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Risk Communication and the Disposal of Radioactive Debris: Answering Questions Without Questioning Answers

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ABSTRACT

Between 2011 and 2014, the Japanese government conducted a 'wide-area processing' scheme to dispose of radioactive debris from Iwate and Miyagi prefectures following the Great Eastern Japan Earthquake and Tsunami. The scheme was designed to hasten recovery in those areas by disposing of radioactive debris in other regions. Although 'wide-area processing' was open to localities in all forty-seven prefectures, only eighteen participated. Out of the eighteen participants, nine explained their involvement to residents in Question and Answer (Q&A) sections posted on their homepages. This article examines those nine Q&As from the perspective of risk communication. It holds that different risk perceptions were held by localities on the one hand, and residents on the other. While the Q&As ostensibly represented a wider shift from a 'deficit model' of risk communication to a 'democratic model', they nonetheless operated hierarchically through the construction of 'ambiguous risks' as 'simple risks' to neglect the 'concern assessment' advocated by the International Risk Governance Council (IRGC). As such, the Q&As were employed as a moral technique to discipline local populations into accepting the radiation risks generated by the national government's approach to reconstruction.

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KEYWORDS

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1. Introduction

There has been detailed discussion in the English-language literature about the implications of the earthquake and tsunami of 11 March 2011, and the subsequent nuclear disaster. Examples include an overview of the prospects for recovery in Tōhoku (Matanle 2011); coverage of local and national socio-political reactions (Kingston 2012); analysis of competing narratives about crisis response (Samuels 2013); arguments about the applicability of the concept of 'human security' to recovery efforts (Bacon and Hobson 2014); discussion of the interface between state and society in the communication of scientific controversies (Fujigaki 2015); and the use of debris to represent collective suffering (Dinitto 2014). However, none of this work has focused on the problem of radioactive-debris disposal, known officially as 'wide-area processing'² (*kōiki shori*).

We therefore examine risk communication regarding the disposal of radioactive debris from Iwate and Miyagi outside those areas.³ Originally, the national government invited all of Japan's forty-seven prefectures to undertake disposal, but this initiative met local resistance, and only eighteen authorities consented. In agreeing to participate, nine localities posted their risk perceptions on their homepages in a 'question and answer' (Q&A) format. Our analysis looks at these Q&A pieces. We hold that although the Q&A format implied a 'democratic model' of risk communication in line with recent trends in this area, the content followed the traditional 'deficit model' of hierarchic engagement, in which 'ambiguous risks' were constructed as 'simple risks' and citizens' concerns were effectively ignored. The

² 'Wide-area processing' is the Japanese government's official English translation.

³ Debris from Fukushima was disposed of inside that prefecture.

seemingly participatory approach of Q&A was thus employed as a moral technique to discipline local communities into following centralized goals for economic recovery.

We develop our argument as follows. First, we explain the concept of risk used here and note that in the most authoritative approach to practical risk governance, upheld by the International Risk Governance Council (IRGC), risks are categorized as 'simple', 'complex', 'uncertain', and 'ambiguous', with each type requiring a different response. The social nature of risk conflicts is then outlined to note that although experts frequently insist on the neutrality of scientific facts, risk perceptions stem from divergent worldviews and attendant social and political values. We finish by discussing the widespread shift from a 'deficit model' of risk communication to a 'democratic model', noting that this shift in other industrialized countries has also occurred in Japan, and is relevant to radioactive-debris disposal. However, despite the democratic turn, scholars have concluded that a hierarchic desire to control risk perceptions is often present in the supposedly more horizontal risk communication approach. In Section Three, we explain the empirical background behind the wide-area processing initiative to show that it was a site of social conflict. In Section Four, we analyse the discourse employed in the nine Q&A pieces. We divide the Q&As into three categories according to their adherence to the Environment Ministry's approach and reveal how 'ambiguous' risks were constructed as 'simple' risks in all nine localities.

2. The Nature of Risk(s)

While the standard technical definition of risk used in the risk-management literature is 'probability times magnitude of consequences' (cf. Kasperson et.al 2000: 232; OECD 2003: 30), there are varied understandings of risk across the social science disciplines, each constructing risk according to its own methods of knowledge production (Althaus 2005). We adhere to the constructivist emphasis dominant in social science to hold that while real harms exist independently of observation (magnitude of consequences), harms are not

'risks' until they have been constructed through discourse into *probable* harms that necessitate a decision (Ewald 1991; Luhmann 1993; Beck 1992; Beck 1999; Loon 2000).

Constructivism is based on four related observations. First, risk is a probabilistic way of thinking. Before the invention of 'probability' in the mid 1600s, the concept of 'risk' did not exist (Bernstein 1996). Second, 'risks' are not therefore objective entities waiting to be discovered. For example, CFCs in refrigerators were not thought to present a health risk until the link between CFC release, ozone depletion, and skin cancer was understood (Arnoldi 2009: 12). This new understanding created a new risk. The link existed as an objective 'harm' before it was discovered, but it did not exist as a 'risk' until it was incorporated into (probabilistic) risk discourse. Third, whether risk-taking, whatever its grounding in actuality, is viewed as beneficial or detrimental, depends on one's values, which are social and may change due to trends or new evidence and experience (Douglas and Wildavsky 1983; Arnoldi 2009:10; Lyng 2005). For instance, the dominant discourse in Japanese society held the risk-taking of nuclear energy policy to be socially acceptable, until the 2011 disaster. Certain groups and experts had disagreed. They represented an alternative minority risk perspective. However, with the events of March 11, and the new evidence and experience which that day brought, the dominant discourse shifted to construct nuclear power as more risky and less socially acceptable (see the Deliberative Polling results in Section 2.3). Such social shifts in risk perception are common, e.g. drink-driving, smoking, air pollution, promiscuity, overtime etc. Fourth, constructivism is not necessarily relativistic. Although risks are constructions, not all constructions correspond equally with the 'real world'.⁴ Some risks may better represent objective reality than others (Rosa 2003). Yet what is known, or not known, and the implications of the level of knowledge obtained, is often contested, especially when the degree of correspondence to reality remains unclear (e.g. the health effects of low-level radiation exposure).

