate the enactment and circulation of 'safe food' in the agrifood assemblage.³⁵⁹ As mentioned in Section 5.5, setting the 'provisional reference limits,' the Food Safety Commission (2011c) emphasized the need for risk communication to relay the distinction that these numbers are considered 'safe,' *but only in emergency situations*. The report reads:

It should be clearly heeded that this emergency report is not appropriate as a basis for risk management measures under normal circumstances. All parties concerned are needed to lay out appropriate risk communication so as to prevent confusing emergency response with non-emergency response. (FSCJ, 2011c: 26)

³⁵⁸ In practice, in the Food Safety Commission's (2011c) first assessment of the 'provisional reference limits' published in the *Emergency Report* on March 29, 2011, 'state-of-the-art scientific knowledge' used to review the 'provisional standards' was not so 'state-of-the-art.' In fact, some of the reports were so dated that they are now stamped with the message "no longer valid" (for example, IAEA, 1994; 1996).

³⁵⁹ Again, for cesium-134 and cesium-137 the 'provisional reference limits' were 200 Bq/l for drinking water and milk, and 500 Bq/kg for other foods; for iodine-131 they were 300 Bq/l for drinking water and milk (100 Bq/l for milk used in infant formula), and 2,000 Bq/kg for vegetables and (eventually) fishery products. See Ministry of Health (MHLW, 2011b; 2011g).

Here, the enactment of ‘safe food’ becomes more nuanced in its materiality, but not in its representation. In other words, while foods containing activity concentrations of radionuclides below the ‘provisional reference limits’ are referred to as ‘safe,’ legally the values representing the foods’ ‘safety’ are only applicable to situations categorized as ‘emergencies.’ Regardless of the appeal by the Food Safety Commission, in most risk communication materials this distinction between ‘safe food’ in *emergency* and *normal* situations was not made. Even in risk communication coming directly from the Food Safety Commission itself. For example, as mentioned in Section 5.5, in her English-language correspondence regarding the *Emergency Report*, the then chairperson of the Food Safety Commission, Naoko Koizumi (2011a), mentioned the ‘provisional reference limits,’ but did not clearly describe the differences between ‘safe food’ in *emergency* and *normal* situations. The food was safe. Period.

Koizumi’s correspondence also highlights a number of ontionorms participating in the enactment of ‘safe food’ and the bodies intended to purchase and ingest these foods according to the Food Safety Commission and their risk assessment framework. Having first framed the work of the Food Safety Commission as being in line with the Basic Law—as an institution that uses “science-based risk assessments in an objective, neutral and unbiased manner”—Koizumi (2011a) ends her one-page letter by describing the behaviors expected of consumers in the agrifood assemblage concerning the ‘safe food’ being enacted following TEPCO’s nuclear disaster. She writes:

The warm support of Japan does involve your calm and rational behavior unaffected by groundless rumors, which will be definitely encouraging the people of Japan who are putting every effort into its rehabilitation. I deeply appreciate your course of action based on unbiased scientific data on foods imported to your country from Japan. (Koizumi, 2011a)

What does this statement say about the ontionorms participating in the enactment of ‘safe food’ or the bodies of those people who are intended to purchase and ingest it? First, Koizumi follows previously-mentioned logics, enacting ‘safe food’ as a commodity. However, her description goes a step further, enacting ‘safe food’ as an object connected to the rehabilitation of the suffering people of north-eastern Japan. This, in turn, enacts two categories of bodies: those that are supporting the recovery of

the country, and those that are sabotaging it. The ‘Eat to Support’³⁶⁰ “catchphrase”³⁶¹ and campaign launched soon after TEPCO’s nuclear disaster further elucidates these ontornorms.

The campaign produced a number of commercials³⁶² and advertisements featuring the popular all-male musical group TOKIO, a move which was surely designed to attract a large number of female fans to the cause (see Kimura, 2016a: 7). Within these commercials and ads, TOKIO members would savor and describe the deep flavors of food from the Tōhoku region—with particular focus on foods from Fukushima Prefecture—and would meet with farmers to show the faces of some of those bodies whose efforts to produce and sell ‘safe food’ could be either supported or sabotaged by consumers. By the time of my fieldwork in 2016, an additional ‘catchphrase’ linked to the ‘Eat to Support’ campaign and featuring the band TOKIO had also emerged, that of ‘Fukushima Pride.’³⁶³ The commercials and advertisements using this new catchphrase adds a further dimension to the support-sabotage binary: sabotage not only involves preventing producers from performing their livelihoods, but rejecting their sincere offering of food, callously wounding their pride.

Onishi Hisako, a mother of two who was living in the Kansai region since before TEPCO’s nuclear disaster, describes how ‘Eat to Support’ campaigns showed up in a ‘reconstruction/revitalization [*fukkō*] corner’ at her local supermarket.

³⁶⁰ The campaign has been translated into English as both ‘Eat to Support’ and ‘Eat and Support’ (see Kimura, 2017: 462, n65). I prefer the ‘Eat to Support’ translation as I feel it better captures the message of the campaign. See Minister of Agriculture and Minister of State of Consumer Affairs (2011) for one of the first messages encouraging subscription to the campaign (in Japanese). Also see Ministry of Agriculture (2015) for a brief overview of the campaign (in Japanese).

³⁶¹ The slogan is referred to as a “catchphrase” by the Ministry of Agriculture (2015).

³⁶² Kimura (2016a: 7; 2017: 462-3) provides an illustrative description of an early ‘Eat to Support’ commercial in 2011 featuring TOKIO. The commercial was produced through a collaboration between the Ministry of Agriculture and the group Food Action Japan (Food Action Nippon). While the original commercial is no longer available on Food Action Japan’s website, it can still be found on Dailymotion and other video streaming sites. The Food Action Japan site provides a link to the group’s current YouTube channel See http://syokuryo.jp/tabete_ouen/.

³⁶³ The new campaign is being implemented by Fukushima Prefecture. A gallery of commercials produced for the new campaign can be found on the campaign’s website: <http://fukushima-pride.com>.

There was a reconstruction/revitalization [fukkō] corner at the supermarket, [...] eat to support [tabete ōen] and whatnot. There was a period of time that it was there. [...] There were also many Tōhoku fairs. At those events they went through all the trouble to bring food from the Tōhoku region. It was like “people are suffering so we have to buy to support.” There was a period where it was prevalent. In any case, it was after the disaster.

Miki, whose experience in contacting the Board of Education regarding school lunch was shared in Chapter 5, described how ‘fūhyōhigai’ and ‘tabete ōen’ entered her lexicon through friends and television commercials.

Miki: There were mothers [in the group] who did not care about radiation. Nevertheless, I thought it was a danger. I was wondering how the people around me were being careful. I thought it was good to care about it. But it was only me, well, [it was only me] talking about it. I was the only one to mention of it. In the [local women’s group I’m in], in the locally-circulated newspaper they often have a small flier inside of it that they ask people to write. I had written it many times. I made a questionnaire about what kind of things people were being careful about at home and I asked some people close to me to answer. Even people without awareness [about food and radiation issues] were somewhat choosing [food] by place of origin. Then I heard that on the news at that time fūhyōhigai was being used to explain [why food] could not sell. We don’t have a TV at my house. Because we don’t have a TV, we didn’t really hear what was being said. But, as expected, when we went back to my husband’s family’s home, the TV was on all the time. And on commercials and what not they were really saying “eat to support [tabete ōen].”

Karly: Was it TOKIO?

Miki: Yes, yes. It was so surprising this was going on! I thought these things were going on, but it was more incessant than I could have imagined. “Let’s eat to support” and calling people to sightsee. I felt those kinds of things were quite overtly being dispatched one after

another. And fūhyōhigai. From my perspective, radiation was being detected, so even though there is real harm [jitsugai], the fact that there is real harm. It is wrong that it completely becomes fūhyōhigai. It's, how to say, I feel like for people who do not think or inquire much, they will end up believing that it is really fūhyōhigai that has occurred. In any event, I believe there is really harm. As someone without a TV, I don't always hear "it's okay, it's okay." But people like my friends, [...] seeing those commercials, I feel that they start to believe "it's okay to eat, we have to eat to support." It's really frightening.

Another participant, Oikawa Mari, who was also living in the Kansai region since before TEPCO's nuclear disaster and who had two small children at the time of Chernobyl's nuclear disaster, expressed the questions that arose when she encountered 'tabete ōen' at the supermarket near her house:

They say "support reconstruction/revitalization [fukkō]" right? But are they really measuring it properly? It seems like they are only saying that things produced in Fukushima are under the limit. Especially fish. Boiled fish-paste products, processed seafood products. If it's like, "It's to support reconstruction/revitalization [fukkō], but radiation is not detected!" If that were the case, I could feel at ease [anshin].

Like many of my participants, Mari did not agree with the government's 100 Bq/kg reference limit and wanted to eat foods that contained levels of radiation as close to 1 Becquerel as possible.

Thinking back to Miki's experience about asking her child's school to reduce its safety standard (Section 5.1), the desire to eat food measuring less than established reference limits may be labeled by others as being 'scientifically baseless.' I turn back to Koizumi's (2011a) letter to explore how conceptualizations of what is considered 'scientific' and 'unscientific' was enacted in ruling discourses shortly following the onset of TEPCO's nuclear disaster.

Koizumi's (2011a) multiple mentions of 'unbiased science' highlight the ontonorms active in official enactments of 'safe food' and bodies that intend to ingest it. When it comes to 'safe food,' the concept of 'objective,' 'neutral,' and 'unbiased' science enacts food as *anzen* in discourse, though the precise scientific techniques behind this enactment remain ambiguous and unexplored. According to Koizumi (2011a: 1), recognizing the 'safety' (*anzen-sei*) of these foods requires bodies that are 'rational' and 'calm;' bodies that will continue purchasing government certified 'safe food' because they accept the Science that enacts these objects. With one of the first attempts at risk communication seen in Koizumi's letter, we already see a structuration of perspectivalism setting in—the 'correct' way of understanding and enacting the relationship between bodies and radionuclides is established as a Scientifically-derived 'single reality' upon which all human actors must gaze and use as a basis when deliberating and debating radionuclides, food and bodies.

Koizumi's (2011a) call for 'calm' bodies relates to the feeling of *anshin*—'rational' bodies who accept the 'safe food' described by the Food Safety Commission will feel at ease about purchasing and eating these government certified objects. Thus, good bodies must feel *anshin*; they look at the 'objective' and 'neutral' scientific claims of the Food Safety Commission and other government bodies and accept it as the single, 'correct' way of understanding the complex relations among radionuclides, food and bodies. Concurrently, if 'rational' and 'calm' bodies who continue to purchase government certified 'safe food' are enacted as good, then any body that does not want to purchase these foods gets immediately categorized away as 'irrational' or 'uneasy.'³⁶⁴ The ontonorms embedded in performances of 'safe food' help to deal with these 'unscientific' bodies by categorizing them away as 'irrational' bodies that require scientific knowledge to cure them from the uneasiness they experience. Thus, any uneasiness these bodies feel would be due to their own irrationality and inability to accept or understand the 'unbiased' and 'neutral' Science being presented to them. In the way that the International Atomic Energy Agency-sponsored Chernobyl Forum (2006: 36) categorizes all claims of radiation-induced health effects that models and calculations within the transnational nuclear assemblage are unable to recognize as

³⁶⁴ Interestingly, the necessity of scientific knowledge as the basis of 'rational' decision-making regarding radiation seems to imply that bodies without the input of scientific knowledge would be repulsed by the idea of eating anthropogenic radionuclides.

caused by “psychological distress” or “anxiety,” in Japan the word *fuan* has been widely used to describe bodies that do not fit into the categories of ‘rational’ and ‘calm.’³⁶⁵ Here we see how the structuration of perspectivalism does not only depend on the enactment of the seemingly single, stable object of ‘safe food,’ but the enactment of a number of terms for discussing the ‘single reality’ among various, pluralized, perspectives.

There are interesting similarities among the *kanji* characters for *anzen*, *anshin* and *fuan* which deserve some attention.³⁶⁶ All three are compound words containing the character *an* (安) which can be translated as ‘peaceful.’ *Anzen* combines *an* (安) with *zen* (全)—meaning ‘whole.’ This description is interesting when thinking of ‘safe food’ as being enacted through scientific risk assessments which attempt to present the unstable relations among food, bodies and radionuclides as knowable, a ‘peaceful whole.’ This translation seems to fit well with the ambitions of reductionist scientific techniques: using sound, ‘unbiased’ techniques and ‘objective’ scientific practices to reduce reality into easily manageable units which can be used to enact a clear picture of that reality. Through these reductions, objects and phenomena emerge and appear to be understandable, whole. And if some pieces remain uncertain—as in the case of the stochastic effects of exposure to low-doses of ionizing radiation—risk assessments based on consensus about this uncertainty can stabilize predictions about the emergence of future happenings.³⁶⁷ Thus, what seemed to be unmanageable and uncertain—such as stochastic effects to ionizing radiation below a cumulative effective dose of ‘around 100 mSv’—becomes whole and knowable again. There is control. There is stability. There is peace of mind. Questions about which reductions are made and through which techniques and sociomaterial entanglements are pushed to the side and ‘Science’—in all its reverence—gets placed at the center: the best and only way to stabilize the messiness and heterogeneity of the world. While different scientific practices produce pictures of reality that are necessarily ‘partial,’³⁶⁸ they can be enacted as singular and ‘whole’ with the help of perspectivalism.

³⁶⁵ Also see Section 5.3.

³⁶⁶ Yamaguchi (2014) and Sternsdorff-Cisterna (2015) also provides many interesting insights into these terms and their uses.

³⁶⁷ See Section 5.4.

³⁶⁸ See Section 2.6.5 for Haraway’s (1991c) discussions on ‘partial perspectives.’

Sternsdorff-Cisterna (2015: 458, original emphasis) provides another interesting description of the term *anzen* and its role in enacting perspectivalism: “While there can be arguments about how food safety is measured and degrees of acceptable risk, *anzen* speaks to a system based on rationality and consistency in its standards.” Thus, ‘rational’ and ‘objective’ science sets up consistent logics and forms of enacting reality in a way that provides a full, ‘whole’ picture of it. While this picture can be debated, the reverence given to Science as a ‘neutral’ and ‘unbiased’ institution, positions ‘Science’ as providing a single, reliable picture for knowing, especially in the case of very complex, messy subjects—such as the study of invisible radionuclides and their intra-actions with active human bodies. The possible limits of the reductions being made by particular scientific techniques—in this case, science born out of the transnational nuclear assemblage and all of his uneven, ghostly hauntings (Chapter 5)—as well as the ethical and political implications of valuing one reality over others, become muddled by the enactment of Science as reverent and ‘neutral.’

Correspondingly, *anshin* combines the character of *an* (安) with *shin* (心)—heart or mind—to create a word which can translate to ‘peace of mind,’ ‘freedom from anxiety’ or ‘freedom from care.’ In the logic of the Food Safety Commission, the ‘rational’ body that accepts the ‘single reality’—represented as *anzen*—must also be a ‘calm’ body experiencing *anshin*. I find the third definition particularly interesting when thinking about stories of singularity and control versus stories of multiplicity, ‘tinkering’ and care. Following the ‘single reality’ and entering a state of ‘ease’ thus requires bodies to relinquish care, leaving the enactment of ‘safe food’ to the authorities alone. Inversely, *yōjin*, one of the Japanese words for ‘care’ or ‘carefulness,’ combines the characters of ‘use’ or ‘errand’ (用) and ‘heart’ or ‘mind’ (心), creating an image of care which involves a vigilant, as opposed to a ‘calm’ or ‘peaceful,’ heart and mind.

If a ‘rational’ and ‘calm’ body is one that relinquishes care, then a body carefully tinkering within its own sociomaterial entanglements—treating them as ‘matters of care’—would succumb to a different valuation. Going back to Koizumi’s (2011a) first English-language letter, instead of being categorized as feeling *anshin*, people who do not follow the single reality being presented by the Food Safety Commission are categorized as having adverse characteristics: they are anxious, uneasy, experiencing a

feeling of *fuan*. Literally translated as ‘not’ (不) ‘peaceful’ (安), the word *fuan* serves as a description of the psychological state of those bodies who are categorized as ‘irrational’ or ‘uneasy.’ While the word is used to refer to bodies that do not agree with the ‘single reality,’ the ‘peaceful whole’ that enacts ‘safe food’ as *anzen*, it can also be translated as a state of ‘restlessness’ or ‘uncertainty.’ That is, in not accepting the scientifically-performed ‘peaceful whole,’ these bodies are enacted as lacking peace and certainty. How to treat a body ailing from ‘lack of peace’? Through sound risk communication that explains the ‘single reality’ in a way to instill a feeling of *anshin*. Thus, ‘irrational,’ ‘careful’ or ‘anxious’ bodies can be transformed into ‘rational’ and ‘calm’ bodies if they are able to digest the ‘single reality’ being presented by government institutions and members of the transnational nuclear assemblage. Once the feeling of *anshin* is achieved, business as usual can continue. People can stop being ‘careful’ and feeling ‘uneasy’ or ‘uncertain’ and get back to their lives as they were before the nuclear disaster. Managing the relationship between radionuclides and bodies would be the work of the government, not something to be cared for or tinkered with by people in their everyday lives.

One further pair of words containing the character *an* (安) and pertaining to radiation that are worth mentioning are *antei* and *fuantei*. Combining the character of *an* (安)—‘peace’—and *tei* (定)—‘fixed,’ ‘decided,’ ‘regular’ or ‘permanent’—*antei* is used to describe a state of stability, or in its verb form (*antei suru*), the process of stabilization. In risk communication literature, *antei* is used to describe the ‘stable’ decline in food found ‘over the reference limit,’ or to refer to stable forms of iodine or other non-radioactive isotopes (for example, CAA, 2017b: 6 & 37). The term fits well with the stability, control and ‘peace of mind’ promised to bodies that follow the ‘single reality’ being deployed by the Japanese government regarding how radionuclides, food and bodies ‘safely’ relate with each other. *Fuantei*, on the other hand, combines the three characters of ‘not’ (不), ‘peaceful’ (安) and ‘fixed’ (定) which can be used to describe a state of ‘instability,’ or used as an adjective to describe something as ‘unstable.’ The word *fuan* can be found in this term, indicating a prolonged state of uncertainty or

uneasiness.³⁶⁹ In Japanese, *fuantei* is often put in front of the name of an isotope to specify that it is radioactive, highlighting its instability. Thinking through these words, the single reality being deployed by the Japanese government can be seen as an attempt to use science born out of the transnational nuclear assemblage to regain a sense of stability (*antei*) over the overflow of unstable (*fuantei-na*) radionuclides and all of the instability (*fuantei*) they bring to modernist industrial projects that rely on an image of control for their continuing expansion.

While in many cases the enactment of dissenting bodies as ‘irrational’ and ridden with anxiety might be enough to maintain the centrality of the single reality being deployed, the enactment of ‘safe food’ as a commodity connected to stabilization, recovery, renewal and progress following the destabilization caused by TEPCO’s nuclear disaster allows for further normative valuations and enactments of bodies—enactments which aim to categorize bodies whose activities may negatively influence economic and progress-oriented projects. In fact, as described by Madoka in Chapter 4, there have been huge progress projects in the works since the onset of TEPCO’s nuclear disaster, which Japanese government officials urged *all* Japanese people to support ‘in unison.’

In December 2012, the then prime minister of Japan, Noda Yoshihiko (2012), gave a speech to the Japanese Diet declaring 2012 as "the First Year for the Rebirth of Japan." In his speech, he calls on “all Japanese people” to “join hands and together create a page in history titled, ‘Japan’s rebirth through reconstruction.’” TEPCO’s nuclear disaster and the ‘rebirth’ of Fukushima Prefecture also played a major role in his speech. Noda (2012) proclaimed:

Without the rebirth of Fukushima, there can be no rebirth for Japan.
Unless Fukushima is reborn, a vibrant Japan can neither be restored. I
hope that my making repeated references to this will lead to all
people sharing this notion. In order to translate this hope into
concrete action, a special measures bill will be submitted to this Diet

³⁶⁹ It is the state of precarity discussed in Chapter 4, in which neither certainty nor control (two basic ingredients for modern progress projects) can be guaranteed.

session for the Government and communities to promote the rebirth of Fukushima in unison.

Noda's aspirations for a united approach to the recovery efforts in Fukushima Prefecture emerged in two policy documents³⁷⁰ which would help to 'unify' and coordinate activities of industry and citizenry.³⁷¹ Both of these documents outline plans for urgently and intensively coordinating economic projects that will 'revitalize' and 'reconstruct' (*fukkō suru*) Fukushima Prefecture, and thus the country. While these plans include a number of economic endeavors in nuclear power—not only cleaning up TEPCO's nuclear disaster, but advocating the 'safe' restart of Japan's remaining nuclear power plants—and agriculture—for example, the establishment of "plant factories"³⁷²—at its core, its success depends on the stabilization of the overflow of radionuclides following TEPCO's nuclear disaster. Thus, "sweeping away rumors [*fūhyō fusshoku*]"³⁷³ and obtaining coordinated unity in implementing proposed 'rebirth'³⁷⁴ and 'revitalization' progress projects have become the cornerstone of Japanese economic policies post-2011.

Revisiting the excerpt from Koizumi's (2011a) letter, we see the use of the term 'groundless rumors,' which corresponds to the Japanese word *fūhyōhigai*. The term appeared in the 1980s as a way to describe a decrease in seafood sales following

³⁷⁰ The documents are titled: *Comprehensive Strategy for the Rebirth of Japan: Exploring the Frontiers and Building a "Country of Co-creation"* (Cabinet Secretariat of Japan, 2012) and *Japan Revitalization Strategy: Japan's Challenge for the Future* (Prime Minister of Japan and His Cabinet, 2014).

³⁷¹ See Williamson (2015) for a commentary of Noda's speech in June 2012 where he also called for the restart of the Ōi Nuclear Power Plant in Fukui Prefecture—within 160 kilometers of all of my study's participants in 2016.

³⁷² Plant factories are discussed by Sekine and Bonanno (2016) in their recent book describing the entrenchment of neo-liberal corporate takeover of agriculture—"disaster capitalism" (Klein, 2007)—in post-2011 Japan. While the stated goal of plant factories is "to rebuild home-grown products' features such as 'tasty,' 'safe' and 'environment-friendly,'" their establishment are expected to lead to the further alienation of farmers from their local environments, turning farmers into factory workers for mega trans-national corporations (Cabinet Secretariat of Japan, 2012: 53).

³⁷³ This is a new ruling discourse regarding 'harmful rumors' circulating in the news and mass media. See, for example, a news article by the *Kahoku Shimpō* ("Sweeping away rumors," 2017).

³⁷⁴ The push toward 'rebirth' is reminiscent of the case of Minamata discussed in Section 4.4.1.

overflows from nuclear power plants (Kimura, 2016a: 32; Sekiya, 2003; 2011). As pointed out by Katsunori in the introduction to this chapter, the term gained popularity following the 1999 JCO nuclear criticality disaster in Tokai-mura, Ibaraki where it was used to describe the reason behind loss in agricultural sales following the overflow of radionuclides into nearby sweet potato fields and other farmlands.³⁷⁵ The use of the term reveals a shift in emphasizing the role of ‘irrational’ and ‘anxious’ consumers in the decline in food sales, and not the possible material presence of radionuclides or the people responsible for their overflow. The lingering message? People cause economic damage, not radionuclides and not energy corporations or the government.

The term *fūhyōhigai* has also been established as a legal tool: producers can apply for compensation of losses in sales caused by ‘irrational consumers,’ but not necessarily because their fields have been contaminated with radionuclides—especially when the activity of these radionuclides falls under the government’s legal definition of ‘safe’ doses or concentrations. Because there is no other legal term available in the Japanese legal system that recognizes a situation in which people might avoid eating foods possibly containing radionuclides, we see how the establishment of legally recognized ‘safe food’ enacts all bodies that are ‘careful’ or question a food’s ‘safety’ as vectors of ‘harmful rumors.’³⁷⁶ Again, it is the rumors from ‘irrational’ bodies that require legal attention, not the presence of radionuclides.

Koizumi’s (2011a) use of the word ‘groundless’ adds another clue to the ontonorms contributing to the enactment of bodies intended to eat government certified ‘safe

³⁷⁵ See, for example, Furukawa (2000) Kyodo News (1999), Osnos (2011), Ramseyer (2012) and Sekiya (2003; 2011).

³⁷⁶ Interestingly the Organization for Economic Co-operation and Development (OECD) (2012: 111-2) published a report which points out the problems with using “‘rumour-related’ damage” as a legal tool as it focuses only on damage caused by what is termed ‘irrational’ behavior by a third party, and seems to imply that there is no reasonable reason why someone might avoid products or activities due to concerns about radionuclides. The document reads: “when related to a nuclear accident such as the accident [in Fukushima], at the very least it should be regarded as an adverse reaction by the market in order to avoid the risk of contamination with radioactive material, which is not necessarily clear scientifically, and consequently there is eligibility for compensation as nuclear damage where such avoidance behaviour can be said to be reasonable” (CRPPH, 2012: 111-2). However, the report continues using this expression (in quotations) because “currently no appropriate substitute expression has been indicated in court procedure” (CRPPH, 2012: 112).

food.’ Within the structuration of perspectivalism, something that follows the single reality presented by the Food Safety Commission and other government factions is considered to be standing on solid, scientific ‘ground.’ If the science used to enact ‘safe food’ is ‘grounded,’ then any body that denounces this single, ‘correct’ reality or questions the object of ‘safe food’ automatically falls into the category of ‘groundless.’ And not only are these perspectives scientifically ‘groundless,’ but legal texts recognize them as the sole reason why producers in the most contaminated regions suffer and cannot rebuild their livelihoods. Therefore, bodies that do not purchase government certified ‘safe food’ are not only enacted as ‘irrational’ and ‘uneasy,’ but legally liable for spreading ‘unscientific,’ ‘groundless rumors’ that sabotage recovery efforts and cause harm to both local and national economies.³⁷⁷

In 2016 and 2017, the words *anzen*, *anshin*, *fuan*, *antei* and *fūhyōhigai* continue to litter media articles³⁷⁸ and risk communication documents. As an example, the *Food and Radiation Q&A* booklet updated yearly by the Consumer Affairs Agency—the main agency tasked with risk communication—continues to activate these words. Each updated booklet begins with a note from the agency’s current secretary general. While the first half of the letter has varied throughout the years, the last paragraph has for the most part remained the same.³⁷⁹ The paragraph reads:

Using an easy to understand Q&A format, this booklet strives to explain information about food safety and radioactive materials about which consumers appear to have questions and uneasiness [*fuan*]. I hope the information provided will help to ensure food safety [*anzen-*

³⁷⁷ This set-up between the victims and perpetrators of ‘harmful rumors’ is also described by Yamaguchi (2016: 71-2).

³⁷⁸ For example, Belogolova (2013) and “Harmful rumors: Signs of no further worsening” (2016).

³⁷⁹ I have been able to review the eighth (CAA, 2013: 3), ninth (CAA, 2014: 3), tenth (CAA, 2016: 3) and eleventh (CAA, 2017b: 3) versions which all include the exact same statement. One of the first versions (published in July 2011) is very similar, but instead of hoping the “information provided will help to ensure safety and security about food, and prevent groundless rumors” (CAA, 2017b: 3), it only shares the hope that the information will “prevent harm to health and groundless rumors” (CAA, 2011: 3). While the eighth edition was translated into English (CAA, 2013), I used my own translation of the paragraph to highlight some of the nuances in the Japanese version.

sei] and a sense of security [*anshin*] about food, and prevent groundless rumors [*fūhyōhigai*]. (CAA, 2017b: 3)

Here, the structuration of perspectivalism continues to be enacted through government texts, even more than six years following the onset of TEPCO's nuclear disaster. In 2012, the Consumer Affairs Agency initially attempted to provide 'correct' information about food safety to an uneasy public through a number of events and promotional materials outlined in its *Action Plan for Consumers to Feel at Ease [Anshin]* (CAA, 2012).³⁸⁰ The agency has additionally been conducting bi-annual investigations into consumer 'awareness' since 2013. Led by a group called the 'Team to Advance Consumer Understanding,' the survey-style investigation is titled "The Survey of the Current State of Consumer Awareness Concerning Harmful Rumors [*Fūhyōhigai*]" (CAA, 2017a).³⁸¹ While surveys are usually guilty of confining participants to pre-determined categories,³⁸² the title of the Consumer Affairs Agency's survey is strikingly unambiguous about how it plans to enact the bodies of the people answering its questions. That is, people who willingly purchase foods from the seventeen prefectures³⁸³ where testing for radionuclides is mandated have 'correct' awareness, while those who hesitate have faulty knowledge and are promulgators of *fūhyōhigai*. It is the job of the Consumer Affairs Agency to identify these tendencies and revise their risk communication materials in an attempt to transform bodies that are 'irrational' to 'rational,' bodies suffering from *fuan* to those feeling *anshin*.

However, the experiences of my participants poke holes in the idea that these forms of knowledge are the cure for unease (*fuan*). Experiences shared by Kawano Hotaru (pseudonym), a nuclear refugee from Yokohama City in the Kantō region, reveal that it is not merely scientific knowledge about radiation that helped to transform her feelings

³⁸⁰ See Reiher (2016: 66-8) for a description of some of the risk communication leaflets produced by the Consumer Affairs Agency in affiliation with the Ministry of Agriculture, Ministry of Health and the Food Safety Commission (2012a; 2012c; 2012b).

³⁸¹ Yamaguchi (2016: 84-5 n3) also discusses this survey, pointing out how the questions are not about rumors, but consumer purchasing behaviors and knowledge on radioactivity—questions which implicate and enact consumers as the ones to blame for any hardships suffered by producers, not the Japanese government or TEPCO.

³⁸² See Callon et al. (2009: 153-8) for a discussion on surveys and their role in thwarting truly democratic discussions and deliberations.

³⁸³ See Ministry of Health (2017) and Figure 9.

of *fuan* to *anshin*, but the ability to discuss her concerns and make visible radionuclides that might be present in the foods she and her family eat.

If you don't have knowledge, you can't get scared. Information was overwhelming scarce. Also people did not know much about radiation. Well, really only some at the time of Chernobyl, there were some people who studied. There were really only some who understood. I by chance interacted with those people. I could start studying. However, most people don't know anything, so they have nothing to be scared about. Then, since the start of the accident, in any case, the state says that it is safe [anzen], so I feel like everyone is going in that direction. Everyone is being brainwashed. That's the feeling I get.

She describes the difficulty she experienced in trying to talk about radiation with people around her.

We lived in a company residence, friends that lived at that residence, five, six people also promptly understood the radiation problem. We were all careful together. However, school classmates' mothers who I have absolutely no relation with and such, those people did not care at all. Well, if I asked, "Do you care about food?" The conversation would become, "If you care so much, you will have nothing to eat." Hmm. I felt like I couldn't communicate with those people, I couldn't talk with them. I just exchanged information with my friends at the company residence.

Hotaru eventually relocated to the Kansai region where she found another community of people with whom she could discuss her concerns about radiation at a CRMS near her new home. For her, it was having access to this new community and a measuring device that brought a feeling of ease (*anshin*).

The ability to measure is near so, for example, I bought rice from Akita Prefecture [in the Tōhoku region]. Well, when I thought about how Akita Prefecture was doing, I could quickly measure. After checking if it was safe [anzen], I could eat it. The fact that this kind of measuring ability is so near, it's a really big change. You know, it

has reached the point that I am able to eat food I feel at ease [anshin] about.

Kikuchi Aoi (pseudonym) and Ueno Masami (pseudonym), two mothers who were living in Fukushima Prefecture at the time of TEPCO's nuclear disaster, describe their experiences in shopping after relocating to the Kansai region. During our focus group, they also provide insights into how both numbers and opportunities to discuss their concerns helped to bring them a sense of *anshin*.

Karly: How do you choose food at the supermarket?

Aoi: I look at the place of production.

Masami: I look. I look. I always look. [...] Also at the place of manufacture, for processed things.

Aoi: Normally, there are also things like additives, as much as possible, when I can I pay attention to it. [...]

Masami: Yes, of course. I'm really sorry, but I don't buy, I don't buy things from the Kantō region. Gunma, Ibaraki, Chiba.

Aoi: Even Ibaraki.

Karly: What makes you particularly concerned about food from the Kantō region?

Masami: They are not really measuring, well, there are measuring stations where private people are measuring, though. Still, for food produced in Fukushima Prefecture, the reference limit is high, but rice over 100 Becquerels is not being shipped. As far as measuring goes, there are facilities in Fukushima Prefecture. But, the reasonably contaminated Kantō region.

Aoi: Measurements in the surrounding areas.

Masami: They aren't measuring. They aren't, right?

Aoi: Not really, because their awareness is low.

Masami: Yes. So, on the contrary, I'm more worried about food from prefectures around Fukushima. It seems like this is how normal market circulation goes. Even people in the Kantō region who care, they go to a measuring station and have things measured. But I guess only if there is a measuring station they can do it. My understanding is that there are things not being measured. So I end up thinking that it is best not to choose them.

Aoi: That's why, the best thing is to measure and publicly share the numbers.

Masami: Yes, yes, yes. If you do that, you can better decide what not to buy.

Aoi: It's possible. Even for us.

Masami: With only the place of production, in any case, all you can do is use your awareness about contaminated regions.

Aoi: Ultimately, that may get connected to rumors [fūhyō]. But, in any case, if you share the measurements with producers.

Masami: Yes, I want the numbers to be rendered visible.

Aoi: It would have an influence on producers right? I think those producers would really understand. I think there are definitely producers who think measuring is really important and can stir awareness.

Masami: There are. There are.

Aoi: Well, in any case, this point represents the first reaction of citizens. But, unmistakably, I think there are people who will not utter their concerns, but just choose foods outside of the prefecture. Especially in Fukushima. You know, it's like, "It's all okay!" is the normal message being purveyed. Gradually this way of making people buy. You know, it is imposed.

Masami: It's awful!

Aoi: But if ordinarily numbers would reliably appear, I would be really happy!

Masami: Conversely, because they are reliably rendered visible, I feel this will connect to safety/feeling at ease [anzen/anshin]. In order to decide.

Karly: And what is your experience shopping here in the Kansai region?

Aoi: Here, it's still safe.

Masami: It's still okay, things from the west. Things from Fukushima are sold here but, there's not so much. Also, in any case, there is the measuring station, so if you are worried, you can have them measure it.

Aoi: There are also people to discuss it with.

Masami: Those are the aspects that bring a feeling of ease [anshin], aren't they?

Here, again we see that the feeling of ease (*anshin*) is not produced through proclamations of 'safety' or a belief in Science, but through having access to measurement results at the site of purchase, people to discuss these values or other concerns with, and a measuring station to check for radionuclides if one is concerned. Viewing the numbers allows people to more carefully relate with radionuclides; without the numbers, people are left only with prefecture of origin labels to guide their practices.

Mai, whose story I shared in Chapter 1, also expressed how ruling discourses of 'eat to support (*tabete ōen*)' and 'harmful rumors (*fūhyōhigai*)' worked against her own attempts to carefully relate with TEPCO's radionuclides, especially as she was breastfeeding at the time of the disaster's onset in 2011. Again, numbers played a role in instilling her with a feeling of ease (*anshin*).

Eat to support [tabete ōen], even harmful rumors [fūhyōhigai]. It's really not harmful rumors [fūhyōhigai]. But that kind of label, in any

case, I feel it's the kind of society that labels you. Any people who care are deliberately labeled negatively as spreading harmful rumors [fūhyōhigai] and obstructing reconstruction/revitalization [fukkō] and whatnot. And then for the good intentioned people, for people like those in Fukushima, I feel it's really difficult. I feel the good intentions of the people of Fukushima are being used, manipulated. Also eat to support [tabete ōen]. Really. You know, if it's really eat to support [tabete ōen] [...] the increase from 1 millisievert to 20 millisieverts, the food safety standard increasing from 1 Becquerel to 100 Becquerels and whatnot, this government, they are deliberately hiding the severity of the contamination. In any case, if there was accurate communication about the accident. Even more, there should be discussion. Real eat to support [tabete ōen] means accurately measuring and making public the amount of Becquerels. More than that, if it's okay to eat, even if it's higher than 1 Becquerel, it might be strange for me to say, but for the people who want to eat it, it's okay. In any case, at [the time of the accident], I was breast feeding, so I became very nervous. The things I would eat. Contaminated things would go directly to my child. I experienced that kind of fear. Hmm. That's why I go to the measuring station, the citizen radiation measuring station. I'm a member.

As visible in my participants' various experience, terms such as *fūhyōhigai*, *anzen*, *anshin*, *fuan* and *tabete ōen* were quickly dispatched through media outlets, providing a language for people to discuss and negotiate their newfound relations with radionuclides. Good bodies are not 'careful' (*yōjin-bukai*), measuring foods, deliberating Becquerel counts and discussing their concerns. Instead, they are 'calm' and 'peaceful' (*anshin*) because they have accepted the 'unbiased science' behind legal reference limits. Any bodies espousing carefulness or discussing the 'safety' (*anzen-sei*) of government certified 'safe food,' are enacted as not only anxious (*fuan*), but purveyors of 'groundless,' 'harmful rumors' (*fūhyōhigai*), malicious saboteurs of recovery and revitalization (*fukkō*) efforts.

In this section I have explored how ‘safe food’ and the bodies intended to ingest it are enacted in ruling discourses and texts, and how these objectified accounts misrepresent and disregard the needs of my participants who want to know the activity of radionuclides in the foods they ingest. Living so far away from the actual places where government measurements were taking place, all of my participants had some questions about how ‘safe food’—in its material form—was being enacted through situated practice. In the next section I will go one layer deeper to explore the food-testing regime designed by the Japanese government which begins to uncover the multiple enactments of ‘safe food’ and how any inconsistencies among these multiple enactments are contained within an ever-evolving, ever-expanding complex of ruling texts.

6.3 Enacting ‘safe food’ through reference limits and judgements

While the then chairperson of the Food Safety Commission, Koizumi Naoko (2011a), sent out her English correspondence on April 8, 2011 explaining how the provisional food safety measures were “effective enough to ensure the safety of vegetable, seafood and other foodstuffs placed in domestic markets and exported abroad from Japan,” on the ground government personnel were still scrambling to find equipment to test foods. That is, while foods were instantly being enacted as ‘safe’ in ruling discourses, actual testing procedures were taking place in a haphazard fashion as people on the ground were trying to gauge the extent of the overflow of radionuclides into the agrifood assemblage. Given the impossibility of testing all foods, a screening process was developed in an attempt to stabilize the radionuclides that had reemerged as vicious and mischievous actors within the agrifood assemblage. Instructions for testing procedures were being outlined in an ever evolving textual complex developed by the Japanese government, creating an image of stability and control in the face of instability and grave uncertainty. However, these procedures offered a lot of room for creative interpretation among the people activating them in practice. In this section, I will provide a brief overview of the evolving government-prescribed testing procedures that participate in the enactment of ‘safe food,’ and how a very mutable meaning of ‘safety’ is used to stabilize ruptures in control and maintain circulation of the economy when messy, heterogeneity rears its head.

When the ‘provisional reference limits’ were set on March 17, 2011,³⁸⁴ they included an announcement asking all testing for radionuclides to follow the *Manual for Measuring Radioactivity of Foods in Case of Emergency* published by the Ministry of Health in 2002.³⁸⁵ From March 19 to April 3, 2011, over 900 samples were said to have been tested, and the data was used to inform the first comprehensive guidelines for enacting ‘safe food’ disseminated in a press release on April 4, 2011 (MHLW, 2011c). The press release, titled *The Handling of Provisional Regulation Values Related to Radioactive Materials Present in Food*, included an attachment from the Nuclear Emergency Response Headquarters titled *Concepts of Inspection Planning and the Establishment and Cancellation of Items and Areas to Which Restriction of Distribution and/or Consumption of Foods Concerned Applies* (hereafter *Concepts of Inspection*). The lack of proper machinery for measuring was also mentioned in an attachment to the April 4th press release, with the Ministry of Health acknowledging that it was working to secure proper inspection equipment for those prefectures not equipped to enact the new guidelines. If the process of ‘testing’ is supposed to enact ‘safe food,’ without machinery to make the activity of radionuclides perceptible to humans, how could ‘safe food’ be enacted? The answer? Indexes and judgements.

The April 4th *Concepts of Inspection* specified eleven prefectures and municipalities (out of forty-seven total) that were expected to test for radionuclides in food (Figure 9).³⁸⁶ Local governments were asked to “divide prefectural areas into appropriate districts” to manage both the testing of food and assist in organizing processes of restricting foods found ‘over the limit.’ As mentioned, given the chaotic circumstances that ensued following the nuclear disaster, the prefectural and municipal governments were awarded great flexibility in implementing the *Concepts of Inspection*.

The instructions did not ask prefectures and municipalities to test all foods—this would be impossible given the time and preparation involved in testing procedures as well as the reality that many local districts did not have equipment for testing—so the document laid out a list of foods which should be prioritized. Prioritized foods

³⁸⁴ See Ministry of Health (MHLW, 2011b; 2011g).

³⁸⁵ See Ministry of Health (2002).

³⁸⁶ The eleven prefectures and municipalities were Fukushima, Ibaraki, Tochigi, Gunma, Miyagi, Yamagata, Niigata, Nagano, Saitama, Chiba and Tokyo.

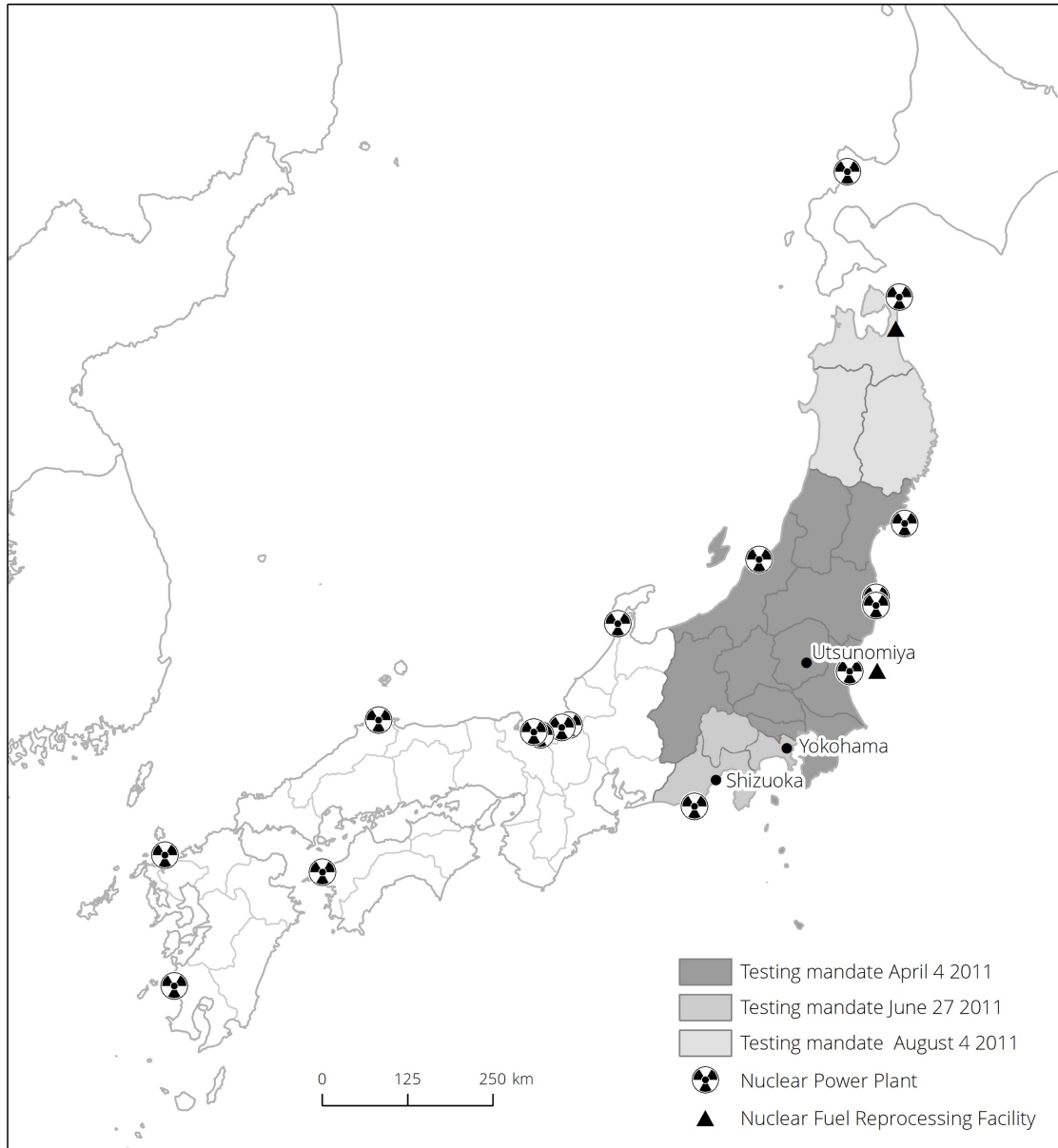


Figure 9 Prefectures and municipalities mandated by the Japanese government to test for radionuclides in food.

were those of the 900 measurements found to have high levels of radioactivity, so would become “indexes” for radioactivity in other foods (MHLW, 2011c: 6). On April 4th, these foods included leafy vegetables, milk and other explicitly specified foods. Testing of these foods was recommended to take place “about once per week” (MHLW, 2011c: 6). Here, the ‘safe food’ in Koizumi’s (2011a) letter on April 8th was not *all* “vegetable, seafood and other foodstuffs,” but an estimation of ‘safety’ based on results from measurements of radionuclides in leafy vegetables, milk and other selected items. In fact, provisional standards for seafood were only established on April 5th,

three days before Koizumi's letter was written.³⁸⁷ And in a press release on April 8th concerning radioactive iodine in fishery products, the Food Sanitation Subcommittee's Radioactive Material Response Working Group (hereafter Working Group) argued that “the inspection and monitoring system needs to be enhanced in order to improve the safety [*anzen-sei*] and sense of security [*anshin*] of people” (MHLW, 2011j). There seemed to be a disjuncture between the ways ‘safe food’ was being enacted in discourse and in situated practice. So how would the results from the weekly tests be used to ensure foods circulating within the agrifood assemblage were ‘safe’? According to the *Concepts of Inspection*, weekly ‘judgements’ would be used to determine which foods to restrict. The document explains:

inspection results are summed up every week, and the applicability of the requirements is judged in a comprehensive manner. [...] As for items exceeding the provisional regulation values, if the regional spread is unclear, the surrounding areas will be inspected and the judgement will be made on the necessity of restriction of distribution. As for items for which a significantly high concentration value is detected, restriction of consumption is promptly set irrespective of the number of samples of relevant items. (MHLW, 2011c: 9)

The policy behind the setting of restrictions is legally based on the Act on Special Measures Concerning Nuclear Emergency Preparedness Article 20 (3) which outlines the right of the director-general to “give necessary instructions to the heads of the relevant designated administrative organs” in order to implement “emergency response measures accurately and promptly” following a nuclear disaster (MHLW, 2011h). However, the abovementioned excerpt highlights how the type and extent of the restriction will be based on the *judgement* of local government authorities. In scanning the week's data, local officials have discretion in implementing a “restriction on distribution”—if there seems to be contamination spread over a regional area—or a “restriction on consumption”—targeting specific items where high amounts of radioactivity were measured (MHLW, 2011c: 9). That is, within the evolving screening processes, if some food item was found to be ‘over the provisional reference limits,’ a restriction might be put in place, but only if *judged appropriate*. There does not seem to

³⁸⁷ See Ministry of Health (2011i).

be a clear definition for interpreting what constitutes an ‘appropriate’ versus an ‘inappropriate’ restriction.

While some prefectures and municipalities may have had the adequate testing equipment and the impetus to enact stringent testing schemes, others used their judgements to avoid testing foods. Of course, these judgements are not visible within the documents outlining the screening procedure which are intended to guarantee the enactment of ‘safe food.’ As Berends and Kobayashi (2012: 58) explain in their review of the early *Concepts of Inspection*: “There is not always an instruction on the number of samples, or on the size of the material, to be collected. The categories of items to be inspected are also not exhaustively defined. Prefectural governments reacted differently to this discretion.” In some cases, prefectural and municipal governments decided to blatantly dismiss government requests to enact the *Concepts of Inspection* when it came to foods of high economic value and importance. That is, even though the government certified ‘safe food’ being enacted in discourse was to be food ‘under the provisional reference limits,’ testing practices could be manipulated in ways to prevent possible restrictions on foods from being made visible. One example of this could be found in the enactment of ‘safe tea’ in Shizuoka Prefecture, the leading producer of tea in Japan located over 350 kilometers from TEPCO’s nuclear disaster (see Akune, 2016).³⁸⁸

Tea featured prominently during my fieldwork in 2016. Not only was it something I drank with my participants, but I observed the process of measuring tea at a CRMS, and also visited a tea farm in the Kansai region on a field trip organized by a CRMS. Being the largest tea producer in Japan, many of my participants remembered when tea from Shizuoka was found to be ‘over the reference limit.’ And because tea is consumed so regularly and frequently in Japan, a number of my participants expressed their specific concerns about its possible contamination. Arioka Kanna (pseudonym), who was living in the Kansai region at the time of TEPCO’s nuclear disaster, shared her concerns about tea:

³⁸⁸ See Figure 9 for the location of Shizuoka Prefecture and its capital, Shizuoka City.