⁴ There is a difference between 'hard' constructivists, who view all risks as subjective ways of thinking and thus relative, and 'soft' constructivists, who view risks as an imperfect way of comprehending real (objective) harms. We take the 'soft constructivist' approach.

We therefore look at the radioactive-waste disposal risks constructed and communicated through discourse by local authorities on the one hand, and individual residents on the other, without trying to ascertain 'accuracy'. Our aim is simply to demonstrate the difference between the risk constructions proposed by local authorities and residents.⁵

2.1 Risk and the IRGC

A unified notion of risk is required for comparison of risk constructions. To enable comparison, we use the concept of risk constructed by the IRGC's risk governance framework. This was set out in a 2005 White Paper authored by Ortwin Renn, and in a 2008 summary of the White Paper. The IRGC describes itself as a 'private, independent, not-for-profit foundation' established '...to support governments, industry, NGOs and other organisations in their efforts to deal with major and global risks facing society and to foster public confidence in risk governance' (Renn 2005: 5). It represents the most recent comprehensive attempt to provide an interdisciplinary approach to risk analysis and management (Rosa 2008: 101-102), and builds on the US National Research Council's 1983 and 1996 risk management reports (Löfstedt and Asselt 2008: 77-78).

Renn (2005: 29) holds that 'complexity', 'uncertainty' and 'ambiguity' are not 'intrinsic characteristics' of risk, but relate to 'the state and quality of knowledge available' regarding causality. They can be used to classify different risks as follows (cf. Renn 2005: 29-31; IRGC 2008: 16):

- Simple Risks : cause and effect are understood, and regulations are obvious and accepted (e.g. home fire safety)
- Complex Risks: causes and effects are hard to identify (e.g. failure in an ICT system)

⁵ However, *our* underlying values dictate that we find the citizens' perspective of ambiguous risk more appropriate than the authorities' perspective of simple risk.

- Uncertain Risks: data on which cause and effect calculations are based is poor quality or unclear (e.g. long-term effects of GM crops)
- Ambiguous Risks: conflicting social perspectives about justification for and severity of possible harm (e.g. exposure to low-dose radiation)

The IRGC argues that different risks necessitate different governance responses. Simple risks can be met with laws and regulations, whereas complex risks should be handled through use of the best scientific knowledge available, together with attempts to guard against outcomes that have not been fully comprehended. In contrast, the precautionary principle should be applied to uncertain risks so that decisions may be reversed and unexpected outcomes withstood. Finally, ambiguous risks are best approached through broad dialogue aimed at reconciling antagonistic values and perspectives. Overall, the IRGC recommends a strategy of 'inclusive governance' wherein 'stakeholders' participate in risk decisions. The level of 'stakeholder' participation should increase from simple through to ambiguous risks, with the latter involving input from civil society. Because the IRGC agrees with the OECD (2003: 67) that risks are 'mental constructions' (Renn 2005: 23), the distinctions are not absolute, and the above classifications have been criticized for being too 'rigid', for overlapping, and for being impractical (Renn and Walker 2008: 342). Furthermore, the IRGC accepts that disagreement may also exist between stakeholders about what kind of risk is being addressed (Renn 2005:52-53).⁶ Nevertheless, we hold that the categories provide a useful typology for examining the discourse used in risk communication.

2.2 Risk Conflicts and Society

⁶ Should such disagreement occur, the IRGC argues that '[t]he best means...to deal with this conflict is to provide for stakeholder involvement when allocating the different risks into these four categories' (Renn 2005: 53). This was not done in the cases examined in this paper.

Key approaches to risk in sociology, namely risk society, the 'culture of fear' approach, and governmentality, share '... the view that pre-occupations with risk are wedded to capitalist modernization and the burgeoning cult of expertise' (Walklate and Mythen 2010:47). While these considerations of risk differ in their emphases, they all focus on the politics of '...diverse interest groups contending over relatively intractable scientific claims' (Ungar 2001: 277) to argue that the 'sites of social anxiety' are now centered on crises caused by unknowns, often scientific and technological accidents and side effects. The upshot is that '...science is used mainly as a material and discursive resource in pursuing broader agendas in which values and interests intermingle with the interpretation and use of scientific findings' (Maesele 2010: 3).

Not only can a focus on technical risks obscure larger questions about the use of science and technology (Irwin 2006: 302), scientists have often forgotten that scientific pronouncements are valueless for citizens unless they can be used and come from a source that people view as reliable (Irwin et. al. 1996: 62; Engdahl and Lidskog 2014: 707). Bland assurances of safety from 'outsiders' that disregard local knowledge can sideline citizens in favour of more 'powerful groups' (Irwin et. al. 1996: 63). Failure to acknowledge that identities, value judgments, and even emotions (cf. Sjöberg 2000; Slovic et. al. 2004) are involved in people's and *experts'* risk perceptions, and that scientific procedures are similarly value laden, with final positions often hiding uncertainty (Latour and Woolgar 1979; Wynne 1996; Wynne 1996b; Morrone and Lohner 2002: 3-14; Bickerstaff et. al. 2010: 476; Nagashima 2015), can moralize risk conflicts and mask the underlying political disagreement, thereby closing avenues for democratic expression of conflicting values (Maesele 2010: 4; Douglas 1994).

2.3 The Democratic Turn in Risk Communication

Initiatives in states like Japan to actively involve citizens in science-policy debates and account for citizens' broader socio-political perspectives on risk have necessitated parallel changes in risk communication strategies (Drake 2011: 528). Greater 'humility' is sought

with the aim of treating citizens as subjects to talk with and learn from, rather than objects to talk (down) to (Jasanoff 2003). Risk communication experts have also emphasized the need to establish *trust* amongst the public, with '[o]penness, transparency, and dialogue [being] key words in their efforts to gain the trust of citizens and stakeholders' (Engdahl and Lidskog 2014: 706). The IRGC (2008: 10-11) highlights the role of 'concern assessment' as a vital supplement to 'scientific risk assessment', and states that concern assessment 'is a particular innovation of the IRGC' (IRGC 2008:10). Concern assessment focuses on the accommodation of citizens' risk perceptions and acknowledges the importance of values and emotions.