I was really concerned about tea. I felt the contamination of tea was quite extensive. It was being found as far away as Aichi Prefecture. Hmm. Even though they were regularly testing it.

So just how was ‘safe tea’ being enacted in practice? Here, I turn to a somewhat well-known controversy that erupted in May 2011 to explicate one enactment of ‘safe tea’ through the use of reference limits and judgements.

A *Yomiuri Shimbun* article published on May 19, 2011 tells an interesting story about some of the judgements made by Shizuoka Prefecture’s governor Kawakatsu Heita who participated in enacting ‘safe tea’ just two months after the onset of TEPCO’s nuclear disaster (“Governor gives ‘safety declaration’”). Sipping on a cup of freshly-harvested tea with tea growers at a promotional event on May 18, 2011, Kawakatsu issued a “safety declaration [*anzen sengen*]” for all teas produced in the prefecture. The declaration of ‘safety’ was based on test results at eighteen locations around the prefecture which showed both raw tea leaves and read-to-drink tea to be “under provisional reference limits.” The chairman of the Japan Agriculture Shizuoka branch also proclaimed the ‘safety’ (*anzen-sei*) of the teas at the publicity event: “Tests have confirmed that the prefecture’s tea is safe [*anzen*]. We would like everyone in Japan to feel at ease [*anshin*] when drinking Shizuoka’s tea.” The article points out that the Ministry of Health had been requesting fourteen prefectures, including Shizuoka, to test for radionuclides in *aracha*—fresh tea leaves that are steamed and dried, also referred to as ‘unprocessed’ or ‘crude tea.’³⁸⁹ Governor Kawakatsu refused this request. Why not test *aracha*? Because the results “will confuse [cause *konran* among] consumers.” He goes on to explain: “If we do something to make consumers feel confused [*konran saseru*], it will lead to an unnecessary deepening of distrust in the government.”

A number of ontonorms can be found in Kawakatsu’s performances of ‘safe tea’ and the bodies who are intended to drink it. As with ‘safe food’ in general, ‘safe tea’ is

³⁸⁹ Information on Japanese tea processing can be found at Ministry of Agriculture (n.d.).



Figure 10 Tea leaves gathered by the author during a farm visit with a CRMS in the Kansai region during fieldwork for this study in 2016. Photo taken by author.

enacted as a commodity. Resembling Koizumi's (2011a) declaration on the safety of *all* "vegetable, seafood and other foodstuffs" circulating in domestic and international markets, Kawakatsu's 'safety declaration' attempts to enact *all* tea from Shizuoka as 'safe,' whether it has been tested or not. That is, the sheets of data produced through testing the activity of radionuclides in some teas are used to represent the 'safe' level of radioactivity in *all* teas. Not only do these statements ignore the unstable and disobedient nature of radioactivity, but the longevity of many radionuclides—and thus their potential to act-out for hundreds or even millions of years into the future³⁹⁰—becomes smoothed over by his 'declaration of safety' based on test results that were

³⁹⁰ Throughout years of research, there have been predictions made about the physical half-lives of radionuclides, or "the time after which a half of the initially existing atomic nuclei has decayed" (Gruppen, 2010: 5). It can take up to ten (Gruppen, 2010), possibly twenty (Nuclear Information and Resource Service, 2009) half-lives for radionuclides to completely transform into other elements (see ATSDR, 2004: 114 & 117). Thinking in terms of "hazardous life" (Nuclear Information and Resource Service, 2009)—as opposed to 'half-life'—we can understand the long-term relational entanglements different radionuclides entail. For example, while iodine-131 may only be active for 80-160 days, cesium-134 can be active for 20-40 years, cesium-137 for 300-600 years, strontium-90 for 280-560 years and plutonium-239 for 244,000-488,000 years (see ATSDR, 2004: 116 & D4).

determined to be ‘under provisional reference limits’ at a particular point in time. While no numerical values were shared in the article, it is very likely that the results may not have been legally considered ‘safe’ according to the ‘new reference limits’ rolled out in 2012, further complicating a smooth enactment of ‘safe food’ as coherent and singular.

Back to the promotional event, in drinking the ‘safe tea,’ Kawakatsu also enacts it as something bodies enjoy and find to be delicious. The farmers standing beside him enact this ‘safe tea’ as the product of the hard work and pride of local producers. Tea is already enacted as a symbol of the prefecture. But what about bodies? Because ‘safe tea’ is tea that is legally allowed to circulate within the agrifood assemblage, bodies are both citizens and consumers. However, the ‘rational’ and ‘calm’ Science-reverent consumer bodies in Koizumi’s (2011a) letter have disappeared: Kawakatsu only enacts consumer bodies as ‘irrational’ and easily ‘confused’ (put in a psychological state of *konran*).³⁹¹ The bodies of government officials, on the other hand, are enacted as trustworthy and knowledgeable: they understand the science behind the enactment of ‘safe tea’ that would only confuse the poor ‘irrational’ bodies of the consumer class. In Kawakatsu’s enactment of ‘safe tea,’ risk communication would be of no use in transforming ‘irrational’ bodies into ‘rational’ ones. In order to avoid being labeled as ‘confused,’ bodies must accept Kawakatsu’s enactment of ‘safe tea’ and leave the complex details to he, his fellow government officials and the tea industry. The message here is: ‘Drink up! Don’t mind your cup! You are not smart enough to understand the science behind safe food. If you do try to understand what is going on, you will only be confused. Don’t worry, we’ve got it under control.’

However, as explored in Section 6.2, for many of my participants, ‘safety’ (*anzen-sei*) is not something that can be declared without providing clear information on the activity of radionuclides. Segawa Haruo (pseudonym)—who had been living in the Kansai region prior to 2011 and who grew up in the 1950s and 60s during the time of nuclear bomb testing in the Pacific—discusses problems that may arise from merely

³⁹¹ Here, the governor uses the term *konran* to describe a psychological state of confusion, a diagnosis that fits when enacting bodies as either with or against a ‘single reality,’ feeling *anshin* or *fuan*, in perspectival debates. However, in an attempt to interfere with perspectivalism, in this thesis I instead attend to the term using sensibilities from the field of material semiotics, focusing on how disorder emerges from inconsistencies and tensions within heterogeneous sociomaterial entanglements, from multiple realities clashing in practice.

using the terms *anzen* and *anshin* without linking them to actual measurements and testing procedures.

In a situation where it's safe [anzen], in any event, well, physically, with evidence from physics, there is a uniform measurement. Something is measured, and if it seems to be close to zero, if it is zero, it is safe [anzen]. That kind of certification is possible. For feeling at ease [anshin], it's very, hmm, psychological. Well, you know, just because a person says it to another person. Well, even if you are being controlled, you get the feeling of ease [anshin], right? [...] To say safe [anzen], in any case, I feel it is best to accurately show detailed evidence. Therefore, it is overlapping with feeling at ease [anshin]. I feel it is really difficult to divide the two.

Why would testing *aracha* cause such confusion? Because the process of steaming and drying leaves might increase the level of radioactivity measured in samples. If ‘tea under provisional reference limits’ could be enacted as ‘safe tea,’ then food measured as ‘over provisional reference limits’ could not be easily enacted as the same. These versions of ‘safe food’ would be incompatible. *Konran*—not as psychological confusion, but as disorder caused by aggravated tensions from these versions clashing in practice—would emerge. But judgements can help to smooth over these glaring tensions. According to Kawakatsu’s judgement, only *aracha* in its drinkable state³⁹² should be measured, not the raw ingredients. While these ‘crude’ tea leaves may be measured as ‘over provisional reference limits,’ they are not intended to be sold directly to consumers, but blended and made into ready-made drinks to fill vending machines and line supermarket shelves. However, explaining such results would complicate attempts to enact all Shizuoka-produced tea as ‘safe tea’—tea that is ‘under provisional reference limits.’ So instead of testing the teas and allowing ‘rational’ bodies to be ‘calmed’ by the ‘unbiased’ Science, the governor made his own judgement—a judgement which attempted to coordinate and stabilize the heterogeneity and messiness of the relations among numbers, raw tea leaves, crude tea leaves, ready-made tea

³⁹² In fact, under the 2012 ‘new’ standards, Kawakatsu’s method prevails as only tea in its liquid form is measured (see MHLW, 2012b: 10).

drinks, vending machines, radionuclides, farmers, consumers, the delicious taste of freshly harvested tea, provisional reference limits, billions of yen in tea sales,³⁹³ the Hamaoka Nuclear Power Plant, equipment for measuring radionuclides, among multitudinous other sociomaterial relations the governor may be entangled within. And this messiness is only looking at the case of ‘safe tea’ in Shizuoka. What about all of the other different foods in all of the various prefectures, each being enacted within their own sociomaterial entanglements?

In fact, less than a month after the governor’s ‘safety declaration,’ Shizuoka tea measuring ‘over provisional regulation limits’ was discovered in the prefecture (“Cesium detected,” 2011), and was also measured at levels beyond what was considered ‘safe’ according to French law (Kyodo News, 2011b).³⁹⁴ With the Ministry of Health requiring tests on *aracha*, judgements could not as easily be used to smooth over the unstable and disruptive activities of radionuclides. Instead, further propagation of PR events and applications for financial hardship due to *fūhyōhigai* became strategies to re-enact tea as ‘safe’ (*anzen*).³⁹⁵ Unnecessarily strict regulations combined with ‘confused,’ ‘rumor-spreading’ bodies would become the target of blame for business losses, not radionuclides, not TEPCO, and not the policies of the Japanese government.

Institutional ethnography teaches us that while ruling texts are intended to coordinate activities and work process in a way to make them both efficient and accountable to the people they are intended to protect, they are also designed to uphold the interest of the institution.³⁹⁶ With the goal of maintaining a smooth circulation of legally certified ‘safe food’ following TEPCO’s nuclear disaster, in some cases judgements were made in an attempt to maintain stories of control and prevent the instability and heterogeneity of radioactivity from interfering with the pace of economic markets. While legally established reference values are intended to distinguish between foods that are legally allowed to circulate within the agrifood assemblage and those that are not, they have

³⁹³ See Akune (2016).

³⁹⁴ According to the article, 1,038 Bq/kg of cesium was found in the tea.

³⁹⁵ See, for example, “Governor Under Pressure from Minister of Health” (2011) and “Shizuoka City’s Mayor Takes to the Streets” (2011).

³⁹⁶ See Section 3.3.1.2.

been used as a tool for enacting all food testing ‘under the reference limit’ as ‘safe.’ The stability of this enactment is not fixed, however, and oscillation between the singular object of ‘safe food’ and its multiple enactments reveals the precariousness of the stories of control behind their enactments.

All of my participants observed such fervent attempts to prove the ‘safety’ of foods possibly containing TEPCO’s radionuclides from the very outset of the nuclear disaster. Masuda Fumika (pseudonym), a mother of one whose hometown is in Fukushima Prefecture, reflected on government ‘safety’ declarations during a focus group session. Fumika was living in Tokyo at the time of TEPCO’s nuclear disaster and, after first seeking refuge from TEPCO’s radionuclides in Okinawa, ended up in the Kansai region where I met her in 2016. During our interview, she described her thoughts on the difficulty of enacting food as ‘safe’ without accompanying such declarations with actual measurements.

Image, image, it’s merely an image. Only saying safe/feel at ease [anzen/anshin]. It’s all an image. Concretely, let’s say the detection limit [kenshutsu genkaichi] was 1 Becquerel and it was measured, and it seemed that nothing was detected. That would somewhat be the sense of safe/feel at ease [anzen/anshin].

When asked what she knew about the government’s actual countermeasures, she pointed out how the inconsistency in government claims about the safety of food has left her with little option but to question their entire measuring process.

What do I know about the government’s countermeasures? It seems like they aren’t doing anything. Let’s see, now it’s okay for food less than 100 Becquerels to circulate, right? Exactly what are they doing? They must be doing something, but ultimately, in any event, they are doing things for their own convenience, right? Even if they actually do things, they only tell lies about it. I have no idea what they are doing.

The suspicion of government activities expressed by Fumika is something that was discussed by a number of my participants. Some of my participants even argued that zealous claims of ‘safety’ unaccompanied by actual radionuclide measurements has

produced what the Japanese government views as an epidemic of *fūhyōhigai*. Kuroda Asami (pseudonym), a mother of two who relocated from the Kantō region following TEPCO's nuclear disaster, shares her take on this phenomena:

There are also people who say, “that’s harmful rumors [fūhyōhigai]!” But that’s also mind control [maindo kontorōru]. They are not properly investigating, they are also not properly publishing the numbers, they are not officially announcing them. Terms like harmful rumors [fūhyōhigai], eat to support [tabete ōen] are only used to block people who are concerned. They are just trying to make it look like nothing ever happened. [...] Even if it is okay now, at the outset they did not investigate. At the outset, they did not publish the data. Even more, the fact that they said it’s okay. Now things that are okay, things that are really okay have become tied to harmful rumors [fūhyōhigai]. At the outset, if they really investigated, published the data, informed everyone, [...] people would be clear on what was actually okay and what was not. [...] If you hide things from the outset, then real harmful rumors [fūhyōhigai] will emerge. Therefore, the responsibility for the harmful rumors [fūhyōhigai] we have now. The government is saying they cannot believe the distrust. It’s very strange, no? The government produced this situation where people cannot trust.

As my participants' experiences highlight, tensions arise when 'safety' declarations are made without sharing data on radionuclide concentrations. Without information on radionuclide concentrations available for deliberation, when food 'over the reference limit' enters the arena, fervent attempts to enact food 'over the reference limit' as 'safe' clash with the enactment of food testing 'under the reference limit' as the same. In the next section, I will discuss the ways in which differences between these two government certified enactments—foods 'over the reference limit' and 'under the reference limit'—are smoothed over through another practice: broadening the definition of 'safety' through the activation of dose estimates.

6.4 Enacting ‘not necessarily unsafe food’ through dose estimates

Since its first publication on April 4, 2011, the *Concepts of Inspection* has been continually updated based on data being collected (MHLW, 2011i). Along with the deployment of ‘new’ reference limits in 2012, the *Concepts of Inspection* were updated in March 2012, July 2012, and annually every March following.³⁹⁷ By June 27, 2011, the number of prefectures and municipalities mandated to test for radionuclides in food rose from eleven to fourteen, and finally to seventeen by August 4, 2011 where it remains today (see Figure 9).³⁹⁸ On June 27, 2011 the updated *Concepts of Inspection* also expanded the list of which foods need to be tested, broken into five categories.³⁹⁹ Again, because all food was not being tested, local governments divided their prefectures into what they viewed as “appropriate zones,” collecting samples from each zone (MHLW, 2011k: 4). Some areas were targeted, for example those with foods that exceeded provisional limits, or where soil concentrations of cesium-134 and cesium-137 were high. The frequency of these inspections was to be decided at the local level “in accordance with the actual situations of the production and distribution and/or consumption,” but was to be conducted regularly—again, “about once a week, in principle” is recommended (MHLW, 2011k: 1 & 5). In addition, seasonal foods or foods with “limited” distribution were to be tested three days before they were first distributed (MHLW, 2011k: 1). Inspections were expected to be intensified if any food

³⁹⁷ See Ministry of Health (2012e; 2013b; 2014; 2015; 2016b; 2017).

³⁹⁸ These include the prefectures and municipalities listed in the April 4th press release—Fukushima, Ibaraki, Tochigi, Gunma, Miyagi, Yamagata, Niigata, Nagano, Saitama, Chiba and Tokyo—along with six additional locations—Aomori, Iwate, Akita, Kanagawa, Yamanashi, and Shizuoka (MHLW, 2011i; 2011k; 2011m).

³⁹⁹ The first category listed foods that were found to have levels of radionuclides higher than the provisional values, including vegetables (prioritizing those grown outdoors and specifying spinach, log-grown *shiitake*, bamboo shoots, and tea leaves, among others), milk, fishery products, and meat (specifically beef). The second category included foods which, according to a National Health and Nutrition Survey conducted in 2008, were consumed in high quantities by Japanese people (including rice, tea—specifically for drinking—milk, eggs, fishery products, mushrooms and algae, among others). The third category included foods whose distribution was once restricted. The fourth included other foods selected by the government which included wild foods (such as wild boar). Finally, the fifth group took into account both major agricultural products currently being cultivated as well as foods already distributed within the market. Migratory fish species were to be dealt with through separate instructions (MHLW, 2011k).

over the reference limit was found. If anything over the limit was found, again a ‘judgement’ would be made on how to deal with it (MHLW, 2011k: 5).

While the flexibility afforded to local governments in the various versions of the *Concepts of Inspection* allowed for some creativity in enacting ‘safe food’ within public discourse and an evolving textual complex, it did not always ensure the actual materials themselves remained ‘under the reference limit.’ While choosing foods based on prefecture was a possibility when shopping for oneself, things became much more complicated when people ate out at restaurants, were hospitalized, or were trying to prevent their children from ingesting radionuclides in their school lunches.⁴⁰⁰ It was for this reason that many of my participants with school-aged children became extremely concerned about the food being served in school lunches.

Hotaru again shares her experience, this time about how she worked through her concerns about school lunch at the outset of TEPCO’s nuclear disaster while she and her children were still living in Yokohama City, Kanagawa Prefecture⁴⁰¹—one of the prefectures mandated to test foods for radiation on June 27, 2011:

You know, I was worried about school lunch. At the outset, first I thought milk was dangerous, so we stopped having milk. And then, my oldest child only, for the time being, from April stopped having milk. Then my younger child said he wanted to drink milk at school, so there was nothing I could do. I said I disagreed. As I continued to say, “It’s okay to just leave it on your plate,” I let him drink it. But, even my younger child stopped drinking milk in May. There was a lot

⁴⁰⁰ According to my participants, at public schools it was often the case that city governments would post the prefecture of origin of the foods they served in school lunches—although sometime this was posted after the lunches were already eaten. Private schools had their own strategies for showing the place of origin of school lunch ingredients. For most restaurants and hospitals, my participants needed to ask about the place of origin of various foods, something most of them felt was a bit too uncomfortable as it made them appear pedantic or overly concerned. One of my participants who gave birth after TEPCO’s nuclear disaster described how she had her family bring her food at the hospital as it was not clear where the hospital food was being sourced from. The doctors and nurses she spoke to about her concerns told her not to worry about radiation.

⁴⁰¹ Yokohama City is located approximately 250 kilometers from TEPCO’s nuclear disaster. See Figure 9 for the location of Yokohama City.

of news circulating about contamination, so maybe he himself became aware that it might possibly be contaminated? After that, when I said, "It's okay to stop drinking," he said, "Ok." So in May my younger child also stopped. And, um, fish. Even though at that time, there was no talk about fish being contaminated. Let's see, at that time, [we avoided] things like mushrooms, bamboo shoots [takenoko] and whatnot. Well, we did avoid fish. At the time when there were deeply contaminated things from the Tōhoku region, I made side dishes at home and made my children bring them. Even though they ate school lunch. Well, I had my children leave behind foods in the school lunch that were dangerous and eat the side dishes they brought from home.

I asked her how she communicated her concerns with her children's teachers.

First, I wrote a letter to the homeroom teacher who quickly said it was okay. [...] The print from the school was a menu, but the place of production was not written. If I looked at that menu, there were lots of things, like if they were using sardines and whatnot. I would know if they were having mushroom spaghetti. Then, Yokohama City's homepage published the place of production, so I checked that. Then, if on one day the main was a little scary and I did not want to let my children eat it, I would tell the school.

Like many of my study participants with school-aged children, Hotaru spent a lot of time in the early days after TEPCO's nuclear disaster trying to ensure her children did not consume high levels of radionuclides. While some of my other participants easily received permission to opt out of school lunch or negotiate days when their children would bring a *bento*, the pressure felt by others led them to claim their children had an allergy as a way out of school lunch—although this was not always successful as many schools asked parents to produce a doctor's certificate. In other cases, schools asked parents to make the exact same lunch as the meal being served at school to ensure the children were eating according to strict nutritional guidelines. Regardless of the particular situated struggle, trying to protect one's child from consuming radionuclides has not been an easy task for my participants, and news about foods 'over the limit'

being found in school lunches kept many of them vigilantly checking school menus and making *bentos*, even five years after TEPCO's nuclear disaster.

One of the earliest cases of food 'over the limit' that snuck through government screening processes in the summer of 2011 and caused a societal uproar has since become known as 'cesium beef,' instigator of the "cesium beef scandal."⁴⁰² One news article described the incident: "[b]eef from more than 1,000 cows, which ate feed contaminated with radioactive cesium, was shipped across the country. Some of the meat ended up being sold at supermarkets, served to children at nursery schools and to passengers on Japan's bullet trains" (Herman, 2011).⁴⁰³

Tests conducted in July 2011 revealed that some of the beef—from cows which were said to have been fed rice straw left outdoors⁴⁰⁴—contained up to 4,350 Bq/kg of cesium-134 and cesium-137 (MHLW, 2012d: 111). These results are almost nine times higher than provisional reference limits in effect at the time, and 43.5 times higher than the new reference limits set for these radionuclides. In its coverage of the 'scandal,' the *New York Times* includes a quote from the then minister responsible for managing the nuclear disaster, Hosono Goshi, giving his take on the 'safety' of consuming beef much higher than the provisional reference limits: "If you eat it every day, it might be a problem. [...] But if you eat just a little, there would be no big effect on your health" (Tabuchi, 2011). Here tensions arise between two different enactments of 'safe food': food 'over the reference limit' and 'under the reference limit.' If 'safe food' is food that is not 'over the reference limit,' then how is food found more than nine times over the reference limit 'safe' to consume, or at least expected to cause 'no big effect on your health'? How to rectify the inconsistencies produced through these two conflicting enactments? The answer is by shifting the focus away from 'reference limits'—the measured activity of radionuclides in food—to 'estimated dose'—the calculated damage expected to occur once radionuclides enter a human body.

⁴⁰² The phrase is borrowed from Kimura (2016a: 48).

⁴⁰³ Also see Tabuchi (2011) and "Beef containing radioactive cesium served" (2011).

⁴⁰⁴ See Ministry of Health (2011).

As the ‘cesium beef scandal’ took place when the provisional reference limits were coordinating activities among agrifood assemblage actors, the legally established effective dose from cesium-134 and cesium-137 was 5 mSv/year. As the ‘cesium beef scandal’ highlights, once foods ‘over provisional limits’ were circulated and ingested by bodies within the agrifood assemblage, these dose estimates were activated in attempts to enact these bodies—and others who notice the inconsistencies—as *anshin* through ‘unbiased’ and ‘neutral’ risk communication. Kimura (2017) points out one such example: an expert response to the ‘cesium beef scandal’ included in a newsletter designed as a tool for risk communication following the discovery of the ‘cesium beef’ in some school lunches in Yokohama City. The expert, Karaki Hideaki (2011) explains:

the standard is not a clear boundary between safety and danger, so even people who temporarily ate the beef don’t have to worry about the emergence of health impacts. It is said that “radiation will damage genes, cause cancer. Therefore, it is best to avoid even small exposures.” However, the standards for radioactive cesium in food is not zero, but 5 mSv (millisieverts) a year.

Karaki (2011) goes on to describe how even if someone did receive a dose of 5 mSv/year “there will be almost no increase in the risk of cancer.” Looking to the colorful illustration of radiation doses to the right of Karaki’s article reveals that his confidence is drawn from his activation of another dose estimate: the ‘around 100 mSv threshold assumption’ often activated by the Food Safety Commission, the ICRP and various organizations active within in the transnational nuclear assemblage (see Figure 11, Section 5.4.1 and Section 5.5).⁴⁰⁵

Created by the National Institute for Radiological Sciences (NIRS) (2013), the illustration has appeared in a number of risk communication documents in Japan since the onset of TEPCO’s nuclear disaster. The illustration shows an inverted pyramid with doses of ‘artificial radiation’ on the left, ‘natural radiation’ (NORM)⁴⁰⁶ on the right, and descending dose levels. The colors start at red, blend into yellow and end in a soothing

⁴⁰⁵ The illustration shown in Figure 11 is a newer version of the Dose Scale than was printed in the newsletter, thus the arrow at 100 mSv is pointing up instead of down. These difference are described in this section.