More broadly, the new interest 'trust' reflects a shift from a longstanding 'cognitive deficit model' (Wynne 1991: 113) of risk communication to a more recent 'democratic model'.⁷ The 'deficit model' is a '...top-down' model where only certain forms of knowledge are seen as privileged and legitimate. From this high-science perspective, the central issue is the public failure to understand science' (Irwin et. al. 1996). In the 'democratic model', input from lay people is encouraged. There is evidence of this democratic transition in Japan, for example, risk communication concerning the Monju reactor (Fujigaki 2009: 516).

One should note that we use the term 'model' loosely. It does not refer to a specific set of criteria that practitioners follow, but to an underlying attitude. In other words, approaches to risk communication that are open to citizen input into decision-making and are willing to accommodate alternative lay perspectives adhere to the democratic model. Those that shun lay input to prioritize expertize and state goals adhere to the deficit model. The IRGC's promotion of wide stakeholder participation and concern assessment, especially for ambiguous risks, fits the democratic model.

⁷ To avoid becoming embroiled in semantics, we use the term 'democratic model' generically to refer to an approach to risk management and risk communication that encourages wide stakeholder involvement. However, other finely-nuanced descriptions exist.

There is, however, a difference between the classification of risks and the models themselves. Whereas the two models refer to styles of risk communication, the IRGC's risk categories are a way to comprehend risks. There is a logical connection between concern assessment for ambiguous risk and the democratic model, and the IRGC promotes this link, but it is not assumed. The problem is that the deficit model has traditionally been used when communicating ambiguous risks. In short, a governmental institution could employ either model when dealing with any risk.

Despite improvements, there has been a residual tendency to use public inclusion and debate to legitimize hierarchic policies relating to predetermined risks (Engdahl and Lidskog 2014: 706; Bickerstaff et. al. 2010: 490). Sometimes, concern with a deficit of public knowledge is replaced by concern with a deficit of public trust, deemed resolvable by simply letting people 'talk' (Irwin 2006). This also applies to Japan, where there is adherence to the deficit model in the state's ostensibly democratic 'outreach initiatives' that still seek to educate the public so that it will support science policies (Fujigaki 2009: 517).

Drake (2011: 542) links the 'inherent tension' between hierarchic and egalitarian characteristics to a governmentality observation about the ideology of neoliberalism in states engaged in this kind of risk communication, where '...citizens are expected to actively engage in promoting their well-being but passively accept market forces that may threaten aspects of it'. The imperative of economic development underlies the concept of 'healthy' citizens. Health is highlighted not because it is important in itself, but because ill health threatens economic goals (cf. Foucault 1991; 1997). As Drake observes, concern to maintain health may be elided if it conflicts with economic rationales.

This mixed conception of health exists in Japanese risk governance practices. Although neoliberal techniques of governance centred on 'individual responsibility' have spread (Hook and Takeda 2007), governance of nuclear risk has followed a state-centred paternalistic model in which policies are crafted by isolated experts free of public scrutiny (Yoshioka 2011). Where public wishes to maintain healthy lifestyles conform to economic policy, such as smoking, drinking, drug-taking and obesity, they are held as rational,

responsible and *moral*. But where health concerns can impede growth strategies, as in the operation of nuclear plants and nuclear waste-disposal sites, they are downplayed as irrational, irresponsible and implicitly *immoral* (Williamson 2015a; Williamson 2015b). Regarding radioactive-debris disposal, we argue that seemingly 'open' and 'transparent' dialogue (i.e. Q&A) to involve citizens in a nuclear-related policy promotes pacification of (immoral) opposition that threatens economic development based on nuclear energy.

Perhaps unsurprisingly, therefore, the preeminent example of a seemingly concerted effort to follow the 'democratic model' in Japan in relation to nuclear power was abortive. In the summer of 2012, the Democratic Party of Japan (DPJ) ran a Deliberative Polling (DP) initiative. This was the first time the state had employed this technique,⁸ revealing a slim majority of support for the eventual abandonment of nuclear power, with disagreement remaining about the timing (cf. Mikami 2015). The results of the DP fed into the government's energy strategy that envisaged the phase out of nuclear power by the 2030s. The Liberal Democratic Party (LDP), however, dropped the 'zero option' soon after it was elected in December 2012 (Mikami 2015: 116), opting to ignore public concern about radiation health risks, it being more concerned with the perceived risk that a nuclear-free policy presented to economic growth.

In the following sections, we consider the disposal of radioactive debris in Japan as a case study illustrative of this wider phenomenon. Section Three describes the disposal policy, whereas Section Four analyzes the risk-communication discourse used in the Q&As produced by nine localities. We argue that although the form of Q&A is ostensibly democratic, because it represents open dialogue between local authorities and citizens, the content fits a deficit model of assumed public ignorance and inadequate trust through the construction of ambiguous risk as simple risk to the exclusion of concern assessment.

⁸ Deliberative polling involves questionnaires, and discussion groups comprising citizens and experts, followed by further questionnaires and the final publication of results to be integrated into policymaking. For an account of the DPJ's effort see: Mikami 2015.

3. Implementing 'Wide-Area Processing'

In this section, we provide an overview of 'wide-area processing'. We note that wide-area processing was implemented in a top-down manner, from the Environment Ministry to local authorities, and then from local authorities to residents, and provoked reaction from citizens who felt their concerns about the ambiguous risks they associated with radioactive-waste disposal were not being addressed. Both the Environment Ministry and local authorities responded to citizen concerns through ostensibly 'democratic' techniques such as surveys and public briefing sessions, however their stance was reactive and rooted in a 'deficit model' that focused on scientific assessment to the exclusion of concern assessment. The aim was not to accommodate lay concerns in state risk-governance strategies, but to pacify opposition through explanation of what the authorities held to be a scientifically-justified position.

The effects of the earthquake and tsunami were complex and far reaching. Amongst them was the need to quickly dispose of a large amount of debris from the directly-affected areas to enable a speedy recovery. Japan had faced a similar problem after the Great Hanshin Earthquake in 1995,⁹ but the type of debris produced after 3.11 made disposal much more difficult. Most of the debris caused in 1995 was concrete, which could be recycled or used for reclamation (Tsuchida et. al. 1998), whereas the tsunami produced debris that could not be reused, meaning that incineration was the only appropriate means of disposal (Ministry of the Environment 2012a). The greatest difference, however, was the presence of radioactive matter from the Fukushima Daiichi nuclear plant.

The earthquake and tsunami also damaged prefectural waste-management infrastructures. Consequently, debris disposal either on site or in temporary storage sites within the prefectures would have hindered recovery efforts. It was thus proposed that spare waste-management facilities around the country should cooperate in 'wide-area processing'

⁹ In both cases, the total amount of debris was recorded as twenty million tons (cf. Tsuchida et. al. 1998; Japan Society of Material Cycles and Waste Management 2012).

for waste from Iwate and Miyagi, whereas the national government would take responsibility for disaster waste from Fukushima. The Environment Ministry explained the need for nationwide waste-disposal facilities and defined the principle of 'wide-area processing' on a new website entitled, 'The Disaster Waste Management Information Site' (Ministry of the Environment 2012a). Regarding the necessity of wide-area processing, the Environment Ministry explained that there was 'a lack of facilities', an unprecedented amount of waste, and that '[t]he quick disposal of disaster waste is indispensable for a speedy recovery...[There are] serious problems such as the danger of spontaneous combustion, unpleasant odours from rotting materials, and the proliferation of flies [author's translation]' (Ministry of the Environment 2012b).

In April 2011, the Environment Ministry conducted a survey to find out which prefectures could accept disaster waste. Based on the results, in May 2011, it formulated a 'Master Plan' setting out its policy (Ministry of the Environment 2011a). However, the 'Master Plan' made no reference to radioactive materials. On 3 June 2011, the Nuclear Safety Commission (NSC) invoked the 'Basic Position on the Safety Review of Burial of Secondary Radioactive Waste' (NSC 2010) to determine that 'there is a scientific basis for concluding that safety can be maintained [author's translation]' if the 8000bq/kg limit is followed (NSC 2011). Also in June 2011, Aomori prefecture became the first to accept waste disposal based on the Japanese government's standards, quickly followed by Tokyo. At the second regular session of the Metropolitan Assembly in June 2011, Tokyo governor Ishihara Shintarō announced that local authorities would cooperate with the private sector in debris disposal, and that the assembly had unanimously approved a supplementary budget for that purpose (Tokyo 2013).

Soon after, however, radioactive matter was detected in Tokyo and other regions around the country. This provoked doubts about the wisdom of disposing of radioactive waste even if levels met government standards (*Yomiuri Shinbun* 28 July 2011). In August 2011, the Environment Ministry thus produced a set of 'guidelines' to facilitate wide-area processing. This introduced two types of radiation level that would later cause conflict. The first was a

maximum of 100 becquerels (bq) per kilogram for radioactive caesium in products using recycled disaster waste such as wood; the second was a maximum of 8000 bq per kilogram of radioactive caesium for combustibles deemed appropriate for disposal (Ministry of the Environment 2011b).

Concerns regarding the different radiation levels prompted the Environment Ministry to produce a separate document as clarification. According to this document, 100bq/kg was based on the clearance level for recycling waste established in the Nuclear Reactor Regulation Law, whereas the 8000bq/kg came from the 'Act on Special Measures Concerning the Handling of Pollution from Radioactive Materials', thus enabling the 'safe incineration and burying of waste in accordance with standard practice [author's translation]' (Ministry of the Environment (not dated)).

In August, Yamagata prefecture announced it would accept waste for disposal, but based on its own safety standards, not the national government's. As noted above, Aomori and Tokyo had already agreed to start accepting waste, but Yamagata was the first to do so based on its own standards (Yamagata 2011a). Following Yamagata's decision, Osaka also started accepting debris according to its own standards (Osaka 2012).

However, even with the involvement of prefectures using their own standards, the programme continued to falter. Heads of local authorities who had agreed to accept waste met objections at public meetings. Examples of common concerns from citizens included whether transportation would spread radiation, whether disposal facilities would become contaminated, and whether areas that participated would be stigmatized. Consequently, in March 2012, the Environment Ministry issued a survey asking local authorities if they would participate in wide-area processing. The main concerns raised by respondents focused on the stringency of the government's safety standards, the strategies to prevent stigmatization, and the level of the state's financial contribution. Based on the survey results, the Environment Ministry issued a plan in April 2012 for those localities that would participate in the disposal programme, and in May 2012 the estimated tonnage for disposal

was revised downwards from 4,010,000 tonnes to 2,470,000 tonnes (Ministry of the Environment 2012c).

Although the new wide-area processing plan was now based on an agreement between the national government and local authorities, in June 2012 there was a demonstration to block the transportation of debris to a test incinerator in Fukuoka prefecture. There had been a public briefing for citizens of the host city, Kitakyushu, at which it was explained that there was no problem with accepting debris and that safety had been ensured. However, materials not covered by the agreement had been found amongst the debris and public trust in the scheme had been lost. The city authorities nonetheless deemed that there was no problem and continued to accept debris from Miyagi. In July, one hundred and forty-two residents sued Kitakyushu and Miyagi for damages. They argued that the scheme was not necessary and had been poorly explained (*Yomiuri Shinbun* 19 August 2012). Additionally, Sapporo city and Tokushima prefecture announced that there was no scientific basis for regarding the national standards as safe, and that the government's explanation was insufficient (Sapporo 2012; Tokushima 2012).

Amongst growing opposition, the total amount of debris for wide-area processing was again revised, although no reason was given why, with the final total being 620,000 tonnes (330,000 tonnes from Iwate, and 290,000 tonnes from Miyagi). In the end, eighteen localities participated in wide-area processing. It was officially completed on 31 March 2014 (Ministry of the Environment 2012a). The areas involved and the amount of debris processed are shown in Table 1.

Table 1.