⁴⁰⁶ See Section 5.4.2.

hue of blue. At 100 mSv, a bold red line is drawn. In the Yokohama newsletter, which uses one of the earliest versions of the illustration, the pyramid is split in half, each half placed near an article written by a male described as an ‘expert.’ At the line there is a downward pointing arrow, next to which reads: “excess incidence of cancer is not confirmed” (T. Inoue, 2011; Karaki, 2011). Tsuda and colleagues (2017) explain how this illustration has been updated since its first deployment as a risk communication tool in April 2011, but any differences among its versions, or any inconsistent translations of what the authors term the “100 mSv threshold assumption,” are left unexplored and unexplained. In fact, Tsuda and colleagues (2017) point out that discussions about the assumed threshold are strictly kept out of scientific debates due to fear of causing “anxiety” (*fuan*) among members of the public. The authors explain:

There is no discussion on the 100 mSv assumption in academic and medical societies in Japan. One reason for this is that it is regarded as ‘unethical’ to debate this matter in public because it is thought to generate anxiety among residents in Fukushima Prefecture. The aim to ‘dispel anxiety’ is currently given top priority not only in Fukushima but also throughout Japan. This is an ethical problem.
(Tsuda et al., 2017: 3)

Due to the lack of discussion about the assumed ‘threshold’ and its various interpretations in risk communication texts and discourses, different versions of the illustration continue to circulate around the internet and can be found in government documents (Tsuda et al., 2017). Later versions—such as the version in Figure 11—continue to include a bold red line at 100 mSv, but with an arrow pointing up and reading, “It has been found that the risk of cancer death will gradually increase with radiation dose” (CAA, 2017b; MHLW, 2013a).⁴⁰⁷ According to Tsuda and colleagues (2017), however, even this new portrayal is a misinterpretation of scientific studies on exposure to ionizing radiation. The red line seems to enact an image of certainty in the science of radiation protection, when vast uncertainty remains. That is, the line’s solid and bold figure superimposed onto the 100 mSv mark seems to smooth over any uncertainty in the science of radiation protection; its accompanying message enacting

⁴⁰⁷ This is a direct quote from the English version depicted in Figure 11.

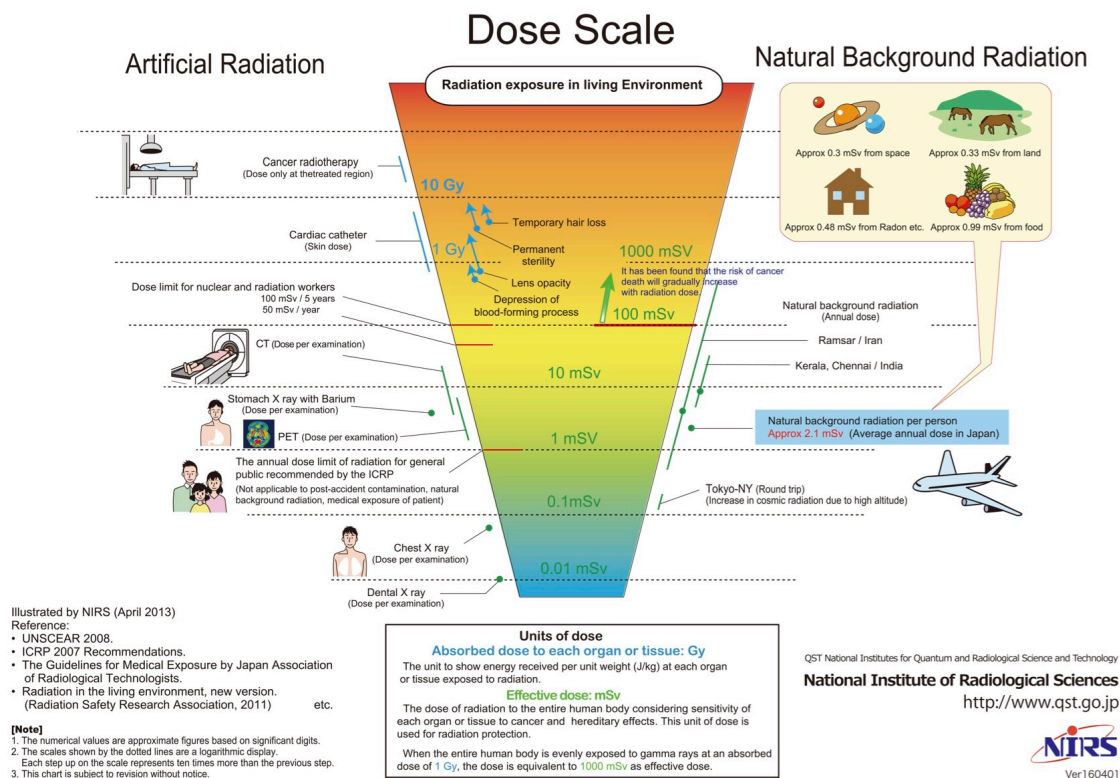


Figure 11 Dose Scale illustration (in English) produced by the National Institute of Radiological Sciences (2013) in Japan. Because this is a 2013 version, the arrow at the 100 mSv line is pointing up, instead of down as in the newsletter.

some estimated doses above the line as ‘possibly causing cancer,’ and those below it as ‘not being proven to cause cancer.’ Even when the illustration is not presented, statements such as, “According to current scientific thinking, the effects of exposure to less than 100 millisieverts is so small that it cannot be confirmed” can be found in risk communication documents (CAA, 2017c: 5). Such statements can easily be misunderstood by readers to suggest doses under 100 mSv of ionizing radiation are scientifically proven to be ‘safe’ (Tsuda et al., 2017).

While the Food Safety Commission has refused to refer to 100 mSv as a “threshold” as it is known in toxicology—that is, drawing a line between ‘toxic and ‘nontoxic’ (Koizumi, 2011b: 2)—it is clear that they and other government agencies continue to use the value of “around 100 mSv” to represent a threshold below which scientific studies have been able to ‘confirm’ damage to health—at least according to the scientific studies in the bibliographies of their reports.⁴⁰⁸ Here, the uncertainty

⁴⁰⁸ See Section 5.5.

stabilized within the textual complex of the transnational nuclear assemblage is able to assist in smoothing over inconsistencies among different enactments of government certified ‘safe food’ (Section 5.4.1). While food declared as ‘under the reference limit’ is easily enacted as ‘safe food’ in both discourse and legal texts, food ‘over the reference limit’ can also be enacted as ‘not necessarily unsafe’ since calculations of equivalent and/or effective doses—which provide the basis for calculations of reference limits—can be used to prove scientific uncertainty in detecting negative effects. Thus, through activating the transnational nuclear assemblage’s ‘100 mSv threshold assumption,’ foods ‘over the reference limit’ may not be directly referred to as ‘safe,’ but are enacted as ‘not necessarily unsafe’—an enactment which blends in well with other performances of ‘safe foods.’ The transition from ‘provisional’ to ‘new’ standards in 2012—and questions about how levels of cesium-134 and cesium-137 at 500 Bq/kg and 100 Bq/kg could both be enacted as ‘safe’—could also be smoothed over through the activation of the ‘100 mSv threshold assumption.’

Thinking back to the concepts of effective versus equivalent dose used to enact ‘not necessarily unsafe food’ raises another question: what kinds of bodies are being enacted through activating these dose calculations? Essentially, they are bodies that interact with radionuclides in the same fashion as in the models that make up the ICRP’s Reference Person (Section 5.4.1). That is, bodies become a number of distinct ‘critical tissues’ that hang together through models and averaging. Within these bodies, unstable ionizing radionuclides are ingested and travel to different ‘critical tissues’ which may receive varying doses of exposure to radiation depending on the radionuclide.⁴⁰⁹ According to Japan’s ‘provisional’ standards for iodine-131, bodies are enacted as thyroid glands. Standards for cesium-134 and cesium-137, on the other hand, enact bodies as a mix of ‘critical tissues’ held together through averaging of possible doses to each individual part. How to deal with difference among bodies with more breast tissue, or ovaries versus testes? The heterogeneity in these cases are also resolved through the technique of ‘sex-averaging.’ Again, autopoietic stories about ‘individual bodies’ and their various ‘units’ dominate models for estimating radiation ‘dose,’ pushing any questions about symbiotic or sympoietic relationality to the sidelines—

⁴⁰⁹ For example, iodine-131 mimics iodine so is expected to interact with the thyroid, cesium-134 and cesium-137 mimic potassium so are expected to interact with the whole body, and strontium-90 mimics calcium so is expected to interact with bones (see Hirano et al., 2016).

ending up as stochastic ‘noise’ within the models designed within the transnational nuclear assemblage (Section 5.4.1).

Overflows of foods ‘over the reference limit’ continue to appear and exacerbate tensions among various enactments of ‘safe food,’ even in 2016 and 2017. During my fieldwork in 2016, a case of fresh bamboo shoots (*takenoko*) being served in a school lunch in Utsunomiya City, Tochigi Prefecture was discussed by some of my participants.⁴¹⁰ Bamboo shoots have been included in all revisions of the *Concepts of Inspection* since June 27, 2011, always falling into the first category of “items subject to inspection” which include foods from which levels of cesium-134 and cesium-137 had been detected ‘over the reference limit’ in previous tests.⁴¹¹ Additionally, because *takenoko* are wild foods usually gathered seasonally from local forests, they are often left out of screening procedures. Thus, as Hotaru’s earlier comments about school lunch illustrate, alongside milk and mushrooms, bamboo shoots have been a food of concern for many people trying to avoid ingesting TEPCO’s radionuclides.

The discussion about the bamboo shoots found ‘over the limit’ in Utsunomiya City came up during the CRMS-organized field trip to the tea farm in the Kansai region. I had noticed a news article circulating about the incident over social media the day before, and the topic was brought up by one woman on our drive to the farm. As all of the women in the car were mothers, they were horrified that children were involved in the incident. However, having lived through five years of TEPCO’s radiological overflow, they commented that there is no surprise in how it was handled. They noted how the activation of dose limits was always the way out of such a predicament.

A May 11, 2016 *NHK* news article describes how a wholesaler in Utsunomiya City purchased the bamboo shoots—measuring 234 Bq/kg, more than two times the new reference limits—from a rogue “man” who did not know about the shipping restriction on the wild delicacies which were cooked into a delectable seasonal dish (bamboo shoots and rice) and served to the school children (“Radioactive material over the

⁴¹⁰ See Figure 9 for the location of Utsunomiya City.

⁴¹¹ See Ministry of Health (2011k; 2011m; 2012e; 2013b; 2016b; 2014; 2015; 2017).



Figure 12 Bamboo shoots harvested by the author during a visit to a tea farm in the Kansai region. Photo taken by author.

limit,” 2016). The city’s Health Department commented on the incident: “The amount of bamboo shoots [*takenoko*] consumed by each child was not a lot, so the values are *not expected to pose any immediate health effects*. However in order to provide a safe school lunch, we want to ensure a thorough investigation is carried out” (“Radioactive material over the limit,” 2016, emphasis added). The phrase ‘not expected to pose any immediate health effects’ was a favorite of the Japanese government following the nuclear disaster.⁴¹² While it struck a nerve with many commentators (“The suspicious backdrop,” 2016), the women in the car seemed displeased, but used to the phrase as it had appeared each time a breakdown in the screening process was exposed. During our field trip, the farmer invited us to dig up bamboo shoots growing in a grove near where we at lunch. As I dug up a bamboo shoot to take home, I could not help thinking about the ‘man’ in the news article who had done the same not long before (Figure 12).⁴¹³

⁴¹² The phrase was also mentioned by Madoka in Chapter 4, where she described its deployment in the media from the very outset of TEPCO’s nuclear disaster, immediately after the first explosion at the power plant. Also see Webronza (2013).

⁴¹³ I had learned from my time at various CRMSs that while the Kansai region has not been affected greatly by TEPCO’s overflow, remanences of radionuclides from nuclear bomb tests in the Pacific and possibly even the Chernobyl disaster have been measured in foods throughout

In the case of the bamboo shoots in Tochigi Prefecture, once again food found ‘over the reference limit’ could be enacted as ‘not expected to pose any immediate health effects’—an enactment which seems to cause little inconsistencies with other enactments of ‘safe food.’ Also, because the incident was caused by a careless ‘man’ and not the school or the Japanese government, and because there were calls for an investigation, the multiplicity exposed through the controversy could be pressed back into singularity.

In 2017, another rogue “man” in Tochigi Prefecture was seen to be instigating tensions in the enactment of mushrooms as ‘safe food.’ As mentioned in Chapter 4, mushrooms are efficient bioaccumulators of radionuclides and have been included in the *Concepts of Inspection* since June 27, 2011—specifically wild mushrooms which do not conform to parameters set out by the government.⁴¹⁴ News reported on August 25, 2017 revealed that the mushroom *Lactifluus volemus* (*chichitake*) was measured at 720 Bq/kg, though this was only realized after the mushrooms were sold. In this case, because the radioactivity was discovered before consumption was recorded, instead of enacting these mushroom as ‘not necessarily unsafe’ the news article provides a phone number, relaying a request from the direct distribution outlet responsible for selling the items: “Along with the launch of a voluntary recall, the direct distribution outlet is requesting all purchasers of [the mushrooms] to refrain from eating and to return them” (“Radioactive material from direct distribution,” 2017). When cases of contamination are found before consumption is recorded, ‘safe food’ can remain stably and singularly as food that is ‘under the limit.’ To abide by the Food Sanitation Act, wholesalers must prevent bodies from ingesting mushrooms containing radioactivity 7.2 times higher than the reference limits as, at this point, the food would not be legally fit for sale. However, once bodies do ingest food with concentrations of radioactivity ‘over the reference limit’—as in the cases of ‘cesium beef’ and bamboo shoots in school

western Japan. There were also cases of mushrooms being found with radionuclides, but in many of these cases the contamination was because the trees they grew on came from areas in north-eastern Japan where higher concentrations of TEPCO’s radionuclides were deposited. These were some of the many things I considered as I dug up that bamboo shoot, and will be discussed further in Chapter 7.

⁴¹⁴ See Ministry of Health (2011k; 2011m; 2012e; 2013b; 2016b; 2014; 2015; 2017).

lunches—these same foods that were once ‘not fit for sale’ can be enacted as ‘not necessarily unsafe’ by turning away from reference limits to a focus on estimated doses based on models involving the ICRP’s Reference Person.

These examples highlight the difficulty of enacting the seemingly singular object of ‘safe food’ when radionuclides are involved—their instability disrupting stories of ‘control’ and ‘stability’ that are so necessary for the smooth circulation of economic markets.⁴¹⁵ While the deployment ruling discourse is able to establish a structuration of perspectivalism which categorizes ‘good’ and ‘bad’ bodies according to their acceptance of the ‘single reality’ being deployed, numerical reference limits and estimated ‘safe’ doses of ionizing radiation borrowed and translated from the transnational nuclear assemblage assist in making sure enactments of ‘safe food’ hang together long enough to appear as solid and singular. It is these multiple enactments of ‘safe food’ that my participants, and myself, interact with in our everyday lives. However, the multiplicity does not end with the activation of dose estimates. One final process for enacting ‘safe food’ that I would like to briefly address are the locally based measuring processes themselves—the relations among bodies, machines, foods, radionuclides and other situated actors which participate in the enactment of foods categorized as either ‘over the reference limit’ or ‘under the reference limit.’

6.5 Enacting ‘safe food’ through situated practice: Radionuclides, machines and confining heterogeneity within an evolving textual complex

Into 2016 and 2017, media reports and various forms of risk communication continue to attempt to stabilize and contain the activity of radionuclides with statements about the number of foods found ‘under the reference limit.’ Newspaper headlines reading “Less Than 0.01% of Fukushima Products Over the Limit” (2016) and “Inspections for Radioactive Materials Show Fukushima Prefecture's Vegetables and Fruits All Fall Under the Reference Limit” (2016) continue to participate in enacting food that possibly contains TEPCO’s radionuclides as ‘safe’—with a large focus on food produced in Fukushima Prefecture. The Consumer Affairs Agency’s (2017c: 10) mini risk communication booklet also uses the test results to illustrate a ‘stable’ decrease in radioactivity: “Since the beginning of the fiscal year in 2013, test results have shown

⁴¹⁵ See, for example, Callon (1991).

that vegetables, fruits and tea have not exceeded reference limits. All livestock products have also been within the limits. Also, since 2015 rice and pulses have not been found over the reference limit (as of December 26, 2016).” Material semiotics and institutional ethnography teach us that beneath ruling texts and discourse always exist situated activities within tangles of human and more-than-human sympoietic sociomaterial entanglements. While efforts to manage the ‘safety’ of food circulating within the agrifood assemblage are able to frame *all* food as ‘safe,’ it is important to notice some of the heterogeneity that lies behind these enactments—the situated scientific practices behind the claims portrayed under the guise of a ‘neutral,’ ‘unbiased’ and all-reverent ‘Science.’ Thus, in this final section, I will take a look deeper to explore how these measurements are enacted through locally situated performances among bodies, foods, machines and radionuclides.

As previously mentioned, since the onset of TEPCO’s nuclear disaster in 2011, government screening processes for measuring radionuclides have been evolving, with details on updates and amendments noted in the various versions of the *Concepts of Inspection*. By the time of my fieldwork in 2016, the “items subject to inspection” expanded to eleven categories which are “identified based on values detected in the past” (MHLW, 2016b: 6-8).⁴¹⁶ That is, the data accumulated from the previous year is

⁴¹⁶ In 2016, the items on the list included: 1. Foods that tested ‘over the limit’ in the previous year (specifically mushrooms and wild plants including bamboo shoots, wild meat such as boar and deer, and buckwheat, among others); 2. Foods that tested at half of the reference limit (50 Bq/kg) of cesium-134 and cesium-137 in the previous year (including broccoli, Japanese mustard spinach (*komatsuna*), Japanese apricot (*ume*), Japanese persimmon, log-grown *shiitakei*, rice, soybeans, and honey, among others); 3. Foods that serve as indicators of ‘safe’ feeding management for cattle (milk and beef in Iwate, Miyage, Fukushima, Tochigi and Gunma prefectures); 4. Fishery products that measured at half of the reference limit in the previous year (both marine and fresh water fish); 5. Food items that are consumed in high quantities by the population (according to the National Health and Nutrition Survey of 2013) and major agricultural or fishery products (after taking into consideration the “status of production”); 6. Foods with a restriction since April 1, 2015; 7. Foods circulating within the market (when information on processor and producer is identifiable); 8. Dried processed foods (except those that will be consumed after reconstitution with water); 9. Foods where half of the reference limit was measured in the previous year, but is assumed to be due to improper management techniques that led to contamination; 10. Foods that have not yet been inspected since the disaster (however, radiation levels in these products could also be estimated based on similar “benchmark items”); and 11. Other food items as specified by the government (MHLW, 2016b: 6-8). By 2017, the number of categories decreased from eleven to nine (MHLW, 2017).

used to predict the necessity for the current year's testing procedures. The Ministry of Health has been uploading hundreds to thousands of page-long spreadsheets listing test results gathered from testing centers around the country since the onset of the nuclear disaster (for example, MHLW, 2016a). The spreadsheets provide various bits of information that offer clues about sociomaterial relationality involved in enacting the test results at each location. The columns on the spreadsheet include: (1) the test number; (2) the reporting municipality; (3) the organization in charge of enforcement; (4) the prefecture where the food is from; (5) the local area where the food is from; (6) other information on the specifics of the food; (7) indication if the food is circulating in the agrifood assemblage or not; (8) the food category; (9) the food name; (10) other information on the food or its testing; (11) the name of the agency that conducted the test; (12) the type of machine used; (13) the harvest or purchase date; (14) the date the test results were attained; (15) the date the results were announced to the Ministry of Health; (16) the results for cesium-134 (17) the results for cesium-137 (18) the results for a combination of both cesium-134 and cesium-137—often indicated as a value less than (<) the 'minimum detection limit' (*kenshutsu kagenchi*); and (19) a column to indicate (with a circle ○) any test results that are over the reference limit (see Figure 13). In the following section, I would like to briefly untangle some of the sociomaterial relations being stabilized within these spreadsheets, specifically relating to the results of cesium-134 and cesium-137 (column 18) and the types of machines used in enacting the results (column 12).

While the International Atomic Energy Agency (2011: 41-9) lists over 300 measurable radionuclides in food and water following a nuclear disaster, in Japan—as in most countries—the activity concentrations of three radionuclides were chosen, at least initially, as indicators of radioactivity in food: cesium-134, cesium-137 and iodine-131.⁴¹⁷ The choice of indicators is practical: because all of these radionuclides emit

⁴¹⁷ See Steinhauser (2014: 4649) for an overview of the many disregarded radionuclides that were released in the aftermath of TEPCO's nuclear disaster, what he refers to as "'orphan' radionuclides."

gamma rays, it makes them much more convenient and economical to measure.⁴¹⁸ At the same time, however, difficult-to-measure alpha particle-emitting radionuclides (such as plutonium-239) and beta particle-emitting radionuclides (such as strontium-90)⁴¹⁹ are of particular concern when it comes to internal exposure due to the uncertainty of their behaviors and interactions upon entering human bodies. Unlike gamma rays which pass through the body, when ingested, alpha and beta particles may become lodged in the body and cause damage to nearby cells (see Section 5.2).

Given the complexity of measuring radionuclides without gamma emissions, estimations on the possible presence of alpha and beta particle-emitting radionuclides are assumed based on calculations of ratios. For example, the ‘new’ numerical reference limits for the two indicator radionuclides cesium-134 and cesium-137⁴²⁰ are also intended to account for the possible presence of other alpha and beta particle-emitting radionuclides through calculations of estimated proportionality.⁴²¹ Thus, even if the Ministry of Health’s spreadsheet only indicates the ‘singular presence’ of radioactive cesium-134 and cesium-137, the ‘multiple absence’ of a number of other difficult-to-detect radionuclides are assumed to be present—at least according to documents describing the scientific principles behind the chosen ‘new reference limits.’ (see MHLW, 2011a).⁴²²

While focusing on levels of cesium-134 and cesium-137 in food may be an economical and efficient way to screen for radionuclides, decreases in radioactive cesium may not always indicate a decrease in the other alpha- and beta-emitting radionuclides lurking beneath declining measurements. Take for example an article by the *Fukushima Minpo* titled: “All 2014 Fukushima Rice Cleared Radiation Tests, Thanks to Fertilizer” (2015).

⁴¹⁸ See Agency for Toxic Substances and Disease Registry (2004) for an overview of the different emission types of some of the radionuclides mentioned in this section.

⁴¹⁹ Cesium-134, cesium-137 and iodine-131 are also beta emitters.

⁴²⁰ Again, iodine-131 is no longer measured due to its short half-life.

⁴²¹ According to the Ministry of Health (2011a: 3), strontium-90, plutonium-238, plutonium-239, plutonium-240, plutonium-241, and ruthenium-106 are taken into consideration in the ‘new reference limits’ for cesium-134 and cesium-137. That is, the reference limits chosen for cesium-134 and cesium-137 should ensure that exposure to all of these radionuclides do not result in an estimated dose of ionizing radiation from food of more than 1 mSv/year.

⁴²² See, for example, Ministry of Health (2011a; 2012b).

As previously mentioned, cesium is chemically similar to potassium, thus not only could it be mistaken for potassium once it enters active human bodies, but also the active bodies of plants and animals. Since early on in the disaster, many countermeasures have been applied to decrease levels of detectable cesium-134 and cesium-137 in food, the addition of copious amounts of potassium fertilizer being one of them (N. Kato et al., 2015).

According to some studies, changes in on-the-ground practices—specifically adding potassium fertilizers to soils—have been able to decrease the amount of cesium being absorbed by many crops (Tsukada & Ohse, 2016). However, these practices are not visible within the data as presented in the spreadsheets. Thus, many questions remain about the other alpha and beta particles that may be hidden within these declining cesium-134 and cesium-137 measurements. In addition, without explanations about farming practices made clear in spreadsheets, the declining levels may be assumed to be ‘natural’ and not due to the persistent efforts of farmers on the ground. This includes the exposure of farmers to innumerable other radionuclides they are in relation with on a daily basis when working in the fields or with their livestock. Here I will turn back to my focus group session with three CRMS volunteers in the Kansai region—Daiki, Kazuki and Maiko—to illustrate how some of my participants were grappling with these less straightforward issues which take into consideration the messy sociomaterial entanglements of farmers living and working among large concentrations of TEPCO’s radionuclides.

Karly: If you read the Fukushima Minpo, they say everything is ‘under the limit.’

Daiki: Yeah, the reference limit is 100.

Karly: They say because it’s ‘under the limit,’ you don’t need to worry.

Kazuki: Because the limit is so high, that’s why they can say it’s okay. They purposefully made it high.

Daiki: Well, now I feel there is certainly not much rice that is over 100 Becquerels. Recently some rice from Fukushima was measured

[...], from a place that was really contaminated. [...] It was an official evacuation zone. The evacuation order was cancelled in around May this year. A year before, they were trying to grow rice experimentally, but it wasn't sold in the local market. They just wanted to try to grow it. They measured the rice, they measured brown rice. But there was not a lot of radiation found. There were just a few Becquerels. Why was that the case? [...] A person from that place, people from Fukushima, they know that their rice paddies are contaminated, so there are various countermeasures they take. Well, they often spread potassium and whatnot. That and zeolite. Zeolite, which absorbs cesium, they spread large amounts of it. Well, by doing these things, through a lot of hard work, the radiation problem does not transfer to the rice. Beyond that, people in Ibaraki Prefecture, they are not doing these things. Earlier, someone in my neighborhood received some rice from Ibaraki Prefecture. So, they thought they would eat a little, but they were a little worried. When we measured it, we found 15 Becquerels. Well, it was produced using natural farming practices. Trying so hard, without using any chemicals or fertilizers, only using natural fertilizers. They were grown so consciously without using any pesticides. But regarding cesium, they had no countermeasures. That's why, in the end, there was radiation.

Kazuki: And now. Organic production is reversely more dangerous. Things like cow manure. [...]

Daiki: Things like manure. And mulch. [...]

Kazuki: Well, they are also giving [straw and such] to cows in western Japan.

While food below 100 Bq/kg of cesium-134 and cesium-137 are legally allowed to circulate within the agrifood assemblage, the farmers are legally allowed to apply manure and other soils measuring up to 400 Bq/kg of these radioactive cesium isotopes (CAA, 2017b: 32). This scenario in which farmers are expected to work within potentially high levels of cesium-134 and cesium-137 brings up further questions about

the dispensability of farmer bodies at the expense of enacting ‘safe food.’⁴²³ If the cesium-134 and cesium-137 are not absorbed by these ‘safe foods,’ then they remain in the soil where they may enter the bodies of farmers, people that join farm tours as tourists, or during group planting activities (for example, “Kawauchi's rice,” 2012).⁴²⁴ And what happens to the ecosystem when there are copious amounts of extra potassium fertilizer being added? Again, the ‘multiple absence’ behind the decrease in cesium-134 and cesium-137 produces many questions. But before becoming too distracted by the multiplicity and heterogeneity,⁴²⁵ I would like to get back to the Ministry of Health’s spreadsheet.

Before discussing how to understand results being presented on the spreadsheet, it might be useful to discuss the variation in machinery being used at each site. While in 1954 Geiger counters were used to test for radioactivity emitting from the bodies of tuna fish possibly containing radionuclides from the United States’ nuclear bomb tests in the Pacific (see Section 5.3), laws for measuring radionuclides in food following TEPCO’s 2011 overflow required much more sophisticated—and much more expensive—machinery for measuring gamma-emitting radionuclides.

⁴²³ While I am unable to go into the issue here, this does bring up further questions of the dispensability of bodies within capitalism as discussed by academics such as Neil Smith (2011) and Julie Guthman (2011).

⁴²⁴ Farmers and their supporters in Japan’s Family Farmer’s Movement (*Noumiren*) have been petitioning the government to implement measures to decrease the amount of radiation exposure farmers are receiving. The group has also mentioned that there have been a number of cattle deaths linked to the ingestion of potassium fertilizers (see M. Honda, 2016).

⁴²⁵ There are many more aspect that could be brought up here. For example, the further alienation of farmers from their own farming knowledge and practices. As mentioned, so-called ‘plant farms’ are being proposed as one way to decrease levels of measurable cesium-134 and cesium-137 in foods (Sekine & Bonanno, 2016). Also, Yamaguchi (2016) points out that farmers in areas where there are countermeasures in place are required to use not only potassium fertilizers, but also zeolite on their fields if they want to receive any support. Those who disagree with these policies are left behind. Additionally, as mentioned by Daiki, most of the focus for these countermeasures and ‘revitalization’ projects are given to Fukushima Prefecture, abandoning many farmers living in various other radioactive hot-spots. With everyone’s focus on food from Fukushima Prefecture and so little known about the hard work farmers are putting into lowering the amount of measurable cesium-134 and cesium-137 in the animals and plants they raise, decreases in radionuclides in foods produced in the prefecture might lead others to incorrectly assume that these decreases are ‘natural.’

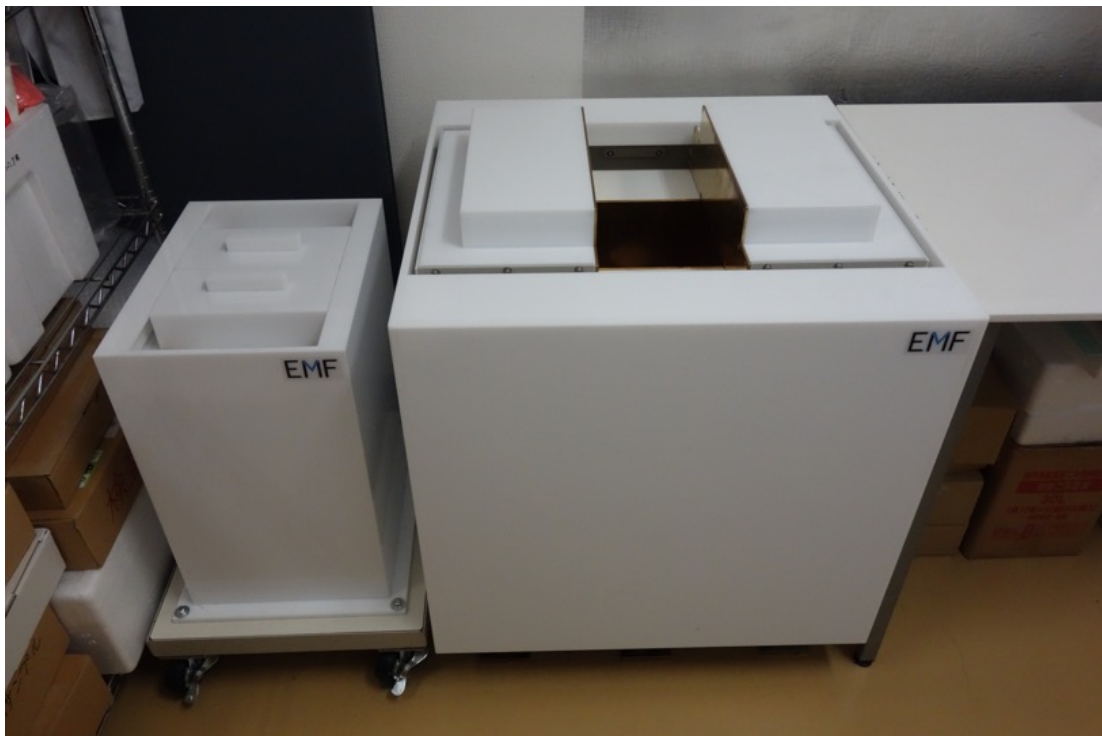


Figure 14 Some of the measuring devices I saw during my fieldwork in 2016. Water bottles are used to block ambient radiation that may interfere with measurements. Photos taken by author.

There are two main classes of machinery used in Japan for testing gamma-emitting radionuclides: germanium semiconductors and scintillation detectors. While germanium semiconductors are much more precise and accurate than scintillation detectors, they are also much more expensive and therefore not an option for many local municipal governments.⁴²⁶ Along with the adoption of the ‘new reference limits’ in 2012 came some changes to screening procedures which are now designed to include both kinds of measuring devices (MHLW, 2012c). The Japan Radioisotope Association (2015) published a list of over fifty scintillation machines that could be used in government screening tests, including a number of thallium doped sodium iodide (NaI (TI)) scintillation detectors and cesium iodide (CsI) scintillation detectors, among others. Some of the detectors listed are conveyer belt models, often used in measuring rice in Fukushima Prefecture.⁴²⁷ During my fieldwork, I was able to see some of these recommended models at the various CRMSs I visited in the Kansai region (see Figure 14).

The risk communication booklet distributed by the Consumer Affairs Agency (CAA, 2017b: 28, emphasis added) describes how tests results from these two classes of machines are intended to enact ‘safe food’:

Tests are carried out as an association between the *precise* radionuclide analysis of tests conducted using germanium semiconductors and the *efficient* screening tests conducted with NaI (TI) scintillation detectors. [...] Even though NaI scintillation detectors are inferior in precision and sensitivity to germanium semiconductors, they are able to carry out a large number of tests in a short period of time. The price is also much lower than germanium semiconductors. [...] If the results of the screening tests are not

⁴²⁶ While many of the machines used by my participants cost between ¥1,500,000 and ¥2,000,000 JPY (approximately \$14,000-\$19,000 USD), a germanium semiconductor could cost between ¥10,000,000 and ¥20,000,000 JPY (approximately \$90,000-\$190,000 USD). These prices do not include the potentially high costs for maintenance. Also, because a stable temperature is necessary when using these devices, users must spend a lot on their electricity bills to maintain these machines.

⁴²⁷ An article by *Fukushima Minyu News* ("How to convey 'food safety,'" 2016) shows a photo of one of these conveyer belt machines.

below the screening level, [...] a definitive inspection will be made using a germanium semiconductor.

Thus, the new screening method set forth in 2012 attempts to coordinate measuring activities in a way to allow for test results from various machines conducting measurements in various locations to be made comparable, all ‘efficiently’ or ‘precisely’ enacting ‘safe food’—food that measures ‘under the reference limit’—that is legally permitted to circulate within the agrifood assemblage.

While earlier tests often listed test results below the limit as ND (not detectable),⁴²⁸ the newest test results tend to present results as “< 25” if using a scintillation detector, or under a lower number if using a germanium semiconductor. How to understand these numbers? In 2012, the lowering of the reference limits also meant that testing procedures needed to test for lower levels of radioactivity than previously necessary in order to ensure the food being tested could be scientifically verified to be ‘under the reference limit.’ According to the Ministry of Health’s (2012c) *Screening Method for Radioactive Cesium in Food*, the ‘screening level’ was decreased from 250 Bq/kg to 50 Bq/kg (half of the reference limit) and the ‘minimum detection limit’ (*kenshutsu kagenchi*)—also referred to as the ‘minimum measurement limit’ (*sokutei kagenchi*)—was decreased from 50 Bq/kg to 25 Bq/kg (now one-fourth of the reference limit) (see MHLW, 2012a). The screening level has been described in risk communication documents as a scientifically established percentage, below which the activities of radionuclides can be ‘judged’ to be under the set reference limit. The Consumer Affairs Agency (2017b: 28) outlines the purpose of the screening level: “test results beneath this scientifically established level can be judged to be under the reference limit.” The Ministry of Health (2012c: 3 & 7) describes that setting the screening level at half of the reference limit is the most “statistically accurate” method of ensuring screened samples are ‘under the reference limit,’ with a “99% confidence interval.” The minimum detection limit is another tool in the government’s screening method, indicating the minimum amount of radioactivity, above background levels, the test will be detecting.

⁴²⁸ See, for example, Ministry of Health (2011e).

Looking at the test results, most ‘screening’ tests present results found ‘under the reference limit’ as a combined measurement of cesium-134 and cesium-137 less than 25 Bq/kg (“<25 Bq/kg”). While this number appears to indicate that the sample contains less than 25 Bq/kg of cesium-134 and cesium-137, this might not be the case. Instead, the number may simply be indicating the minimum detectable activity measured during the specific period of time it takes for the machine to determine that the sample is under the screening level (50 Bq/kg). Thus, while this technique may be useful for ensuring levels of cesium-134 and cesium-137 are under the 100 Bq/kg reference limit, they do not provide much information for people interested in knowing the actual activity of radionuclides in the foods being measured. This would involve much longer, and more careful forms of tinkering with these machines, something done at many CRMSs, but not often possible at government testing stations which must be expedient in order to keep up with the temporal pace of commerce. Instead of providing numbers for careful deliberation, government testing procedures serve to enact government certified ‘safe food’— food that is ‘under the reference limit’ and can, thus, legally circulate within the agrifood assemblage.⁴²⁹

For most of my participants, the data produced by the Ministry of Health was not very useful as they were more interested in knowing the actual measurements of radionuclides found in food. During my fieldwork in 2016, I was able to visit a mixture of CRMSs, food cooperatives, cafés and restaurants that were testing food for radionuclides. It was at these places that I learned about how people were tinkering with their various machines in ways that produced numerical values they could trust. For example, one CRMS tested each of its samples for at least ten hours in order to ensure the results were valid. Others would have a set limit of about three hours, or would check in after one, two, or three hours to decide whether or not it would be useful to prolong the test. As was probably the case with all of the government personnel who needed to quickly obtain and master how to use these complex machines, I heard many stories from my study participants regarding their processes of obtaining and learning how to use their own machines—many of them spending long

⁴²⁹ See Burch, Legun and Campbell (forthcoming) for more on the deliberation of numbers following TEPCO’s nuclear disaster.

hours and sleepless nights tinkering with the various parts and accompanying computer software packages.

In the days leading up to TEPCO's nuclear disaster, one of the food cooperatives in the Kansai region now testing for radionuclides in food had been active connecting with farmers in the Tōhoku region, collecting signatures to petition the government regarding the Rokkasho Nuclear Fuel Reprocessing Facility in Rokkasho-mura (Rokkasho-village), Aomori Prefecture, the most northern prefecture on the island of Honshu (see Figure 2). They submitted their petition to the government on the same day as the onset of TEPCO's nuclear disaster. Imai Yukari (pseudonym), one of the volunteers at the cooperative, described how the cooperative worked through the *konran* that erupted following TEPCO's overflow:

Yukari: On March 11th we handed over the signatures. [...] At that time, when we said, "Japan is a country with many earthquakes so it is dangerous," they said something like, "We are working diligently."

Karly: So when you handed over the signatures, you said that nuclear power was dangerous?

Yukari: We said it. But from their side we only heard the set phrases: "We are diligently following the provisions," "There will not be an accident," and "No radiation will be released into the environment."

Karly: And then the earthquake struck.

Yukari: Yes. [...] We had submitted the signatures and just after the earthquake began. [...] We had a high awareness about nuclear power and radiation, a relatively good understanding, so after the accident we were quickly able to establish countermeasures.

Karly: What did you decide?

Yukari: We quickly spoke about measuring. But, at the beginning we didn't have the best measuring device. [...] There was one woman who quickly from the start, we really didn't know any better, so we

measured vegetables with a Geiger counter. (Laughing at herself)
[...] We didn't know anything about how the readings are influenced
by the surroundings. There were so many things we didn't know. It
took experience.

Like many people in the aftermath of TEPCO's nuclear disaster, Yukari and many of my other participants learned about radiation through making many mistakes in real time.⁴³⁰ In fact, like Yukari, many of my participants laughed at themselves as they thought back to the ways that they initially thought Geiger counters were useful tools for measuring radiation in food. Because it took time to obtain a machine designed to measure food, Yukari explained that she and others in the cooperative spent a lot of money at the beginning sending food samples to a laboratory in Kyushu that had a germanium semiconductor. When I visited the cooperative's measuring station in 2016, they had a full time staff testing a variety of foods. The cooperative includes this data in its weekly catalog.

Almost all of my study participants had, at one point or another, joined a food cooperative that tested its food for radiation. In discussing these different cooperatives, it became clear that they each had their own reference limits, minimum detection limits, machines, measuring periods, and ways of sharing their data. Beyond choosing a reference limit they felt most comfortable with, one of the most important aspect for my participants was that the numerical measurements could be linked to a real food item they might purchase. Also, the ability to contact and ask questions about various foods also brought them a sense of comfort—though people working at the cooperative explained that this made work difficult for them as they received very specific questions about ingredients, particularly when it came to processed food items where the source of the various ingredients might change depending on season or price.

While producing numbers for deliberation consumes a lot of time and money, I met many people who felt the practice of making radionuclides visible through numbers

⁴³⁰ Each cooperative had its own processes for dealing with the overflow of TEPCO's radionuclides. See Kimura (2012) for a description of how a different group, the Seikatsu Club Consumer Cooperative, worked through the *konran* they experienced in the aftermath of TEPCO's nuclear disaster.

was of utmost importance, even five years after the onset of TEPCO's nuclear disaster. Yanagiba Akira (pseudonym), a volunteer at one of the CRMSs I visited during my research, describes why he believes citizen-run, locally based measuring stations play an imperative role in helping people to stay attuned to the activity of TEPCO's radionuclides, particularly within textually-mediated ruling relations which fervently work to silence both radionuclides and discussions about them.

Karly: Does your measuring station have a goal?

Akira: We don't have a particular goal.

Karly: You don't?

Akira: No, we don't. It's just to look.

Karly: Just to look?

Akira: Yes, that's right. Therefore, we measure and show the results. The point is for the results to be seen. So, consumers, well, our members and whatnot can look at those measurement results, and they can decide for themselves whether to eat it. Is it good to eat? Is it best not to eat? If it is locally produced [in this prefecture], it's maybe okay. But I should not feed this to my grandchild. Those kinds of decisions. [...] After all, depending on the person it's different. [...] The measuring station, well, we have various duties. One is to inform people about the dangers of exposure to low-doses of radiation. It is not simply saying that it would be best to have no radiation. There is pesticide residue, chemicals and whatnot, there are so many various things. What this means is it is important to think about food safety in its entirety. Another duty is to take back science. I'm more of a humanities person, someone with absolutely no relation to Becquerels, Sieverts. But, just like this through studying, we ourselves are one-by-one taking back science, so that we are not deceived by the government, various administrations, people referred to as experts and such. In other words, it's a way of life where we ourselves protect our own lives, our own health, our own families and children's futures. We have to keep doing it, if not we

may face big trouble. Well, it's for that reason measuring stations, they are places with a lot of significance.

Ultimately, standardized testing procedures conducted by the Japanese government and filtered into spreadsheets help to provide some stability and consistency in the face of heterogeneity in background radiation, measuring equipment and myriad other sociomaterial interactions within each specific testing location. However, in the same way that historical overflows of radionuclides were translated and contained within the vast textual complex of the transnational nuclear assemblage (Section 5.3), standardized testing procedures work to translate and contain the volatility and heterogeneity of ionizing radiation within an ever-expanding textual complex. That is, the multiplicity and heterogeneity of radionuclides are filtered back into a textual complex where their instability can be managed, and the vast data collected on their activities can be used in various attempts to predict future activities of these volatile isotopes in a way that aligns with the legal definition of 'safe food.' However, through tinkering with various machines within their own sociomaterial entanglements, many of my participants have been attuning to the heterogeneity that is left out of government spreadsheets. For many, continuing to measure and produce numbers has been the only way to notice the radionuclides that we all may be interacting with in our everyday lives.

6.6 Conclusion

In an interview with *Asahi Shimbun* ("I don't want," 2016), Tarukawa Kazuya, a Fukushima farmer living in the city of Sukagawa, approximately 60 kilometers from TEPCO's nuclear disaster, was asked by a journalist about the *fūhyōhigai* he was facing.⁴³¹ While it is clear that he himself experiences *konran* about his own everyday activities as a farmer and an 'eating body' in Fukushima Prefecture, his answer does not seem to enact a story which positions consumers as the enemy, perpetuating perspectival debates about radiation and food:

⁴³¹ As mentioned in Madoka's story in Chapter 4, Tarukawa's father had committed suicide after finding out his vegetables, which were measured to be over the reference limit following TEPCO's nuclear disaster, were circulated in the agrifood assemblage. He and his mother became the focus of the documentary *Inheritance (Daichi wo Uke Tsugu)* (J. Inoue, 2015) that was screened in the Kansai region during my fieldwork in 2016.

Our rice, in 2011, radiation was at most around 30 Becquerels. The regulation level was under 500 Becquerels [...] so the numbers were sufficiently okay, but, even still, it's something you put in your mouth. Even I really didn't want to eat it. Well, there is no reason to buy from somewhere else, so I ate it. Nevertheless, when I ship [my food], I get a kind of feeling that I'm doing something bad. I really understand the feeling of people in Tokyo who don't want to eat food from Fukushima. There's this crumbling nuclear power plant, who wants to go out of their way to buy and eat [the food from here]? This is not *fūhyōhigai*. *Fūhyōhigai* is when you can't sell because there are unfounded [rootless and leafless, *ne mo hapa mo nai*] rumors spreading. It's not that. Because there are both roots and leaves. Radiation is really falling.

Through focusing on his own sociomaterial entanglements with TEPCO's damaged nuclear reactors and their overflowing radionuclides, Tarukawa is able to break through perspectival debates about radionuclides, food and bodies to find some common ground with the people who, according to ruling texts and discourses, should be his enemies—his object of blame for all of the hardship he and his family have faced since the onset of TEPCO's nuclear disaster. In this chapter, I have attempted a similar feat: attuning to the seemingly singular object of 'safe food' using sensibilities from the fields of institutional ethnography and material semiotics.

Through examining the enactment of 'safe food' in discourse, through activating reference limits and making judgements, through activating dose estimates, and even through situated tinkering with various machines, I have attempted to illustrate the multiplicity of the seemingly singular object of 'safe food,' and how tensions and inconsistencies among multiple versions of this object clash and are smoothed over in practice. Through my analysis, 'safe food' is exposed as being multiple, no longer a 'matter of fact,' but a 'matter of concern.' That is, the 'safe food' is not singular and stable, but an enactment that emerges from within heterogeneous sociomaterial entanglements. Throughout my analysis, the concept of 'carefulness' (*yōjin*) emerged as a way of thinking about carefully enacting one's relations with radionuclides in the face of coordination efforts asking people to look away and ignore these very

entanglements. That is, instead of advocating the use of rational control to ‘Mind your plate!’, Japan’s food safety regulations enact bodies that are expected to use rationality to ascribe to opposing advice: Don’t mind your plate!

However, the *kanji* characters that make up *yōjin* (用心, use and heart/mind) tell a different story. They point to a kind of vigilant heartfelt and mindful care that is essential for relating to imperceptible and potentially life threatening materials that have overflowed into my participants’ sociomaterial entanglements. In exploring the ways my participants produce or deliberate radiation measurements, we see that ‘safe food’ is not only a ‘matter of concern,’ but also a ‘matter of care’ (de la Bellacasa, 2011)—it takes a lot of time, money and energy to tinker with machines in ways to make visible levels of radionuclides, especially when using less precise scintillation detectors.

Sensibilities from institutional ethnography have been useful in explicating how my participant’s experiences of *konran* related to eating in post 2011-Japan emerge from their entanglement within very complex tangles of textually-mediated ruling relations. In addition, by attuning to experiences of *konran* using material semiotic sensibilities, it becomes clear that *konran* emerges from and is exasperated by the clashing of multiple versions of ‘safe food’ in practice. My analysis has revealed how maintaining a focus on practices and ontionormative enactments within messy sociomaterial entanglements provides an opportunity to break free from the confines of perspectival debates—to take seriously heterogeneity and multiplicity, and all of the political and ethical implications that come from silencing various humans and more-than-humans through the deployment of an epistemologically normative ‘single’ reality. Thus, ontionorms have proven to be an extremely effective tool for thinking through the role of normativities in attempts to coordinate this ‘single reality.’

In both Chapters 5 and 6, I have been explicating the ruling relations involved in coordinating everyday eating following TEPCO’s nuclear disaster. As highlighted in my participants’ stories, producing numbers for deliberation has been one way for them to feel a sense of ease (*anshin*) in the years following TEPCO’s overflow. However, there are many other ways they carefully enact their lives within exceedingly

constrictive ruling relations; these are the experiences I will explore in my final analysis chapter (Chapter 7).

7 *Konran* and *kattō* as enactive: Exploring how experiences of disorder and discomfort participate in enacting care and resistance

7.1 Introduction

One of the first events I attended during my fieldwork in 2016 was a talk by Professor Arakida Takeru of Fukushima University who was invited to the Kansai region by one of the radiation-measuring food cooperatives in the area. Professor Arakida—who had been living in Fukushima City at the time of TEPCO’s nuclear disaster and was very involved in personally helping with initial decontamination⁴³² efforts—rose to the spotlight in 2014 when his name, face, and concerns on the futility of the decontamination process appeared in the popular comic strip *Oishinbo* (or ‘Gourmet Craze’).⁴³³ Given its mention of radiation-induced nosebleeds⁴³⁴ and comments about the futility of decontamination efforts, the comic’s authors and the real-life characters they depicted were immediately chastised in public discourse as being propagators of ‘harmful rumors’ (*fūhyōhigai*). Not only was Professor Arakida accused of spreading

⁴³²Some of Professor Arakida’s earliest experiences were published in a book chapter he authored (Arakida, 2013). The Japanese term for decontamination, *josen* (or *jyosen*) is another compound word made of the *kanji* characters for ‘remove’ (*jyo*, 除) and ‘dye’ or ‘stain’ (*sen*, 染). The Japanese term for ‘pollution’ (*osen*, 汚染) contains the same *kanji* character *sen* and can be understood as a ‘dirty’ (*o*, 汚) ‘stain’ (*sen*, 染). While the term ‘decontamination’ may make sense when dealing with easily containable and controllable materials, the materiality of radionuclides—that is, the inability to remove or completely contain them once they have overflowed into the wild—has led Assistant Professor Koide Hiroaki to instead describe the process as *isen* (移染)—literally ‘move’ and ‘stain,’ which refers to the process as a ‘relocation’ of ‘toxins’ (Hirano et al., 2016: 15). On January 25, 2018 Japan’s Nuclear Regulatory Authority began discussing the possibility of again increasing the allowable estimated dose limits used to categorize areas that are ‘decontaminated’ and those that are not (“Decontamination standard,” 2018). The video accompanying the *NHK* news article shows workers using paper towels and spray bottles to decontaminate people’s homes.