Breakdown of Debris Accepted by Prefectures (in Tons)

Prefecture	Total Amount	Sub-Total Local Authority	Sub-Total Private Sector	Prefecture	Total Amount	Sub-Total Local Authority	Sub-Total Private Sector

Aomori	94,630	10,930	83,700	Tokyo	167,846	31,428	136,418
Miyagi	4,326	-	4,326	Kanagawa	162	162	-
Akita	37,538	37,538	-	Niigata	294	294	-
Yamagata	192,226	1,147	191,079	Toyama	1,256	1,256	-
Fukushima	23,053	-	23,053	Ishikawa	1,961	1,916	-
Ibaraki	49,960	32,788	17,172	Fukui	6	6	-
Tochigi	969	969	-	Shizuoka	3,207	3,207	-
Gunma	7,673	7,673	-	Osaka	15,299	15,299	-
Saitama	1,110	-	1,110	Fukuoka	22,696	22,696	-

Source: Disaster Waste Disposal Information Site (Environment Ministry) [Author's translation]

http://kouikishori.env.go.jp/processing_and_recycling/iwate_miyagi/processing_accepted_municipality/

In all cases, participating municipalities held public briefings to gain support from local residents. They also constructed homepages explaining the reasons for their involvement. In nine cases, these homepages featured a Q&A section that represented direct dialogue with residents in which public concerns were addressed. We examine these Q&As in the next section.

4. Interpretive Analysis of Q&A Discourse

In this section, we analyse the risk discourse in the nine Q&As.¹⁰ In Section 4.1, we divide

¹⁰ Our approach to risk discourse is interpretive. It focuses on the final discourse produced and does not seek a causal explanation of the processes behind discourse production. Thus, because we are examining the final discourse produced, and not discourse production itself, nor the causal effects of discourse on policy implementation, we have not interviewed individuals

the Q&As into three groups according to their adherence to the Environment Ministry's materials. In Section 4.2, we consider the extent to which the discourse includes concern assessment of ambiguous risks.

4.1 Three Categories of Q&A

We used the issues listed in the Environment Ministry's guidelines and pamphlets as a classificatory framework to see if the issues covered in the nine Q&As differed from the those covered by the Ministry, and to highlight any characteristics unique to the localities. There were seven issues in total. They are reproduced in the top left of Table 2 below. We then read the Q&As produced by each locality to see if they corresponded to the Ministry's seven sections. If localities introduced new topics, we listed them in the bottom left section of Table 2. We found that there were five unique regional topics, plus one general topic which we labelled 'Other'. Finally, we divided the Q&A exchanges produced by the nine localities into three general categories according to how closely the contents adhered to the Environment Ministry's guidelines and pamphlets. We called the categories the Ministerial Model Group, the Formulaic Group (I&II), and the Direct Quotation Group. The Ministerial Model Group adhered to the points raised in the Environment Ministry's guidelines and safety pamphlet, but provided more detailed explanation. The Formulaic Group only used some of the Environment Ministry's points, and its Q&A questions were terse. The Direct Quotation Group used direct quotations from citizens as the basis of its Q&As. All source quotations which follow are our translations. The overall correspondence of the three groups to the Environment Ministry is shown in Table 2.

involved in the formulation of the Q&As or in debris disposal. Indeed, bureaucrats routinely change positions every few years and would be difficult to track down, with there ultimately being no satisfactory way of verifying the accuracy of any claims made by parties with a vested interest in this controversial issue. All we can infer is that because neither the Environment Ministry nor the localities mentioned the IRGC, it is unlikely that they referred to the IRGC's work.

Table 2 Topics Covered in Q&A

	I Ministerial Model Group		II Formulaic Group				III Direct Quotation Group		
			II-1		II-2				
	Osaka	Kitakyushu	Yamagata	Tokyo	Toyama	Saitama	Kanagawa	Akita	Gunma
Necessity of Acceptance	○	○	○	○	○	○		○	○
About the Materials	○	○	○			○			○
Radiation	○	○	○	○	○		○	○	○
Transportation	○	○				○		○	
Incineration	○	○		○			○	○	
Disposal Facility	○	○	○	○		○	○		
Test Disposal	○	○			○				
Other	○		○				○	○	
Unique Regional Policy	○		○						
Damaging Rumours		○			○			○	
State of Acceptance			○	○		○			
Monitoring			○					○	
Decision-making Process				○			○	○	

Source: Authors

Osaka and Kitakyushu comprised the Ministerial Model Group. They were both much longer than all the others. For example, Osaka (2013) produced Q&A exchanges for the following seven topics¹¹:

1) The necessity of acceptance

¹¹ Osaka included a section titled 'Other', but this is not included above because it does not represent a specific topic.

- 2) The disaster waste to be accepted
- 3) Ways of thinking about radiation
- 4) Transportation etc.
- 5) Incineration and the final disposal site
- 6) Osaka prefectural policy regarding the disposal site for disaster waste from the Great Eastern Japan Earthquake
- 7) Test disposal

With three to twelve Q&A exchanges listed under each heading, the overall material was extensive. However, the various items were nearly all the same as those given in the Environment Ministry's guidelines (Ministry of the Environment 2011b) and safety document (Ministry of the Environment 2012b). This is clear if one compares the items to those given in the safety pamphlet (Ministry of the Environment 2011c), a short six-page handout for laypeople based on the previous two documents. The pamphlet included a three-part Q&A exchange which covered all seven topics raised in Osaka's Q&As. The three parts were:

- A. What kind of trash is disaster waste? Why can't the directly affected regions dispose of it?
- B. Is disaster waste safe?
- C. How will the disaster waste be disposed of?

Table 3 shows the overall level of correspondence for Osaka and Kitakyushu (2012) to the Environment Ministry.

Table 3. Comparison of Osaka and Kitakyushu to Environment Ministry

Environment	Topics Covered by Osaka
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Ministry Safety Pamphlet	and Kitakyushu
A	Necessity of Acceptance
	About the Materials
B	Radiation
C	Transportation
	Incineration
	Disposal Facility
	Test Disposal

Source: Authors

One difference is that Osaka established its own safety standards, and thus its general outlook diverged from the Environment Ministry's. In first considering local conditions, Osaka's evaluation of scenarios was based on different assumptions from those employed by the national government.

As shown in Table 3, Kitakyushu also produced headings that were essentially the same as those used by Osaka and the Environment Ministry. The sequencing was different, but Kitakyushu followed the same structure of bringing together several Q&A exchanges for each heading. The only significant difference was that whereas Osaka had produced its own safety standards, Kitakyushu accepted those set by the national government.¹²

The next group, Formulaic Group I, comprised Tokyo (2013) and Yamagata (2011b) prefecture. In contrast to the Ministerial Model Group, both localities omitted consideration

¹² Kitakyushu had a section titled 'Public relations and Damaging Rumours'. The section produced by Osaka entitled 'Other' also addressed 'damaging rumours'.

of 'transportation' and 'test disposal', instead including 'state of acceptance' (*ukeire jōkyō*) (both), 'monitoring' (Yamagata), and 'decision-making details' (Tokyo). For example, one of the items produced by Yamagata was the question (Q5) 'How is the disaster waste monitored?' The answer related to radioactive cesium and covered topics such as incinerated ash, radiation levels in the air near the disposal facilities, and the measurement of wastewater. It stated that 'everything from transportation to final disposal is monitored' with no further elaboration. Use of the term 'monitor' was rare in the other localities, but when it was used, for example by Toyama (2013), it was within the context of wider safety assurances such as (Q28) 'with monitoring to prevent radiation leakage sufficient safety is maintained'.

Tokyo included the question (Q3) 'How was the decision taken?' This was followed by details, complete with dates, of the municipal assembly decision-making process, and the conclusion of the disposal agreement. Tokyo provided seven Q&A documents about the acceptance of waste from seven specific regions, for example 'Q&A concerning acceptance of disaster waste from Miyako city, Iwate Prefecture'. However, the seven Q&A documents were very similar in form, and there were no significant differences in content.

The questions produced by Tokyo and Yamagata were extremely brief and abstract. For example, Yamagata and Tokyo covered the 'necessity' of wide-area processing with the question 'why will disaster waste be accepted?',¹³ thereby eliminating the kinds of detailed issues that the Ministerial Model Group pursued over the course of several questions. For example, Kitakyushu (2012) also addressed the following two questions, (Q1-4) 'Isn't transporting debris all the way to Kyushu for disposal a waste of money and energy?', and (Q1-10) 'The estimated amount of disaster waste has been reduced. Can't it be disposed of without bringing it over here?' Such doubts and varied perspectives were not present in Formulaic Group I.

¹³ This is a direct quote from Yamagata, Tokyo included the names of the areas that would accept the waste.

Toyama (2013) and Saitama (2015) prefectures made up Formulaic Group II. Compared to Formulaic Group I, they covered far fewer issues. Toyama focused on safety, whereas Saitama focused on 'transportation' and the 'state of acceptance'. In other words, Toyama took a theoretical approach, while Saitama took a practical approach. Specifically, Toyama answered each question thoroughly with frequent use of diagrams and tables, and care was taken to explain scientific debate over safety in a reader-friendly manner. For example, in response to the question, (Q5) 'Which prefectures will the waste come from? (Will waste from Fukushima prefecture also be included?)', Toyama produced three maps in its discussion of Yamada-cho in Iwate prefecture, which was requesting waste disposal.

Toyama's questions six to eleven addressed safety, and discussion included not only the Environment Ministry's documents about wide-area processing, but also the Ministry of Education, Culture, Sports, Science and Technology's supplementary reader on radiation. It explained the differences between alpha, beta and gamma radiation using charts so that laypeople could understand. Moreover, concerning the difference between 100 bq/kg and 8000 bq/kg (see Section 3 above) Toyama stated that it had 'demanded that the national government clearly explain the different standards', and included the response it had received from the Environment Minister amongst the charts. Diagrams were also used when covering the issue of incinerator ash and in a detailed depiction of the final disposal site. Overall, in focusing on theoretical aspects and carefully explaining them step-by-step, Toyama produced an extremely large amount of text. However, the answers were restricted to issues that could be answered scientifically, and the underlying assumption was that a clear explanation would resolve the issue.

In contrast, Saitama focused on the 'state of acceptance' and 'transportation', without any theoretical discussion of safety. After the standard questions concerning 'necessity', the type of waste, and its origin, Saitama listed the following:

What is the state of acceptance outside Saitama?

What is the state of acceptance inside Saitama?

Why are cement works accepting waste?

How will it be transported?

Won't acceptance of waste increase traffic in the vicinity of the cement works?

Aren't facilities other than cement works accepting waste?

The Q&As finished with these highly pragmatic and factual questions. The answers were brief, ranging from two to five lines, and no charts or tables were used. Thus, while Toyama focused on a theoretical discussion of radiation that quoted varied sources and charts to produce an understandable explanation, Saitama completely ignored the safety issue to focus on the process of disposal through a concise handling of pragmatics.

The third group is the Direct Quotation Group, comprising Kanagawa, Akita, and Gunma. This group is noticeable for directly listing questions from residents without editing them first. For example, while all other localities started their questions with the issue of the 'necessity' of acceptance, Kanagawa (2012) started with Kanagawa-specific questions all derived from a local perspective. For example, 'How much is the budget?', and, 'When will the road from Hirasaku to Oyabe be finished? I want you to stick to your agreement to finish it by March 2012'. The prefecture's answers to these were largely very simple. Akita (2012) also used questions directly phrased by citizens. These covered a wide spectrum, ranging from identification of local places, consideration of the legal basis, and demands for live television broadcasts of public briefings.

Gunma (2012), however, followed a different format from all other localities. The following four headings were listed under the title 'Q&A about wide-area processing':

- 1) Anxiety about wide-area processing
- 2) Are you going to accept contaminated waste?
- 3) The diffusion of radioactive materials from waste incineration
- 4) One should actively cooperate with wide-area processing

Under each of these headings there were two to five statements listed as 'opinions sent to the prefecture'. These were followed by an explanation of the prefecture's position. Another unique feature was that while the first three sections took the Q&A form, the fourth was an assertion. The first three sections provided direct quotations from residents, such as 'It has been said to be safe thus far, but is that really the case? Please think about the children', and 'If Japan is exposed to any more radiation there will be nowhere left to live, cancer and leukemia will increase, and it will be the end of Japan'. This use of direct quotations reflected the same approach taken by Akita prefecture. However, unlike *all* the other localities, the fourth section gave three opinions that supported wide-area processing.

4.2 Ignoring Concern about Ambiguous Risks

In the previous section, we divided the Q&As into three groups according to the extent to which they reflected residents' voices, or explicitly followed the Environment Ministry's policy. We now consider the role of concern assessment in the Q&A risk communication format. As we noted in the second section, the IRGC has constructed a new system of risk governance that proposes a reevaluation of risk. Whereas previous risk evaluation had been based solely on scientific risk assessment, the IRGC holds that this should be supplemented with concern assessment that focuses on the anxiety of citizens. This may be especially acute for ambiguous risks, such as those which citizens associate with the disposal of radioactive debris.