⁴³³ Written by Kariya Tetsu and illustrated by Hanasaki Akira, *Oishinbo* has been a popular comic in Japan since its debut in the 1980s. Professor Arakida appeared in an episode titled “The Truth of Fukushima” first published in May 2014 in a weekly comic magazine. The comic was later published in an *Oishinbo* comic book (Kariya & Hanasaki, 2014). Also see Ochiai (2013).

⁴³⁴ See Ochiai (2013) and Hirano et al. (2016: 11-2) for further discussion of the incident and the issue of radiation-induced nose bleeding.

fūhyōhigai by his university, but the comic book and its characters were also criticized by government officials from the Ministry of Environment, the Reconstruction Agency and Fukushima Prefecture (see Kimura, 2016a: 33-4). In fact, while the comic magazine was still on the shelves of convenience stores, Prime Minister Abe Shinzō was quoted in a *Sankei Shimbun* article as saying, “The state will respond to baseless rumors [*konkyo no nai fūhyō*] with full force” (“Prime Minister Abe,” 2014).⁴³⁵

The event I attended in early 2016 was one of the first times Professor Arakida had spoken to a group since his public condemnation. He spoke about his experiences of decontaminating areas where children played following TEPCO’s radiological overflow, the role of ‘science’ and ‘objectivity’ in the aftermath of the disaster, as well as the process of enacting food safety standards. It wasn’t until someone finally asked him about how he endured the public attack that he discussed his experience. ‘Isolation’ (*koritsu*, 孤立) was one of the terms he used in his response.

Until this point, I have been using the term *konran* to describe the disjunctures and disorder experienced by my participants regarding everyday eating in the aftermath of TEPCO’s nuclear disaster. Here, I would like to introduce another Japanese word, *kattō*, which might be of use for imagining people’s embeddedness within twisted and troubling sociomaterial entanglements. Throughout my interviews and focus groups, some participants used the word *kattō* to describe instances of discord, when they found themselves entangled in uncomfortable, troubling relations.⁴³⁶ *Kattō* (葛藤) is another compound word made up of the *kanji* characters of two creeping and twining vines: *kudzu* (Japanese arrowroot, 葛) and *fuji* (wisteria, 藤). Both *kudzu* and *fuji* are leguminous woody vines which creep, crawl and twine through their situated,

⁴³⁵ See Kimura (2016a: 33-4) and Hirano et al. (2016: 11-2) for more on the incident.

⁴³⁶ For example, see Tomohisa’s story in Chapter 1 where he uses the term to describe he and his wife’s disagreements about bringing their children to Fukushima Prefecture. Kahoru (Chapter 1; Chapter 6) also used the term to describe the discomfort she felt discussing internal radiation with anti-nuclear activists who did not show much interest in it. Others used the term for describing the discomfort of discussing radiation with others. It was even used to describe the internal discord experienced by a father who did not want his family to live apart from each other. The important aspect about *kattō* is that it is an embodied discomfort that is physically uncomfortable and unsettling. One of my Japanese friends described it as a feeling that there was something twisting around and strangling her heart.

symbiotic relations with various rhizobial and non-rhizobial organisms (De Meyer et al., 2015; De Meyer et al., 2011; Liu et al., 2005). Described as “woody behemoths” (Doyle, 2003: 900) because of their monstrous abilities to use their symbiotic entanglements to rapidly expand in size and width, these vines are known for twining up trees at a rapid pace (Forseth & Innis, 2004). The image of my participants being entangled in complex twists and twines of creeping vines is both powerful and interesting when exploring their entanglement within toxins and texts as they live their lives in relation with TEPCO’s radionuclides.

While my participants seemed to describe *kattō* as uncomfortable, heart-wrenching and troubling internal or inter-relational discord, I would also like to attend to the term using material-semiotic sensibilities. If we think beyond epistemological or perspectival debates, we see people simultaneously entwined within textually-mediated ruling relations and the material-semiotic entanglements of their everyday situated lives with family members, friends, school principals, doctors, supermarket food labels, TV commercials, mushrooms, milk and myriad other humans and more-than-humans. In the aftermath of TEPCO’s nuclear disaster, radionuclides may make their way into people’s situated sociomaterial entanglements, leading to experiences of *konran* and *kattō* which are exacerbated by people’s entanglement within ruling relations that pressure them to ignore the possible presence of these imperceptible materials in their everyday lives. Thus, as textually-mediated ruling relations following TEPCO’s nuclear disaster call on people to relinquish care to the authorities, to feel at ease (*anshin*), and to try their best (*ganbarō*) to roll forward with revitalization (*fukkō*) and business as usual, experiences of *konran* and *kattō* have been making it difficult for many of my participants to fall back in line—their experiences of disorder and discomfort were so overwhelming that they could no longer be easily suppressed. At the same time, however, speaking up is not always easy and can even make someone a target for being labeled as a propagator of ‘harmful rumors’ (*fūhyōhigai*), an obstructor of revitalization (*fukkō*) efforts—as Professor Arakida’s experience illustrates. How have people been able to work through troubling experiences of *konran* and *kattō* given their embeddedness within the extremely repressive ruling relations explored in Chapters 5 and 6, ruling relations that discourage even uttering the word ‘radiation’? In the previous chapter, I focused on the role of producing and deliberating numbers as a way to work through experiences of *konran* and regain some sense of *anshin*—which, for

my participants, is a state of ease that emerges from activity and not passivity. In this final analysis chapter, I will provide a short reflection on the enactive qualities of the experiences of *konran* and *kattō*. In particular, I will provide a number of insights and reflections from my participants which highlight some of the ways people employed vigilant, heartfelt and mindful care (*yōjin*), creating spaces and opportunities to come together, think together, and discover how their individual experiences of *konran* and *kattō* are linked into much wider relations of ruling.

7.2 Finding a place for the heart to be

As explored in Chapter 6, the Japanese government has been using perspectivalism as a strategy for attempting to coordinate how active human bodies ‘correctly’ relate to unstable radionuclides. By acknowledging only one, single, ‘correct’ way for humans to relate to TEPCO’s radionuclides, people who question the single reality or attempt to enact their relationship differently could be easily categorized away as ‘unscientific,’ ‘irrational,’ ‘uneasy’ or even purveyors of ‘harmful rumors.’ While none of my participants were publicly attacked in the way Professor Arakida was, they were all extremely aware that speaking out about their concerns regarding radiation could make them a target. Or as the Japanese proverb warns, “the stake that sticks out gets hammered down [*deru kui wa utareru*, 出る杭は打たれる].” Thus, the activation of ruling discourses by the media and people around my participants contributed to enacting ‘the sensate’ (Harrison, 2000) in a way that felt very constrictive to my participants; they no longer felt comfortable discussing their concerns about radiation with many of the people around them.⁴³⁷

Mari—whose experience encountering discourses of *tabete ōen* at her local supermarket in the Kansai region were shared in Chapter 6—describes how this played out in her life:

⁴³⁷ As discussed in Section 3.3.1.6, the constrictive nature of the sensate was also evident during my interviews.

With old friends it is totally okay [to talk about radiation], but it is difficult with new friends. They will probably think, “She’s a bit crazy.”

Other participants explained that it was difficult to discuss their concerns about radiation even with their closest friends. The experience of Hisako—who described the *fukkō* corner in her local supermarket in the Kansai region in Chapter 6—illustrates this experience:

I don’t think they are harmful rumors [fūhyōhigai]. I think the damage is real. But all of the people around me are saying they really feel bad for the people suffering from harmful rumors [fūhyōhigai]. They probably think I’m a really strange person. But for mothers with a child, I definitely at least once try to speak with them about radiation. That they have to be careful about food, well, about the place of production, about root vegetables, mushrooms, berries. [...] For the most part, because [my husband and I] speak out about food additives, pesticides and radiation, people stop socializing with us. [...] For the people we used to socialize with, those people we often hung out with, it was probably tiresome to listen to. [...] We gradually stopped meeting. [...] My husband and I were so tired. To hang out for one whole day and pretend you don’t know anything [about radiation]. We both said it wasn’t fun. [...] It was like we were strange people. It felt as if we had joined some kind of new religion. Mmm. I started to feel hopeless. But once joining [the cooperative], there were so many people like us. And there were also many evacuees. These kinds of discussions were normal. There would be a time to meet with everyone. We could bring homemade food and gather together. I really started to feel at ease [anshin].

Before finding the radiation-testing food cooperative, Hisako described that her isolation was so distressing that she had even contemplated leaving the country; she wanted to find a place where she and her family could speak freely about their concerns.

*If you go abroad, there are many people who know and don't know.
But in Japan even if you know, it is considered virtuous to say
nothing. Instead of that, to be in an environment where you can
speak. I know it's strange, but that's how it seems. It's best to be able
to speak, no?*

Hisako's experience highlights a phenomenon that was apparent throughout all of my interviews. The difficulty in speaking out about one's concerns about radiation left many of my participants feeling isolated. However, through attuning to the discomfort and noticing the activities of others around them, people were able to make new connections and together curate spaces of refuge—'refugia' for thinking together⁴³⁸—where mutual and open discussion was possible. Food cooperatives that measured for radionuclides were just one of the many examples of these 'refugia for thinking,' where people could come together and think together as they discussed their concerns about radionuclides and nuclear power.

For many nuclear refugees, however, it was not only difficult discussing radiation, but also sharing the fact that they uprooted themselves and their families, leaving behind their homes, their jobs, their spouses and all of their other sociomaterial entanglements because they did not want to live their lives alongside high concentrations of TEPCO's radionuclides. During a focus group session, Asami—whose thoughts on the government's role in enacting *fūhyōhigai* were shared in Chapter 6—spoke about the hostility she faced when she honestly told her family about her concerns regarding radiation. Asami had been learning about the Rokkasho Nuclear Fuel Reprocessing Facility in Aomori Prefecture,⁴³⁹ and knew about some of the dangers of exposure to ionizing radiation. After hearing about the first explosion at TEPCO's nuclear power plant in March 2011, she wanted to get her children as far away from the Kantō region

⁴³⁸ Again, Tsing (2017a: 54) uses the term "refugia" to describe the places of refuge—spaces where resurgence of life and lifeways can be cultivated—which, though abundant during the Holocene, are depleting at alarming rates in the Anthropocene. In this section, I will borrow the term to refer to 'refugia for thinking'—places of refuge where my participants felt safe to share their concerns and think together—as well as 'refugia for recuperation'—spaces of refuge from radionuclides where people usually living in areas of radioactive fallout, and the accompanying restrictive ruling relations, can find some physical and emotional reprieve.

⁴³⁹ As with some of my other participants, her interest was sparked by the documentary *Rokkasho Rhapsody* (Kamanaka, 2006).

as possible until the extent of radioactive contamination was better known. Living in Chiba Prefecture at the time, Asami took time off work and drove her children down to the Kansai region.⁴⁴⁰ She had been living just next to her husband's family and was very honest with them about her concerns regarding radiation. Their response to her honesty, however, was not what she had expected:

My husband was okay, but his parents, my husband's parents, his aunt and whatnot, they were living just next door and said really awful things. Something like, "Don't come back! You're a stranger now. Get out of here and live your life without any support from us!"

She also explained the various judgements being made about nuclear refugees, particularly if people found out they had left their jobs and their hometowns, or that they had been exposed to radionuclides.

Well, there are people who think about your work and whatnot, that you threw it all away and are an irresponsible person. Therefore, people from Fukushima and whatnot, parents and children, mothers and children who evacuate, you hear that they don't tell people. In any case, if you say something, there are people who see you as someone who threw away your hometown, that is to say, someone with no feeling of responsibility. And there is also discrimination and whatnot. That's, well, you can be discriminated against just for being hibakusha. Therefore, I think there are many people who just don't say [they evacuated].

For Asami, the experience was extremely isolating. Relocating to the Kansai region after being renounced by her husband's family, she found grappling with the possible presence of TEPCO's radionuclides in the food to be extremely overwhelming. One of the only things that brought her ease in the early days of TEPCO's overflow was finding a restaurant that tested its food for radionuclides.

Before, at the beginning, it was really frightening. What? Where to eat? Where is this lettuce from? So, there were restaurants that

⁴⁴⁰ Though she could not know it at the time, her home turned out to be in one of the many, patchy radiological hot-spots in Chiba Prefecture.

checked such things. [...] I went to one and really felt at ease [anshin shite]. At that time, you know, I cried as I ate. Really.

Similar to the radiation-measuring cooperative within which Hisako found community during a period of loneliness and isolation, restaurants that measured for radionuclides became a space for people to gather, feel somewhat at ease, and discuss their concerns about radiation. Aizawa Keisuke (pseudonym), the owner of a radiation-measuring restaurant I visited during my fieldwork in 2016, explained how the *konran* and *kattō* he experienced living in the Kansai region following the onset of TEPCO's nuclear disaster urged him to create a space where people could feel at ease (*anshin*) when eating out. He himself had two children, so was concerned about food and thought he could channel his concerns into something that could also benefit his community. During our interview, he described how his restaurant became a place not only where people could feel at ease about food, but where he could learn about the experiences and suffering of others, especially those people living in areas with high concentrations of TEPCO's radionuclides.

People who lived in eastern Japan and evacuees came. People who lived in eastern Japan, for example, people who came by car from Fukushima or Tokyo, there were many people who came from Tokyo. Therefore, every day in the parking lot, there were cars parked with license plates from eastern Japan. So, about one and a half years from the onset of the accident, for example, four customers would come. They would come as a family and order enough for eight people. And in silence, saying nothing, they would eat right away. Each person would eat the two portions. When they stopped eating, they were crying. Then, the first time I heard stories from my customers, I also couldn't stop crying. [...] To get to this. Is there another country that disregards their citizens to such an extent? Well, it's said that North Korea and China most likely do. But I really felt that Japan would not also succumb to this.

Haruo, whose thoughts on the terms *anzen* and *anshin* were shared in Chapter 6, once worked a preschool in the Kansai region which connected with a local CRMS to measure food served in its school lunches. During our interview he used the phrase

igokorochi ga ii ('comfortable,' 居心地が良い) to describe the feeling that emerges when people are given the opportunity to discuss their concerns and think together:

There was someone who evacuated from Tokyo who entered the preschool. The reason they came to our place instead of another place, they said it was because at our place communication was easier. [...] They were concerned about food and so were we. Because we took the approach of thinking together. It was comfortable [igokochi ga ii], you know?

The term *igokorochi* is made up of the *kanji* characters for 'residing' or 'being somewhere' (*i*, 居), 'heart' or 'mind' (*kokoro*, 心), and 'ground' or 'place' (*chi*, 地). Combined with the word for good (*ii*, 良い), *igokorochi ga ii* points to a type of comfort that is attained when there is a place for the heart to reside. That is, a place where people can feel comfortable sharing their true thoughts and concerns without feeling pressured to be otherwise. Thinking back to Chapter 6, the Japanese government has been asking people to feel *anshin* (安心), that is, to have a peaceful heart in the aftermath of TEPCO's overflow. While the government expects the feeling of *anshin* to arise from people's acceptance of scientific knowledge derived from the transnational nuclear assemblage and deployed through risk communication, the experiences of my participants reveal that it was not only the ability to make visible and deliberate radionuclide measurements that brought a sense of ease, but also the opportunity to discuss their concerns with others. Haruo's curation of a comfortable (*igokorochi ga ii*) refugia where people could openly discuss their experiences and concerns related to radionuclides, and where solutions could emerge from these discussions again highlights how feelings of ease or comfort do not only come from inputs of scientific knowledge and the taking of a particular side in perspectival debates, but from opportunities for people with multiple experiences and various concerns to work and think together across all of their differences. Both Keisuke's and Haruo's experiences point to the ways in which these refugia for open discussion not only bring ease and comfort as people can openly acknowledge and speak about radionuclides, but also an opportunity to hear the experiences of people whose deep suffering following TEPCO's nuclear disasters has been muted within ruling relations.

Particularly the experiences of nuclear refugees or people living within high concentrations of TEPCO's radionuclides.

Throughout my interviews it became clear that even though people living in the Kansai region found it difficult to discuss radiation, it was much more difficult the closer one moved to Fukushima Prefecture. Hashimoto Tetsu (pseudonym)—a volunteer at a CRMS in the Kansai region—describes his understanding of this reality and the important role of people in Kansai and other regions further away from TEPCO's nuclear disaster in supporting those people enacting their lives within these more restrictive ruling relations. During our interview, I asked Tetsu about the difficulty people have in discussing their concerns regarding radiation:

About having an opinion, I think they have an opinion. Expressing that opinion, speaking up and saying it, there are some differences there. Therefore, people who live here [in the Kansai region] can talk. [...] But Fukushima, in Fukushima City, in Fukushima Prefecture, if you try to talk like that, in any case, you will be put under a lot of pressure. That's what I feel. But if you don't say anything, before long, it will completely, it will surely gnaw away at your core, deplete your life-force. [...] One has to raise their voice. That's why, well, it's said that things are not expressed because they are hard to say. But to have uneasiness [fuan] in your heart. To continuously carry it as you live your life. Realistically. How to say? To allow things to be open, to allow for things to be said, I feel that's extremely important. [...] That's why with things like recuperation [hoyō], people who run things like recuperation camps [hoyō kyanpu]. You know, to receive people from those areas. Probably, when people come to [the camps], I think that together they mingle [kōuryū], and all of the things they are thinking about are vented before they go home. [...] But there's a lot that accumulates. It's difficult because it doesn't change instantly.

During my fieldwork I was able to interview and chat with people who participated in organizing various recuperation camps in the Kansai region. These camps were modeled after those initiated following the Chernobyl nuclear disaster. In fact, some of

the recuperation camps for children living in highly contaminated regions of Belarus were located in Japan (Takagi, 2016), so there were a number of people with experience working with children living and developing both within and with large concentrations of anthropogenic radionuclides. While the government in Belarus supports recuperation efforts for children living in areas of high nuclear fallout,⁴⁴¹ the Japanese government has yet to support the recuperation camps throughout Japan. This means that in Japan all of the efforts to provide children living in radioactive hot-spots a chance to recuperate in areas with lower levels of external radiation are dependent purely on volunteer efforts.⁴⁴² The importance of recuperation camps is not only in the ways they support children, but also the support they provide for parents. In fact, camps that invite both children and parents also offer an opportunity for parents to discuss the hardships they face. While I was unable to attend a recuperation camp during my fieldwork, I heard many stories of the hardships discussed by parents trying to raise their children in some of the most contaminated patches of TEPCO's industrial ruins.⁴⁴³

Each camp is organized differently, some spanning only one week, while others having more fluid enrolment over one or two months. There are camps organized during academic spring breaks and also summer breaks. Whatever the length or timing of a particular camp, food plays a major role in organizers' planning processes. For many, recuperation should be a time for children to eat simple, healthy food that contains no trace of TEPCO's radionuclides. However, without financial support it is sometimes a challenge to ensure children are getting radionuclide-free food, even when they are in the Kansai region. In some cases, camp organizers team up with local farmers and farmer groups who donate food and invite children to visit their farms. However, camps' dependencies on food donations can also be problematic, particularly if companies drop off large cases of processed foods where the place of origin of ingredients is not known. Taking into consideration the fact that people may have radionuclides on their clothing and luggage is also a point of concern for some

⁴⁴¹ See, for example, Minsk Region Executive Committee (2009).

⁴⁴² In June 2017, mothers from Fukushima made an appeal to the Japanese government, asking them to provide public support for recuperation camps (OurPlanet-TV, 2017). So far, the government's response is not clear.

⁴⁴³ The film *Little Voices from Fukushima* directed by Kamanaka Hitomi (2015) also provides an intimate lens into the lives of people organizing and participating in recuperation camps in Belarus and Fukushima.

organizers. However, the issue is very sensitive to discuss, and especially difficult to resolve given the financial constraints on organizers—purchasing new clothes for everyone to wear during recuperation camps is not possible without more robust financial support. Regardless of all of the struggles, some of my participants continued to work arduously to organize recuperation camps; their experiences in previous years have shown them just how important these refugia for both physical and emotional reprieve are for people living both within higher concentrations of TEPCO’s radionuclides and stricter textually-mediated ruling relations asking them ignore their very real sociomaterial entanglements with these invisible isotopes.

7.3 Leaning in

As many of the previous examples illustrate, spaces where people can gather and discuss their concerns about radionuclides offer temporary reprieve for many people who feel suffocated within Japan’s post-2011 ruling relations. Another thing these examples illustrate, however, is the importance of not only finding a place to discuss and work through one’s own experiences of *konran* and *kattō*, but to attune to the experiences of others—particularly those who have endured great suffering since the onset of TEPCO’s nuclear disasters. Here, another phrase containing the *kanji* character for heart/mind (心) helps to illuminate this point.

During my fieldwork in 2016, I often visited an English class for nuclear refugees held in the Kansai region. The flier for the class invites “evacuees” and “*kokoro wo yosete kudasaru* [心を寄せてくださる] friends” to join in. The phrase *kokoro wo yoseru* combines the *kanji* character for heart/mind (*kokoro*, 心) with the verb meaning ‘to draw near’ or ‘to contribute’ (*yoseru*, 寄せる). Together, the phrase can refer to the act of drawing your heart near to something, or letting your heart go out to someone. While some dictionaries describe the phrase as a form of sympathy, I like to think of it as a form of empathy—the act of *leaning in* with an open heart (and mind), putting yourself in a position where you are able to notice, and possibly feel, the suffering of others.

For some people, *leaning in* meant actually going to Fukushima and surrounding prefectures to bear witness and offer support to those people trying to carefully enact

their lives along with TEPCO's radionuclides. Nagaoka Kumiko (pseudonym), a mother of two who had been living in the Kansai region since before the onset of TEPCO's nuclear disaster, helped to organize a group of women who have been working together to not only support nuclear refugees, but also people struggling to live their everyday lives in Fukushima Prefecture. Like many of my participants, Kumiko's first introduction to the nuclear disaster was through questions she had about the 'safety' of food circulating in the agrifood assemblage. However, in working through her own, individual experiences of *konran* and *kattō*, she began attuning to the vastness of the trouble and, after connecting with a number of nuclear refugees, formed a group and began working tirelessly to provide support to people living in Fukushima Prefecture. Eventually, she traveled to Fukushima to meet some school teachers her group had been trying to support. During our interview, Kumiko described the constant oscillation between concerns of protecting oneself and being a part of a collective struggle, sharing her experience of *leaning into* the everyday sufferings of people she met in Fukushima Prefecture:

My daughter said, "mom if you go you might get cancer, don't go!" My husband also said something similar. [...] He said I have to eat different food, he said something like that. Even for myself, before I went the first time, I was planning to throw my shoes away before coming home. Even a friend who came from Tokyo told me to throw things away. Even if I planned everything perfectly, there [in Fukushima], everyday life was flowing as normal. My friend was there. The preschool teachers and children were there. Not one person was wearing a mask. When I got there, I questioned. Was I caring too much? Everyone was living their life there. I couldn't refuse the food they offered to me. Everyone would eat together. And for dinner, the preschool teachers all kindly cleared their schedules. At dinner, the head teacher said, "The food we prepared today, it is all from outside of the prefecture and it was all measured. So please feel at ease [anshin shite] and help yourself." You know, it made me extremely sad. "In Fukushima we really have such beautiful things," the head teacher said with utmost effort. It's just. It's just. Really, it's just that. It's just. What is it? It's just so vexing. For this kind of

accident to occur. For the people of Fukushima, every day is difficult. With so many memories, they are made to suffer. When I came back to Kansai, their problems seem like someone else's. For myself, if I wasn't in [this group], I don't think I would have known. That's why I think it's important to tell people about it.

However, visiting Fukushima is not the only way to *lean into* these forms of everyday suffering. One way many of my participants were able to attune to wider, collective experiences of *konran* and *kattō* was through watching documentaries or reading books that depict the everyday experiences of nuclear refugees or people living in Fukushima and surrounding prefectures. For example, books written by nuclear refugees depicting their experiences were being read by a number of my participants (for example, Morimatsu, 2013; Sudou, 2015; C. Yoshida, 2016). In addition, documentaries such as *Little Voices from Fukushima* (Kamanaka, 2015), *Inheritance* (J. Inoue, 2015), *Moms of Iitate Village: Together with the Soil* (Hurui, 2016),⁴⁴⁴ and *A2-B-C: Children and Radiation* (Ash, 2013) were circulating at various screening events, all offering intimate views into the everyday lives of people living in Fukushima Prefecture. For others, *leaning in* meant volunteering at, working at or generally supporting recuperation camps, restaurants, cafés, food-cooperatives that test for radionuclides in food, and CRMSs that test not only food but soil and other goods. It also meant participating in café times at CRMSs or study sessions and events about TEPCO's nuclear disaster, or even supporting nuclear refugees who are fighting the Japanese government and TEPCO through the court system.

In fact, for many of my participants, it was *leaning into* the experiences of nuclear refugees they met in the Kansai region that provided them with many insights into the how their own individual struggles were hooked-up into greater ruling relations. In revisiting the experiences of Aoi and Masami—two mothers who relocated from Fukushima Prefecture—we learn not only about the difficulty and discomfort they both faced after severing themselves from their local sociomaterial entanglements, but the amount of work it takes to be active in collective struggles.