Gunma directly quoted residents in its Q&A. It started with the title 'Anxiety about wide-area processing', and was the only authority apart from Kitakyushu to address the vague notion of 'anxiety'. In doing so, it allowed the publication of opinions that, for example, expressed concerns about the effects of radiation on children, distrust of public institutions due to past false promises made about safety, the effect on Gunma's agriculture (a major industry in the prefecture), and anger about the spreading of radioactive material

in the name of 'support [for the directly-affected regions]'.

The prefecture's answer to these concerns was also unique. In addition to the standard response produced by the other localities that safety had been confirmed, Gunma (2012) went on to state that, 'However, as shown in your opinions, anxiety about the safety of radioactive contamination from waste accepted for disposal is considered natural'. Having thus accepted that concern exists, the prefecture then focused on monitoring as a means of ensuring safety, finishing with the phrase 'We ask for your understanding'. Given that responses from all other prefectures finished with the phrase 'safety has been confirmed', Gunma at least accepted the notion of 'concern', but did not explore it beyond the assertion that 'monitoring' had resolved the issue.

It is clear that the Formulaic Group erased all notion of citizen concerns through abstraction and formalization of the questions. Additionally, the answers given were highly administrative, focusing on areas such as the decision-making process (Tokyo), official safety standards (Toyama), the system of disposal (Saitama), and safety monitoring (Yamagata). Although Toyama concentrated on the health effects of radiation, it was not engaged in concern assessment. The approach fitted the 'deficit model' of risk communication. The long and detailed explanation of the government's scientific interpretation aimed to educate an ignorant public.

The Ministerial Group listed several detailed questions that were closer to reflecting the unedited remarks of residents, however, unlike Gunma, there were no sections that corresponded to a focus on 'concern'. One cannot say whether this occlusion occurred with the formatting of the Q&A, but the evidence from Akita suggests that concerns were erased when the questions were produced. This is because Akita listed 'opinions' that expressed 'concern', numbered from one to seventy-four. After that, nineteen of those opinions were converted into questions and given a response. Although the seventy-four opinions expressed a variety of concerns, the nineteen selected for answering were all issues that could be answered either scientifically, legally, or in terms of the overall system. Put simply,

while the unedited remarks expressed both concern and scientific doubt, those that expressed concern were ignored. Thus, the questions addressed could all be answered through scientific risk assessment.

An example of a concern raised in Akita (2012) which was ignored is:

Q35 We were thinking of having children. But bringing in several billion becquerels of radiation has left us with a feeling of despair. It is absolutely impossible to feel at ease when one thinks about children in Goshono and Akita.

Opinions like the above were not necessarily expressed clearly, but they do show the feelings of residents.¹⁴ Yet because these concerns were deleted during the formatting of the Q&A, they were not given an official outlet.

Kitakyushu (2012) used the subheading, 'To people who have doubts and anxiety about the acceptance of disaster waste'. However, the responses avoided addressing concerns through simple evasion, or assertion of scientific certainty, thus implying that the original concern behind the questions indicated a lack of knowledge. For example, take Q1-2: 'The golden rule for disposal of radioactive material is containment. Spreading radioactive material through wide-area processing is a mistake'. The response given was that the disaster waste designated for wide-area processing was under the regulation level, and that safety had been confirmed, thereby answering that 'containment' was not relevant. Even though this response rested on several unquestioned assumptions, it was held to be complete, with the opinion represented in the question being cast as an error that required correction.

Similarly, in response to Q3-2 about the necessity of total inspection of the debris, Kitakyushu first explained the arrangement as set out in the Environment Ministry's

¹⁴ Concerns are about future unknowns so it may be impossible to make them clear.

guidelines, and then regarding its own position stated that 'the frequency of measurements has been increased out of consideration for the need to ensure the residents' sense of security'. Thus, neither the question nor the original concern behind it were seriously considered. Having said this, there were signs of compromise with residents' demands regarding monitoring and explanations of debris acceptance (Q8-1). Phrases such as 'will be tested again' (Q6-7) and 'sufficient explanations for residents' can be found scattered around Kitakyushu's answers. However, monitoring and public briefings were already part of the standard risk management approach and did not focus on concern assessment. Overall, other than the restricted fashion in which Gunma addressed 'concern', it was essentially excluded from all nine Q&As.

5. Conclusion

The IRGC argues that there are different kinds of risks classifiable according to increasing levels of complexity and, concomitantly, social controversy. They should be approached differently, with greater social involvement required for the most ambiguous, and thus controversial, risks. Focusing on purely scientific risk appraisals to the exclusion of alternative lay rationalities can accentuate risk conflicts. Sociologists have noted that these conflicts employ science, but are ultimately normative as they stem from differing social values, outlooks, and identities, and hinge on emotional questions of trust. Risk communication experts have attempted to account for this through developing and recommending more participatory strategies of risk governance. This has involved a shift from a 'deficit model' to a 'democratic model', but nonetheless still tends to belie hierarchic premises, especially regarding nuclear energy, where citizens encouraged to operate as proactive risk entrepreneurs in other areas of health are cast as passive energy consumers who should not consider possible health effects.

The Q&As produced by nine localities involved in the Japanese state's 'wide-area processing' scheme are an example of the implementation of the 'democratic model' and

reveal the elements noted above. One can perceive from the quotations provided by Gunma and Akita that residents are concerned about risks related to the spread of radioactive materials that reach beyond current scientific knowledge. In addition to distrust of local authorities, politics, and science, there is also concern about the irreversible effects of radioactive materials on health and the environment. In other words, residents did indeed perceive the risks associated with wide-area processing as *ambiguous*. In contrast, while there were some general differences in approach, which we divided into three models according to local adherence to the Environment Ministry, all local authorities promoted a perception of *simple* risk. The three clearest examples are Toyama, with its focus on top-down scientific explanation, Saitama, with its focus on the mechanics of the disposal process and compliance issues, and Tokyo, with its emphasis on the appropriateness of the decision-making procedure. Of the three prefectures that directly quoted residents, Gunma acknowledged the existence of concern about ambiguous risk but did not pursue it beyond asserting that monitoring was the solution; Akita edited concerns about ambiguous risk to address only those that could be handled scientifically; and Kanagawa only published residents' comments about practicalities. Kitakyushu came close to raising the issue of concern about ambiguous risk, but either declined to respond or issued a rebuttal through science-based reasoning. Yamagata and Osaka avoided the topic.