⁴⁴⁴ This film is reminiscent of the documentary *The Babushkas of Chernobyl* (Morris & Bogart, 2015) which premiered just a year before.

Aoi: But, in any case, no matter what we are connected to the state. We talk and talk and talk, but, in any case, how do you draw distinctions between it all? That's difficult.

Masami: Activism also, it takes time, it takes economic resources, it's hard.

Aoi: But this administration, the way they direct people's movement. [...] If you don't have power, even if you raise your voice.

Masami: It's difficult, isn't it?

Aoi: The kind of atmosphere present, it's like the state is a novelist. [...]

Masami: But, that's what we were really made to experience. For this kind of event to occur. You know, I thought Japan was one of the better countries.

Aoi: I also thought so. [...] Even if I feel that I want to lead a "normal life," for myself, since coming here I feel like I am constantly aware.

Masami: That's why, it's impossible to relax.

Aoi: Yeah. And with people who are aware, you share, you exchange ideas like this. Then, even if you can probably feel at ease [anshin] about food, nevertheless my hometown's air. If you ignore the radiation, the air was so clean. Since I came here, in any event, there are various...

Masami: It's dirty.

Aoi: Reasonably...

Masami: Because it's a city.

Aoi: Because it's a city. Car exhaust and whatnot. [...] The sky is a completely different color from Fukushima.

Masami: Different. Different.

Aoi: It's different. [...] Also, Kansai dialect.

Masami: Yeah!

Aoi: Yeah. It's agony!

(Everyone laughs)

Masami: There's no way to escape being worn out. Words I am not familiar with, the landscape, the air.

Aoi: In any case, it wears you out.

Masami: I'm worn out, even if I don't do anything, I'm worn out. [...]

Aoi: You know, ultimately, in the beginning I really thought it was exhausting. [...]

Masami: Right? I feel like there has not even been one day that I have felt relaxed. [...] Always, there are always negotiations, you know. The week I don't go to Tokyo, in Kyoto there is definitely something, I have also gone to other places. I have even gone [back] to Fukushima. You know, this is not anything a normal middle-aged woman would do. (Laughing)

Aoi: Right. It has to be done.

Masami: Things like directly meeting and talking with a member of the Diet.

Aoi: It's tiresome. [...] That's why, when I first got involved with the measuring station, it was about six months after I evacuated. Then we started [another group for evacuees]. So, in any event, it probably took a lot of time before I could make connections. But still, I had someone, one person. [...] Then when I came here I could connect with a lot of people. Little by little, as far as my feelings went, I could start to feel at ease [anshin]. There are really a lot of active people [here].

These examples represent some of the many opportunities for people to *lean in*—an activity that opens up possibilities for noticing how very individual experiences of *konran* or *kattō* are actually hooked into greater ruling relations and collective sufferings. It is from this realization that feelings of complete isolation may begin to dissipate, instead of being a personal problem of a troubled ‘individual,’ it can be recognized as an experience shared by numerous people who are also feeling suffocated within post-2011 ruling relations.

7.4 Opening up the individual

Unlike ruling discourses of *fūhyōhigai* or *fukkō* which create an abstracted and simplified version of people’s everyday experiences in the aftermath of TEPCO’s nuclear disaster,⁴⁴⁵ attuning to experiences of *konran* and *kattō*, and *leaning into* the collective suffering unleashed by the disaster exposes the messy sociomaterial entanglements that people find themselves enmeshed within following this large-scale radiological overflow. At the same time, in attuning to situated sociomaterial entanglements, time is exposed as being much more folded than linear.⁴⁴⁶ That is, overflows remind and attune people to their sociomaterial entanglement with not only TEPCO’s radionuclides, but radionuclides released in other radiological overflows, whether it be from nuclear bomb testing, the Chernobyl nuclear disaster, the JCO nuclear criticality disaster, or one of the many others.

⁴⁴⁵ Thinking back to Chapter 4, in some ways, the term *kōgai* is similar to *fūhyōhigai* in the way they both attempt to contain and define pollution problems—the terms share the character *gai* (‘injury’ or ‘damage’)—and bluntly divide people into groups of ‘victims’ and ‘perpetrators.’ *Fūhyōhigai* might be seen as a neoliberal variant of *kōgai* which pits ‘perpetrator-consumers’ against ‘victim-producers’ and attempts to coordinate private activities in order to serve the ‘greater good.’ *Fukkō*, on the other hand, paints a picture as if all people in Fukushima and surrounding prefectures are excitedly engaging in economic projects of revitalization. The intensive focus on *fukkō* and the revitalization of economic projects mutes the vitality of radionuclides and the people who attempt to carefully enact their lives alongside these imperceptible materials, raising many question about what ‘vitality’ really entails. Is it the vitality of economic projects? Or the vitality of human and more-than-human life and lifeways?

⁴⁴⁶ See Section 3.3.2.3.

During my focus group session with Goto Katsuo (pseudonym) and his wife Tsukiko (pseudonym), Katsuo remembered his mother's warnings about touching or ingesting rain possibly containing radionuclides during the period of nuclear testing in the Pacific.

When I was a child, there was hydrogen bomb testing. Even at home, my mom would say something like, "Don't let the rain fall on you!" and "Don't eat it!"

Having lived through that experience, both Katsuo and Tsukiko said they found it eerie that no warnings were given to avoid rainfall after TEPCO's nuclear disaster. In fact, it was wind and rain that transported many radionuclides from TEPCO's damaged nuclear reactors to areas throughout the country and the world (Norman et al., 2011; Steinhauser et al., 2013; Thakur et al., 2013). Iodine-131 from TEPCO's reactors was even found in rain that fell in Vienna, Austria, where I was living in March 2011 (Steinhauser et al., 2012).

Tinkering with measuring devices also led many of my participants to discover their very real and monstrous sociomaterial entanglements with both current and historical radiological overflows. Because cesium-134 has a half-life of two years, it will transform to a different isotope in approximately 20 to 40 years. Cesium-137, on the other hand, has a half-life of 30 years, so will take about 300 to 600 years to transform to a different isotope.⁴⁴⁷ Thus, at this point in time, when both cesium-134 and cesium-137 are measured in a particular ratio, it can be assumed that these are TEPCO's radionuclides. When only cesium-137 is found, it can be assumed that these are radionuclides from a previous radiological overflow. In the aftermath of TEPCO's nuclear disaster, some people tinkering with measuring devices began picking up radioactive cesium not only in foods from north-eastern Japan, but also western Japan—particularly in the case of log-grown *shiitake* mushrooms. According to a number of my participants who measure radionuclides in food, in some cases, trees from north-eastern Japan were being used by mushroom growers in western Japan and, as a result, cesium-134 and cesium-137 from TEPCO's disaster were being detected. In other cases, only cesium-137 was detected, suggesting that the radionuclides came from

⁴⁴⁷ See Section 6.3.

earlier radiological overflows. Keisuke described his experience in discovering his own sociomaterial entanglement with historical radiological overflows while trying to find *shiitake* mushrooms to serve at his restaurant.

Shiitake will concentrate [radiation] about ten-fold. So, for example, if the tree they are grown on has 0.1 Becquerels, the shiitake that grow on it will have about 1 Becquerel. And radiation is detected in most Japanese shiitake. But, for the ones in western Japan, it's not because of Fukushima. I believe it is cesium-137 from the period of nuclear weapons testing. So for some time I tried not to use shiitake. [...] Now, I have tested shiitake from a place in Okayama and radiation was not detected. Finally, I am able to use them!

Throughout my interviews and focus group sessions, it also became clear that the more people began attuning to their sociomaterial entanglements with radionuclides, the more aware they became about their simultaneous entanglement within textually-mediated ruling relations. For Madoka—whose experience I shared in Chapter 4—it was her own embodied experiences of *konran* and *kattō* following TEPCO's nuclear disaster that led her to not only seek refuge in the Kansai region, but to become active in one of the court cases seeking an admission of responsibility and reparations from the Japanese government and TEPCO for losses suffered due to TEPCO's overflow. That is, she recognized that what seemed to be an individual experience of disorder and discomfort was actually pointing to greater, collective issues related to democracy.

I have gone through this nuclear disaster. That somewhat "normal" way of things, I was always on that majority side. [...] In a disaster, you enter an evacuation center. But usually you can return from the evacuation center and you can put your life back together. However, with something like a nuclear disaster, the term "nuclear refugee" it means you are in the minority. So many citizens of Fukushima Prefecture, there are so many people who remain living on contaminated lands. People like me who left, we are certainly the minority. [...] One day, you're suddenly a minority. And democracy. Its significance in protecting the fundamental human rights of the minority. [...] [Before the disaster] I understood the concept in my

mind. But now, the fact that democracy is about protecting the human rights of the minority. Now I have finally come to know the true meaning of democracy. For the majority, for the most part without having to advocate for your rights, because you are on the side of the majority, things like security, the fact that you have rights. Life goes on without you having to think about it. But if you are forced to view it from the standpoint of someone who one day suddenly became a minority. Aha! I see! It's just the natural right to protect life. [...] If there is a fire, if nearby there is a fire, if a house is burning, you run away, right? And, isn't that the same? However, running away from radiation, naturally feeling it is a danger and running away, that act is criticized. It's completely strange, to be called a traitor [hikokumin]. [...] We take to court battles to acquire rights for the minority. The fact that those battles are so necessary. Now, I am experiencing it firsthand.

During my fieldwork in 2016, I had the opportunity to sit in on court cases being fought by nuclear refugees in three different prefectures in the Kansai region. At one court case in particular, lawyers presented the results of soil tests taken from the homes of the nuclear refugees they were representing. These lawyers had traveled with scientists to areas where the government's measurements of estimated dose rates from radionuclides measured in the air 'proved' it was legally 'safe' for people to return. These 'safe' dose rates also became legal 'proof' that housing support for nuclear refugees could be discontinued; the areas themselves did not need to be treated as 'radiation management areas,' but could be places where people could 'safely' conduct their everyday lives—having picnics under the cherry blossoms, gardening and playing with their children in local parks. Working together to tinker with measuring devices to make visible the actual concentration of cesium-134 and cesium-137 at the homes of nuclear refugees they represented, the plaintiff's lawyers shocked everyone in the courtroom as they revealed that thirty-seven of the forty-one samples measured over 40,000 Becquerel per square meters (Bq/m²)—the clearance level set by the Japanese government to distinguish between a 'radiation management area' and an area where no management is necessary (Hirano et al., 2016: 7-8). More shocking was the fact that at least nineteen of the samples measured between 100,000 and 300,000 Bq/m².

In the way that dose rates create an objectified version of the real activities of radionuclides, simplified categories that bluntly label people as ‘victim’ or ‘perpetrator’ of ‘harmful rumors,’ or ‘promoting’ or ‘obstructing’ economic ‘revitalization’ create an objectified version of people’s experiences which not only obfuscates sociomaterial entanglements, but creates a situation where people are discouraged from creatively working together to find solutions to problems they face. During our interview, Kudo Saburo (pseudonym)—a journalist who has been closely following the aftermath of TEPCO’s nuclear disaster—argued that we need to be wary of objectifying ruling discourses such as *fūhyōhigai*, and need to creatively work together to support people in ways that foreground our very real entanglements with TEPCO’s radionuclides.

Karly: When people don’t purchase food produced in Fukushima, they get accused of spreading fūhyōhigai. It’s as if they are personally destroying the livelihoods of the farmers of Fukushima.

Saburo: Yeah, there’s that kind of campaign. From the side of the government. That kind of destruction, it’s not the fault of the people who don’t buy, it’s the fault of those who caused the contamination.

Karly: Yes. But, within that term, there’s a sense that it’s the consumer’s fault.

Saburo: Or better, there is a campaign from the side of the government saying that. [...] Regarding that, from our side, I think we need an opposing campaign. Eat to support [tabete ōen], really supporting by eating. [...] There has to be something beyond that. [...] It’s not eat to support [tabete ōen]. We have to support those people in securing their rights. Like their right to evacuate, the right to claim for damages for contaminated things. That’s why from the beginning the “under 100 Becquerels” is strange. In other words, even if you have things under 100 Becquerels, your field was polluted in such a way. I just can’t tolerate it. [...] And, in these laws. There are many tricks. [...] For example, if normal trash is left on a field, you can tell the person who left it to take it home. [...] Essentially there is an assumption that radiation will not flow out of the site of a

nuclear power plant. Therefore, in this country there was no law regarding what to do if radiation left the site of a nuclear power plant. It's a pretty severe story, right? Therefore, 8,000 Becquerels. This only applies to [radionuclides] outside of a nuclear power plant. Inside a nuclear power plant, it's 100 Becquerels. Yeah, that's because they had that law. Nevertheless, the 100 Becquerels, they only spoke about things happening inside a nuclear power plant, so for a situation when [radionuclides] came out, there was no law. Hmm. It's extremely severe. [...] Regarding radiation, it's a situation of lawlessness. So, you can't tell the people who scattered radiation on your field to come and remove it. [...] We have to create that kind of law. But the responsibility of a government that pushed nuclear power. It's a very severe responsibility. Yes, all we can do is keep saying it. In no way can we accept this situation of contamination. But Japanese people, they are docile. In any case, I think there are a lot of people who are embarrassed to advocate for their rights. [...] Well, many people don't raise their voices. It's because they are kind people. In that way, they are being taken advantage of. [...] We need to form connections with real farmers. [...] That's the kind of thing we need to keep in view.

7.5 Conclusion

In this chapter, I have shared a number of examples of the various ways my participants have been working through the experiences of *konran* and *kattō* that have emerged in their everyday lives following the onset of TEPCO's nuclear disaster. The experiences of my participants have highlighted the difficulty in discussing one's concerns regarding radiation—those who do speak out are often left feeling isolated, criticized by friends, family members and others they may interact with. While some people may succumb to the pressure to remain silent, I have described how some of my participants have either curated or found refugia where they not only feel safe and comfortable discussing their concerns, but are able to grieve together about the various losses they have experienced since the onset of TEPCO's nuclear disaster.

In her reflections on the cultivation of the “response-ability” necessary for enacting “conditions for ongoingness” in the turbulent times of the Anthropocene, Haraway (2016: 38) discusses the important role grief plays in these processes, particularly the act of grieving together. She explains:

Grief is a path to understanding entangled shared living and dying; human beings must grieve *with*, because we are in and of this fabric of undoing. Without sustained remembrance, we cannot learn to live with ghosts and so cannot think. (Haraway, 2016: 39, original emphasis)

There were tears shed at many of the events and meeting I attended during my fieldwork, and even in some of my interviews as people grieved the many losses they experienced or noticed others experiencing. As mentioned, for my participants, the opportunity to share one’s experiences and *lean into* the suffering of others helped to expose how their individual suffering was actually part of a larger, collective suffering—something that was not to be endured alone, but to be worked through together. This was not only the case for my participants, but for myself in writing this thesis. Starting with the very specific experiences of *konran* related to everyday eating, I was able to explore how these seeming individual experiences are actually hooked into many more complicated ruling relations which, though they appear in the coordination of everyday eating, infiltrate many other aspects of people’s everyday lives.

Noticing the ways in which individual experiences of *konran* and *kattō* are connected to a wider collective suffering, many of my participants were also able to recognize their very real entanglements with historical radiological overflows, and how their experiences of disorder and discomfort are also tied into the experiences of previous generations who similarly struggled to notice these imperceptible materials—possibly within even more draconian ruling relations. *Leaning in* also allowed many of my participants to notice how some people in Japan are living within even stricter ruling relations than those active within the Kansai region. Thus, supporting people who are living under more restrictive ruling relations than oneself—particularly the people living in Fukushima Prefecture where the chants of ‘recovery,’ ‘reconstruction’ and

‘revitalization’ (*fukkō*) are the strongest—has provided an opportunity for many of my participants to channel their individual discomforts into work that supports others.

While all of this sounds very hopeful, these refugia for thinking and recuperation are greatly under threat, particularly those which depend solely on donations and volunteer efforts. CRMSs are under particular pressure as electricity and rental fees are not easily paid by membership dues—which for many CRMSs are decreasing by the year. When saying my goodbye’s as I was leaving one of the CRMSs I visited during my fieldwork in November 2016, I was startled when the volunteer showing me out said, “I hope we’re still here when you come back.” In 2017, one of the most popular restaurants in the Kansai region that tested its food for radiation went out of business due to financial difficulties—it takes a lot of time and money to measure food, but the owner did not want to add a surcharge to food because it needed to be affordable for the many nuclear refugees that visited. At the same time, cuts in housing support for many nuclear refugees is forcing people to move back to places they do not feel comfortable living in, merely because they are unable to afford paying their mortgage while also renting a room in the Kansai region.

It is with neither optimism nor despair, that I bear witness to the experiences of my participants, many of whom continue to struggle as they attempt to conduct their everyday lives within TEPCO’s industrial ruins. Working through their experiences of *konran* and *kattō*, they have begun attuning to their own entanglements with materials both vital and vicious—an attunement that become more and more muddled by the constant, deafening chorus of ‘revitalization’ and other ruling discourses reverberating all around them.

8 Closing reflections

In the months following the March 1954 Lucky Dragon incident—nine years after the dropping of US atomic weapons on Hiroshima and Nagasaki, during a period when radionuclides from nuclear bomb tests were swirling around and appearing on people’s dinner plates, and nuclear power plants were first being approved—a monstrous figure appeared on movie screens throughout Japan. *Gojira* (I. Honda, 1954)⁴⁴⁸ emerged from the depths of the Pacific Ocean, a monstrous, mountain-high radioactive beast awoken by US nuclear weapons tests. The film represented a serious attempt to weave together stories of modern progress, science, nuclear fallout and local storytelling practices⁴⁴⁹ in a country that was becoming more and more entangled with the US’s radionuclides.

The original *Gojira* seemed to be asking audiences to notice, feel and think about the monstrosity of their ongoing entanglement with anthropogenic radionuclides, and the situated role of science and scientists in processes of life and death. The film ends with a sincere warning from the paleontologist Dr. Yamane, expressed just after *Gojira* was obliterated by a powerful ‘oxygen destroyer’: “If we continue conducting nuclear tests, well, it’s possible that another *Gojira* may again appear somewhere in the world.” However, in 1956, Americans dubbed and reshaped the film as *Godzilla—King of the Monsters!* (I. Honda & Morse, 1956) within which a white, American, male character, Mr. Martin, re-narrates the story. While both films portray *Gojira* as a monstrous, radioactive creature awoken by the US’s nuclear tests, the American version ends not with a warning, but with Mr. Martin’s sigh of relief: “The whole world could wake up and live again.”⁴⁵⁰

The stark tensions between Dr. Yamane’s plea for people to notice their sociomaterial entanglements with radionuclides and Mr. Martin relief that the evaporation of *Godzilla* meant business as usual could continue unscathed is the same tension faced by my study participants in 2016, sixty-two years after the Lucky Dragon incident and five years after the onset of TEPCO’s nuclear disaster. Through borrowing sensibilities

⁴⁴⁸ The name *Gojira* is a blending of the Japanese terms for gorilla (*gorira*) and whale (*kujira*).

⁴⁴⁹ It was people in a small village who first named the monster; he was a character in one of their legends.

⁴⁵⁰ The distinction between Dr. Yamane’s and Dr. Martin’s final thoughts is also discussed by Umayam (2013).

from both institutional ethnography and material semiotics to enact a ‘vital institutional ethnography,’ this thesis has been an attempt to attend to the materiality of both of these messages: the materiality of radionuclides that Dr. Yamane is gesturing toward, and the textually-mediated ruling relations that attempt to coordinate the business as usual that Mr. Martin seems most concerned with. In these concluding reflections, I will provide a brief overview of my research process, followed by insights into the importance of attuning to textual and non-textual forms of sociomaterial relationality when studying industrial ruination, and reflections on the need to think together in order to work through the monstrous troubles of the Anthropocene.

8.1 Research overview: Vital institutional ethnography as a method for cultivating ‘response-ability’ in the Anthropocene

This thesis represents my attempt to produce knowledge that will be useful for my participants in understanding how their experiences of *konran* related to everyday eating have emerged from their entanglement within messy heterogeneous sociomaterial relations. More than that, it represents my attempt to produce knowledge that will assist my participants in cultivating ‘response-ability,’ somehow ‘staying with the trouble’ (Haraway, 2016) while acting and being enacted within ruling relations pressuring them to forget these very real sociomaterial entanglements. Such a project required a deep and serious commitment to *noticing* the various sociomaterial entanglements that participated in enacting these unsettling experiences. Embodied experiences of *konran* and *kattō* hold many important clues to these entanglements, and provided an important entryway into the vast institutional complexes from which textually-mediated ruling relations emerge. However, noticing not only involved tracing the ruling texts that have been attempting to coordinate the everyday lives of my participants, but noticing the ways in which ruling relations of the Capitalocene actively work to silence humans and more-than-humans in order to perpetuate industrial progress projects, even in the face of industrial ruination. Attending to these silenced sociomaterial entanglements played an essential role in developing my understanding of how these processes of silencing and ignoring—which are so essential to the ruling relations in the Plantationocene, Capitalocene and Anthropocene—appeared in the everyday lives of my participants.

A look back at historical industrial overflows in Chapter 4 illustrated some of these attempts to silence industrial toxins, as well as the humans who noticed them. In the case of the Ashio overflow, whole villages were erased, and the disruptive activities of trouble-making protesters were expunged from the Earth. In the case of Minamata, ‘erasure’ of industrial overflows took a new form: a coordinated ‘rebirth’ of the humans and more-than-humans intra-acting within Chisso’s industrial ruins. The aftermath of TEPCO’s nuclear disaster reveals similar tactics of erasure and rebirth. However, unlike the ease of submerging trouble underground or underwater, enacting ‘rebirth’ and ‘revitalization’ involves wide-scale attempts to coordinate activities in a way that encourages people to follow in the newly-proposed project of economic ‘revitalization’ which, also blind to sympoietic sociomaterial entanglements, promotes further disregard and ignoring.

My analyses have also uncovered how embodied experiences of *konran* and *kattō* make forgetting much more difficult for people, like my study participants, who feel suffocated within the ruling relations deployed to contain TEPCO’s industrial overflow (Chapter 7). Beginning with *konran* related to everyday eating experienced by my study’s participants provided me with a specific problematic, an entry point into the vast institutional complex from which post-nuclear disaster ruling relations emerge. Staying grounded in the situated standpoint of my participants was essential to this project, allowing me to follow various strings from their experiences into the greater institutional complex of post-2011 ruling relations, without becoming too overwhelmed or lost in its vastness. In Chapters 5 and 6, I focused on explicating (unfolding) some aspects of the apparatus from which Japan’s reference limits for radionuclides in food emerged, telling stories about the simplified, single reality (single fold) they attempt to coordinate regarding how human bodies should ‘correctly’ relate to TEPCO’s radionuclides. At the same time that I attempted to explicate textually mediated ruling relations my participants are bound and participate within, I also highlighted their precariousness—the multiplicity, monstrosity and ghostly ‘absent presence’ implicit in (folded within) ruling discourses and texts revealed the seemingly singular reality and the objects they enact to be multiple—not representing an established order or a harmonious ‘peaceful whole,’ but an explicitly contingent ‘established disorder.’ Ontonorms proved to be an extremely useful tool for exploring the normativities that participate in these coordination efforts (Mol, 2013).

Thinking back to Deleuze and Guattari (2004), I have been explicating some traces of the trees sketched out by the transnational nuclear assemblage and the Japanese government, traces that tell stories of ‘progress,’ ‘safety’ and ‘control’ which participate in the enactment of linear-risk models that pave the textual-path forward for the proliferation of nuclear power and its companion, nuclear weaponry. While the tree depends on the complex relationality of the rhizome for its own vitality and enactments—just think of the myriad microbes, fungi, mycelia, rhizobia and mycorrhiza involved in plant nutrition⁴⁵¹—its simplified, linear, and rational form does not explicitly allow for noticing its own entanglement within human and more-than-human material semiotic, sympoietic relations. The term *sōteigai* (‘beyond expectation’) prolifically used by the Japanese government and TEPCO in the days and years following the nuclear disaster help to illustrate the single reality’s blindness to these entanglements.⁴⁵² My analyses reveal how these tree-like ruling relations are not only blind to heterogeneous sociomateriality, but they explicitly attempt to coordinate activities so that people overlook and ignore their own situated entanglements with not only humans, but more-than-humans, ghostly ‘absent presences,’ and monstrosities of all sorts.

Thinking back to Serres’ handkerchief (Section 3.3.2.3), linear timelines, metrics and risk assessments require an ironing-out of messy folds—multiple (many fold), complicated (entwined, folded together), complex (entangled) relationality—in order to pave the way for future industrial progress projects and manage any overflows that arise. This process of ironing pushes these entanglements into the shadows, as not to interfere with the ‘bright future’ promised by these stories. However, the process of ironing does not erase these relations. They lurk in the shadows, producing tensions

⁴⁵¹ See, for example, Philippot and colleagues (2013).

⁴⁵² The first paragraph of a *Nihon Keizai Shimbun* (known as *The Nikkei*) article describes the questionable use of the term *sōteigai*: “Was the accident really ‘beyond expectation’ [*sōteigai*]? If Tokyo Electric had prepared by carefully [*yōjin fukaku*] assessing the nuclear power plant, there is a possibility that the accident’s large scale could have been prevented” (“Was Fukushima really,” 2016). The article points to documentation that TEPCO knew in 2008 that a tsunami of over 15.7 meters was possible—a height similar to the waves that hit the plant in March 2011—but did nothing to augment its tsunami policies (see Ramseyer, 2012; “Tsunami predictions,” 2016).

that are not visible within the simplified (single fold) story offered by the projects themselves. And what happens to these tensions? They are absorbed by the everyday world-making projects of humans and more-than-humans. In the case of my participants, these tensions emerged as experiences of *konran* and *kattō* which needed to be worked out within their situated sociomaterial entanglements.⁴⁵³ In Chapter 7, I attend to the ways these tensions are worked out in practice. In focusing on my participants' multiple embodied experiences of *konran* and *kattō*, I painted a picture of the ways in which they work together to cultivate places of refuge—'refugia' for thinking and for physical and emotional reprieve—attempting to 'stay with the trouble' and cultivate 'response-ability' even within extremely restrictive ruling relations.

Returning to Haraway's (2016) *Chthulucene*, my analyses of Japan's post-2011 ruling relations reveal that industrial progress projects enacted within industrial ruins are coordinated in ways that explicitly ignore the heterogeneous human and more-than-human sympoietic entanglements that make up the *Chthulucene*. Again, Haraway's (2016) conceptualization of the *Chthulucene* invites scholars to attune to both vital and vicious material-semiotic entanglements, to 'stay with the trouble' of the messiness of these entanglements, even the most frightening and monstrous. Put differently, if ruling relations enacting the industrial progress projects of the Plantationocene, Capitalocene and Anthropocene are asking us to ignore messy and heterogeneous sociomateriality, the *Chthulucene* is an invitation to begin seriously paying attention to monstrous, "tentacular" sociomaterial entanglements (Haraway, 2016: 30-57). Vital institutional ethnography as a method of inquiry has not only allowed me to attune to the coordination of textually-mediated ruling relations, but to the vital and vicious entanglements that are obfuscated within the ruling relations themselves.

⁴⁵³ As mentioned in Section 3.3.1.3, institutional ethnographers Campbell and Gregor (2004: 72, original emphasis) describe how inquiries into everyday practice expose "the tensions absorbed" in everyday work (broadly defined).

8.2 The necessity of noticing textual and non-textual sociomaterial entanglements: The potential dangers of ignoring ghosts and monsters when studying industrial ruination

In this thesis, it was my multiplicitous attempts to grapple with the monstrous materiality of radionuclides—their imperceptibility, the insidious ways they permeate all aspects of life, and their many ghostly hauntings connected to military and industry projects—that impelled me to blend institutional ethnography with sensibilities from the field of material semiotics. However, it was through the process of enacting this research project that I have come to realize the importance, if not the necessity, in attending to more-than-textual sociomateriality when studying cases of industrial pollution—happenings that arise from within the ruling relations of the Capitalocene which actively work to silence multiplicity of not only human, but more-than-human actors.

My attention to historical industrial overflows and ghostly ‘absent presence’ throughout my analyses proved invaluable for attuning to how multiplicity and monstrosity are silenced within the ruling relations of the Capitalocene—highlighting how coordination efforts asking people to ignore sociomaterial entanglements not only participate in enacting industrial overflows, but in containing the overflows through coordinating further acts of ignoring once they do occur. The overflow of radionuclides from TEPCO’s damaged reactors are just one of the many troubles we face in the Anthropocene. If the troubles being faced in the Anthropocene are due in some part to this coordination of the collective forgetting of monstrous and ghostly sociomaterial entanglements, then carefully paying attention to these monsters and ghosts would be essential to truly understanding how ruling relations work in practice.

More importantly, without seriously attending to monstrous and ghostly sociomaterial entanglements, I as a researcher might actually perpetuate the very ruling relations I set out to study. In only tracing ruling texts as they relate to the experiences of my human participants, the various ruling relations involved in silencing the activity of anthropogenic radionuclides and other more-than-humans might be overlooked, and my analysis would confine my participants within the perspectival debates on radionuclides and human health, which themselves play a major role in the coordination of ruling relations. This is the danger, according to Deleuze and Guattari (2004), of focusing

only on tree traces without plugging them back into the rhizome. Here, I turn to an example from evolutionary biology to illustrate this point.

In a paper discussing the need to pay more attention to the biological effects of exposure to low-doses of ionizing radiation, evolutionary biologists Møller and Mousseau (2013b) tell a poignant story on the importance of noticing sociomaterial entanglements within industrial ruins. They share a story of the vibrant birdsongs that can be heard throughout the most contaminated forests near the Chernobyl nuclear disaster. While many people would hear the songs and assume it was a sign of the flourishing of wildlife within abandoned industrial ruins, Møller and Mousseau (2013b) paint a very different picture of what is actually happening—a picture that arose from carefully noticing the monstrous sociomaterial entanglements from which these birdsongs emerge. The authors explain:

There is a bias in sex ratio of birds at high levels of contamination in Chernobyl due to reproducing females being differentially susceptible to the negative effects of radiation, resulting in a greater female mortality rate and a greater number of unmated males. These males sing to attract a mate, and the proportion of singing males is consistently higher in more contaminated areas in Chernobyl. Such high frequency of birdsong may leave the false impression that nature is flourishing. A similar pattern was found in Fukushima, suggesting that similar mechanisms are at work in the two sites. (Møller & Mousseau, 2013b: 17)

My participants' multiple experiences of *konran* following TEPCO's nuclear disaster share striking similarities to the story of the birds in Chernobyl. In the way the vibrant birdsongs enact an image of 'revitalization' and 'rebirth' which distract people from noticing the monstrous sociomaterial entanglements behind the noise, the progress-oriented chorus of 'rebirth' and 'revitalization' encountered by my participants following the onset of TEPCO's nuclear disaster enacts similar blindness to situated sociomaterial entanglements. That is, the chorus of 'rebirth' and 'revitalization,' which began roaring and reverberating almost immediately following the earthquake, tsunami and nuclear disaster in March 2011, makes noticing both vital and vicious entanglements difficult. Here, instead of stochastic realities creating noise—or

*interference*⁴⁵⁴—within statistical models and equations, the intense and unyielding clamor of the chorus of ‘rebirth’ and ‘revitalization’ *interferes* with attempts at noticing one’s own monstrous sociomaterial entanglements within TEPCO’s industrial ruins.

Thus, while there have been valid concerns raised by institutional ethnographers about the dangers of blending institutional ethnography with material-semiotic attuned methods (Rankin, 2017), my thesis has revealed how studying ruling relations within industrial overflows benefits from tying a ‘promising knot’⁴⁵⁵ between these two fields of scholarship. Thus, in taking on the challenge by Deleuze and Guattari (2004) of plugging tree traces back into a rhizomatic map, this thesis represents an example of a method that takes seriously the “stochastic politics of life and death” (Bubandt, 2017: 137), and may be useful for researchers grappling with troubles of the Anthropocene—especially when those troubles are muddled by the pulsating drumbeats and harmonized choruses through which industrial progress projects actively attempt to silence situated, vital, viscous, monstrous and ghostly sociomateriality.

In this way, the act of noticing ghostly and monstrous entanglements is itself a form of resistance within ruling relations that encourage people to ignore and forget. Unable to notice complex, stochastic, symbiotic, sympoietic, situated sociomaterial entanglements, the single reality deployed by purveyors of industrial progress projects bluntly categorizes bodies and objects into classifications that align with their own stories of progress. These categorizations—for example the ‘victim’-‘perpetrator’ binary enacted by *kōgai* (Chapter 4), or *fūhyōhigai* (Chapters 6 and 7)—can sometimes be used to pit people against each other in ways that obfuscate the responsibility of ruling elites or industries in the enactment of industrial ruination. In some cases, activating these ready-made categories may be useful. In other times, however, these categories entrap people within perspectival debates, or allow for categorizing people and their experiences away as ‘irrational’ or ‘anxious.’ In closing this section, I offer an example of how using material-semiotic sensibilities to attune to monstrous

⁴⁵⁴ Michel Serres (1982: 66) defines ‘noise’ in the “scientific tradition” as a type of interference, specifically “the set of these phenomena of interference that become obstacles to communication.”

⁴⁵⁵ Haraway (1994: 66) has encouraged scholars to “invent promising knots, and suggest other figures that will make us swerve from the established disorder of finished, deadly worlds.”

sociomaterial entanglements hidden within the Japanese government-prescribed category of ‘voluntary evacuee’ might interfere with the smooth enactment of projects of ‘rebirth’ and ‘revitalization’ which attempt to erase nuclear refugees from official ruling texts.⁴⁵⁶

As previously mentioned, while the Japanese government officially refers to people who left areas contaminated with TEPCO’s radionuclides as ‘voluntary,’ or ‘independent evacuees’ (*jishu hinansha*, 自主避難者), I have been referring to them as ‘nuclear refugees,’ because they are people seeking long-term refuge—not temporary evacuation—from TEPCO’s radionuclides—some of which will be active for hundreds, or even hundreds-of-thousands, of years.⁴⁵⁷ Revisiting the *kanji* characters that make up the Japanese word for evacuation—*hinan* (避難)—provides interesting insights as the word combines the character for ‘avoid’ (*hi*, 避) with a character that can be translated as ‘disaster,’ ‘danger’ or ‘trouble’ (*nan*, 難). Thus, beyond simply ‘evacuation,’ the term also seems to refer to the act of ‘taking refuge’ or ‘avoiding trouble’—a translation that fits better with the experience of my participants who sought refuge from TEPCO’s radionuclides. Exploring the Japanese word for refugee—*nanmin* (難民)—opens up further possibilities for disrupting blunt categorizations. By combining the ‘trouble’ enfolded in the *kanji* character *nan* (難) with a character for ‘people’⁴⁵⁸ (*min*, 民), a different translation emerges: ‘trouble people.’ Nuclear refugees are, in fact, trouble for business as usual, as their mere existence disrupts attempts to erase the industrial ruination from which they seek refuge. Differing greatly from the benign category of ‘voluntary evacuee’ offered as the only classification for refuge-seekers within government ruling texts, terms such as ‘nuclear refugee’ or ‘trouble people’ help to re-attune to the sociomaterial relations—precisely people’s entanglement with

⁴⁵⁶ See Yoshida (2018) and Khan (2018) for further discussions on how ‘evacuees’ in the aftermath of TEPCO’s nuclear disaster have been treated within Japan’s legal system.

⁴⁵⁷ See Section 6.3.

⁴⁵⁸ This character is usually used to refer to a group or categorization of people, such as ‘citizens’ of a nation (*kokumin*, 国民), ‘citizens’ or ‘residents’ of a city (*shimin*, 市民), or even ‘abandoned people’ (*kimin*, 棄民)—a term that has been used since TEPCO’s nuclear disaster to describe the nuclear refugees (categorized as ‘voluntary evacuees’) left out of current government policies (see Hino, 2016; Kimura, 2016a: 146-7).

TEPCO's radionuclides—that impelled them to seek refuge in the first place. Enacting a vital institutional ethnography has allowed me to notice the myriad humans and more-than-humans, and their various ghostly and monstrous sociomaterial entanglements, active beneath the deafening chorus of 'rebirth' and 'revitalization.' This method will also provide me with an opportunity to share these insights with my study participants, attuning them to how texts, ghosts and monsters contribute to the experiences of *konran* we explored together in interviews and focus group sessions.

8.3 Thinking together

As researchers, attuning to messy and monstrous sociomaterial relations within ceaselessly sprawling industrial ruins—and thus the destruction of 'refugia' needed to support life and resurgence on a damaged planet Earth—we are faced with a number of ethical considerations. Do we continue to participate in single-reality-wielding, autopoietic, tree-like ruling relations that are blind to sociomaterial entanglements and continue to participate in the enactment of industrial progress projects unable to notice their own destructive forces? Or do we take seriously the messy, monstrous heterogeneity referred to as stochastic "noise," "scatter" or "trivial"⁴⁵⁹ forms of static that are silenced within statistical equations of institutions such as the transnational nuclear assemblage?

Noticing means taking this 'static' seriously, staying with the trouble of the monstrous sociomaterial entanglements of Haraway's (2016) *Chthulucene*, without attempting to smooth them over, or categorize them away. It means attending to the experiences of *konran* and suffering expressed by all people entangled within radiological overflows, such as Mrs. Lijon Eknilang—a woman from the Marshall Islands who stood before the International Court of Justice and shared some of the monstrous experiences of women living in the fallout of the United States' sixty-seven nuclear bomb tests. In her testimony, she shared harrowing accounts of how women:

give birth, not to children as we like to think of them, but to things we could only describe as "octopuses", "apples", "turtles", and other things in our experience. We do not have Marshallese words for these

⁴⁵⁹ See Section 5.4.1.

kinds of babies because they were never born before the radiation came.

Women on Rongelap, Likiep, Ailuk and other atolls in the Marshall Islands have given birth to these “monster babies”. ...One woman on Likiep gave birth to a child with two heads.... There is a young girl on Ailuk today with no knees, three toes on each foot and a missing arm...

The most common birth defects on Rongelap and nearby islands have been “jellyfish” babies. These babies are born with no bones in their bodies and with transparent skin. We can see their brains and hearts beating.... Many women die from abnormal pregnancies and those who survive give birth to what looks like purple grapes which we quickly hide away and bury.... (quoted in Lauterpacht & Greenwood, 1998: 412-3)⁴⁶⁰

As researchers, how can we attend to monstrous entanglements, particularly when our objects of concern are difficult to understand without specific forms of scientific expertise? And when the scientific knowledge and expertise about these materials participate in oppressive ruling relations? In this thesis, I found myself as a social scientist struggling to learn about radionuclides, imperceptible materials whose activities have been contained within a vast textual complex that is blind to heterogeneity, sympoiesis and stochastic realities. Enacting my project required moving beyond my own disciplinary boundaries, reaching into other scientific fields which engage directly with environmental and scientific histories, radionuclides, human bodies and other shared objects of concern. While I tried my best to traverse trans-

⁴⁶⁰ The Marshallese poet Kathy Jetnil-Kijiner (2017b) wrote a poem titled “Monster” where she describes the suffering of women in the Marshall Islands who gave “birth to nightmares”—“Sinister. Hideous. Monster. More jellyfish than child.” Her performance of the poem, which lays bare the ghosts of the transnational nuclear assemblage, was filmed just in front of the Hiroshima Peace Memorial in Japan and was posted to the International Campaign to Abolish Nuclear Weapons (ICAN) Facebook page in support of the negotiations to ban nuclear weapons taking place at the United Nations between February and July of 2017. ICAN was awarded a Nobel Peace Prize for its efforts in October 2017. The video of Kathy’s poem “Monster” can be viewed at: <https://vimeo.com/224211868>. See Jetnil-Kijiner (2017a) and <https://www.kathyjetnilkijiner.com> for more of Kathy’s poems.

disciplinary boundaries on my own, working alone is not only extremely difficult, but has its limits, especially when trying to address deeper questions regarding complex biological and physical processes. Therefore, I see much potential in transdisciplinary collaborations when dealing with the messiness and heterogeneity of toxic industrial overflows and other troubles of the Anthropocene. The editors of the book *Arts of Living on a Damaged Planet* provide an excellent example of a promising collaboration between a historian and a microbiologist regarding the effects of low-doses of ionizing radiation on human bodies (Swanson et al., 2017).

At a conference in 2014, historian Kate Brown shared how she was faced with stories of monstrous sociomaterial entanglements during her fieldwork near a plutonium reprocessing plant in Russia.⁴⁶¹ In her talk, she describes how many of her study participants, who were mostly women, wanted to talk about their bodies, sharing their medical records with Brown who instead wanted her participants to stay focused on the reprocessing facility. Eventually, Brown (2014b) was forced to notice what the women had been trying to show her:

Finally one woman, her name was Kuzminova. She just put her papers down and she got up. And before I could stop her, she unbuttoned her shirt and she showed me her abdomen which was alive with scars from multiple surgeries. [...] That really finally got me. Kuzminova forced me to see her body in a way that I had been refusing to see when I turned away these women's medical papers. [...] I didn't know if those many surgeries were caused from isotopes from the plutonium plant, but her pain recorded in her bodily etchings was simply, exhaustingly there. I could no longer doubt it, but I still wished it could go away.

Brown (2014b) went on to describe a number of symptoms experienced by some of the people living near the plutonium reprocessing facility, which have been termed

⁴⁶¹ The fieldwork provided the basis for her book *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (K. Brown, 2013). Brown's (2014b) talk contains excerpts from a forthcoming book chapter uploaded by the University of California, Davis' Environments and Societies (see K. Brown, 2014a).

“Chronic Radiation Syndrome”—a diagnosis only found in the Ural region of Russia.⁴⁶²

She describes the syndrome as:

an illness caused by long-term exposure of low-doses of radiation
[...] doctors [...] have diagnosed it as a multiple assault of
radioactive isotopes on multiple organs, producing a number of
symptoms including chronic fatigue, weight loss, severe joint pain,
disorders of the immune and circulation systems, the digestive track.
All of these problems crop up long before a person gets radiation-
induced cancers. (Brown, 2014b)

The editors of *Arts of Living on a Damaged Planet* point out that Margaret McFall-Ngai, a microbiologist who studies relations among microbes and organisms and works within the paradigm of the postmodern synthesis, was listening to Brown’s talk (Swanson et al., 2017).⁴⁶³ The editors explain the insights McFall-Ngai offered to understanding the sufferings of Brown’s study participants:

Rather than diffuse complaints, a product of bad living, as doctors had argued, McFall-Ngai thought all those ailments could easily arise from one cause: mutations in intestinal bacteria. Chronic doses of radiation that might not yet stimulate a human cell cancer could easily have caused bacterial mutations. [...] Suffering from the ills of another species: this is the condition of the Anthropocene, for humans and nonhumans alike. (Swanson et al., 2017: M3-4)

Such exchanges enact what Haraway (2017: M28) refers to as the “new new synthesis” or the “extended synthesis,” referring to the emerging transdisciplinary interchanges among biologists in the postmodern synthesis and social scientists and humanities (what she refers to as ‘humusities’) scholars—exchanges which have become

⁴⁶² She points out in her talk that US scientists—who were active in the development of the transnational nuclear assemblage (Chapter 5)—have refused to recognize this diagnosis.

⁴⁶³ See McFall-Ngai (2014; 2017) and McFall-Ngai and colleagues (2013). The conference in 2014 provided the basis for the book *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene*.

indispensable for thinking through some of the terrifying troubles of the Anthropocene.⁴⁶⁴

My research into the transnational nuclear assemblage (Chapter 5) has illustrated that the biological insights produced and activated within this assemblage's textual complex are much more in line with the modern synthesis in biology and its autopoietic, single-reality-wielding stories where bodies are broken into units and analyzed in pieces before being put back together in statistical models. This explains why the experiences of Brown's research participants could never be taken seriously by scientists activating scientific knowledge produced within the transnational nuclear assemblage—knowledge based on theories and models that do not recognize the heterogeneity inherent in sympoietic and symbiopoietic sociomaterial relationality.

Thus, insights from the postmodern synthesis in biology could prove useful for disrupting post-nuclear disaster ruling relations that are blind to multiplicity and heterogeneity: the postmodern turn in biology explicitly abandons tree-like conceptualizations of biological processes, recognizing them as instead being more web-like and rhizobial in nature (see Mcfall-Ngai, 2017). In addition, as Haraway (2017) points out, taking seriously our lichen-ness means embracing monstrosity, both vital and vicious.⁴⁶⁵ The work essential for seriously engaging with these monstrosities will necessarily involve not only attuning to sociomaterial entanglements, but 'staying with the trouble' and "become capable of thinking" (Pignarre et al., 2011: 107), not individually, but "thinking together" across disciplines (Haraway, 2016; Swanson et al., 2017: M4). This is the hope these monstrous entanglements might bestow to the researchers and research participants able to notice them.

⁴⁶⁴ Haraway (2017: M28) describes these hopeful scholarly cross-contaminations: "An emerging 'new new synthesis' (or 'extended synthesis') in transdisciplinary biologies and arts proposes string figures tying together human and nonhuman ecologies, evolution, development, history, affects, performances, technologies, and more."

⁴⁶⁵ Or, as the editors of *Arts of Living on a Damaged Planet* argue, "We need both senses of monstrosity: entanglement as life and as danger" (Swanson et al., 2017: M3).

8.4 Concluding remarks

During my fieldwork in 2016, Gojira appeared in Japanese theatres again, this time as *Shin Gojira* (Anno & Higuchi, 2016),⁴⁶⁶ a gruesome and frightening monster that emerged from Tokyo Bay, leaving large areas of Tokyo in ruins following its deadly rampage through the metropolis. In the way the 1954 film drew connections to the Lucky Dragon incident and bestowed a warning about nuclear weapons testing, the 2016 film drew many connections to TEPCO's nuclear disaster, providing an insider view of how this monstrous creature and the radioactivity it spread was handled by the Japanese government who considered the incident to be 'beyond expectation' (*sōteigai*). Similar to the aftermath of TEPCO's nuclear disaster, ruling discourses such as *anshin*, *sōteigai*, *fukkō*, *fūhyōhigai* and *josen* (decontamination) could also be heard throughout the governments' deliberations and public announcements.

With the US planning to destroy Gojira with a nuclear weapon, one of the protagonists—the Japanese Deputy Chief Cabinet Secretary Yaguchi Rando—banded together with his colleagues, employing much more creative strategies involving hoses, bullet trains and other public machines to ultimately freeze Gojira. The film ends with Secretary Yaguchi overlooking the Tokyo skyline from a rooftop, the frozen body of Gojira standing in place of demolished buildings as a reminder of the long-term trouble his awakening poses to the people of Japan and the world at large. In his final remarks, Secretary Yaguchi asserts the necessity for staying with the trouble of Gojira and the invisible threat of radiation the monster carries: "Japan, no, humans have no choice but to live alongside Gojira. [...] However, now is not the time to quit. It will take long for this situation to be resolved."

This thesis emerged from the experiences of my participants who, like both Dr. Yamane and Secretary Yaguchi, have been trying stay with the monstrous trouble posed by the overflow of TEPCO's radionuclides. However, staying with the trouble is not easy, particularly when acting within ruling relations aggressively working to sweep away such troubles in order pave the way for the smooth coordination of business as usual. Similar struggles can be found throughout the globe, as the

⁴⁶⁶ *Shin* (新) is the Japanese word for 'new,' and, thus, the title can be translated as 'New Godzilla.' It is also sometimes referred to as *Godzilla Resurgence*.

monstrosity of industrial overflows, climate chaos and mass extinctions that characterize the Anthropocene are met with ruling relations of the Capitalocene that are blind to this very monstrosity—a blindness that participated in enacting these very troubles. Thus, staying with the trouble means attuning to the sociomateriality of ruling texts as well as the ghostly and monstrous entanglements being actively ignored and discounted by ruling texts and discourses. Better understanding our own sociomaterial entanglements and ways we participate in ruling relations could support the efforts of those people struggling to work together across difference, fighting to curate and protect refugia in the face of overflowing trouble.

Here, I would like to give the last word to one of the ‘trouble people’ from Fukushima Prefecture who I interviewed 2016. As I was writing these reflections in January 2018, she shared her own reflection on a 2014 letter written by a woman living in Date City, Fukushima Prefecture. My hope is that the findings of this thesis will support her and my other participants in better understanding their sociomaterial entanglements with ruling texts, monsters and ghosts as they continue to struggle in their tireless efforts to stay with the trouble of TEPCO’s nuclear disaster.

“Don’t be deceived by terms like ‘fūhyōhigai’ and ‘fukkō.’” I was so surprised [she wrote this]! Today, I said the exact same thing when speaking before a group of elementary school teachers in Osaka. The difference was between being called foolish by others for decontaminating your garden “through your own efforts” and being called foolish by others for continuing to evacuate “through your own efforts.” That was the only difference [in our messages]. Beyond that, [for those] using terms like “fukkō [revitalization],” “kizuna [bonds],” “fūhyōhigai [harmful rumors],” have you completely forgotten that we need to start from our shared reality and the truth? For the past seven years was it the words of the perpetrators who hold power and political influence, or the voices of everyday citizens, the voices of the victims of the disaster that were listened to? Over the past seven years was it possible for the views of the victims to be heard? No system has been established to reflect the voices of victims of the nuclear calamity, has there? I believe these struggles will

accumulate as historical realities. It has been seven years since the disaster, not yet seven years. Please allow me to join others in pointing out such blatant peculiarities.

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