Failure to address the fact that different risk perceptions were causing risk conflicts meant that all the Q&As were effectively hollowed out. Although the Q&A format seemed to be interactive and democratic, it actually functioned as a hierarchic device that channelled widespread concern about ambiguous risk into obedience to science, law, and administration. With repeated assertions that safety standards are correct, that the law is correct, and that administrative compliance is perfect, there was no room to question the answers produced, and 'concern assessment' was ignored in favour of scientific risk assessment. The Q&As appear to have been used to give wide-area processing a democratic seal of approval, while operating as a moral technique to dismiss as unwarranted health concerns about radiation risks that conflicted with a centralized plan for reconstruction.

References

Akita. 2012. *Saigai Haikibutsu no Kōikishori ni kan suru Goiken Goshitsumon ni tsuite* (Questions and Opinions about Wide-Area Processing of Disaster Waste).

http://www.city.akita.akita.jp/city/ev/cp/sa_qa.htm (accessed 25 January, 2016).

Althaus Catherine E. 2005. 'A Disciplinary Perspective on the Epistemological Status of Risk'. *Risk Analysis* 25 (3): 567-88.

Arnoldi Jakob. 2009. *Risk*. Cambridge: Polity Press.

Bacon Paul and Christopher Hobson, eds. 2014. *Human Security and Japan's Triple Disaster: Responding to the 2011 Earthquake, Tsunami and Fukushima Nuclear Crisis*. Oxford: Routledge.

Beck Ulrich. 1992. *Risk Society: Towards a New Modernity*. London: Sage Publications.

-. 1999. *World Risk Society*. Cambridge: Polity Press.

Bernstein Peter L. 1996. *Against the Gods: The Remarkable Story of Risk*, New York: John Wiley & Sons.

Bickerstaff Karen, Lorenzoni Irene, Jones Mavis and Nick Pidgeon. 2010. 'Locating Scientific Citizenship: The Institutional Contexts and Cultures of Public Engagement'. *Science, Technology & Human Values* 35 (4): 474-500.

DiNitto Rachel. 2014. 'Narrating the Cultural Trauma of 3.11: The Debris of Post-Fukushima Literature and Film'. *Japan Forum* 26 (3): 340-60.

Douglas Mary. 1994. *Risk and Blame: Essays in Cultural Theory*. Oxford: Routledge.

Douglas Mary and Aaron Wildavsky. 1983. *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers*. Berkeley: University of California Press.

Drake Frances. 2011. 'Protesting Mobile Phone Masts: Risk, Neoliberalism and Governmentality'. *Science, Technology, & Human Values* 36 (4): 522-48.

Engdahl Emma and Rolf Lidskog. 2014. 'Risk, Communication and Trust: Towards an Emotional Understanding of Trust'. *Public Understanding of Science* 23 (6): 703-17.

Ewald Francois. 1991. 'Insurance and risk'. In *The Foucault Effect: Studies in Governmentality*, ed. Graham Burchell, Colin Gordon and Peter Miller. Chicago: The University of Chicago Press 197-210.

Foucault Michel. 1991. 'Governmentality'. In *The Foucault Effect: Studies in Governmentality*, ed. Graham Burchell, Colin Gordon and Peter Miller. Chicago: The University of Chicago Press: 87-104.

-. 1997. 'The Birth of Biopolitics'. In *Ethics, Subjectivity and Truth*, ed. Paul Rabinow. New York: The New Press: 73-9.

Fujigaki Yuko. 2009. 'STS in Japan and East Asia: Governance of Science and Technology and Public Engagement'. *East Asian Science, Technology and Society* 3: 511-18.

-. ed. 2015. *Lessons From Fukushima: Japanese Case Studies on Science, Technology and Society*. Cham: Springer International Publishing Switzerland.

Gunma. 2012. *Gunmaken - Kōikishori ni kan suru Q&A* (Gunma Prefecture - Q&A about Wide-Area Processing). <http://www.pref.gunma.jp/04/e1600062.html>. (accessed 24 September, 2012).

Hook Glenn D. and Hiroko Takeda. 2007. 'Self-Responsibility' and the Nature of the Japanese State: Risk through the Looking Glass'. *Journal of Japanese Studies* 33 (1): 93-123.

International Risk Governance Council (IRGC). 2008. 'An Introduction to the IRGC Risk Governance Framework'. Geneva: International Risk Governance Council. Available at: www.irgc.org. (Last accessed 17 August, 2015).

Irwin Alan, Dale Alison and Denis Smith. 1996. 'Science and Hell's Kitchen: The Local Understanding of Hazard Issues'. In *Misunderstanding Science? The Public Reconstruction of Science and Technology*, ed. Alan Irwin and Brian Wynne. Cambridge: Cambridge University Press: 47-64.

Irwin Alan. 2006. 'The Politics of Talk: Coming to Terms with the 'New' Scientific Governance'. *Social Studies of Science* 36 (2): 299-320.

Japan Society of Material Cycles and Waste Management. 2012. *Saigai Haikibutsu Bunseki-Shori Jitsumu Maniyuaru - Higashi Nippon Daishinsai o Fumaete* (Analysis of Disaster Waste·Disposal Practice Manual - Based on the Great Eastern Japan Disaster). Tokyo: Haikibutsu Shigen Junkan Gakkai.

Jasanoff Sheila. 2003. 'Technologies of Humility: Citizen Participation in Governing Science'. *Minerva* 41: 223-44.

Kanagawa. 2012. *Shitsumon to Kaitō* (Questions and Answers). <http://www.pref.kanagawa.jp/cnt/f362096/p443157.html>. (accessed 25 January, 2016).

Kaperson Roger E., Renn Ortwin, Slovic Paul, Brown Halina S., Emel Jacque, Goble Robert, Kaspersen Jeanne X. and Samuel Ratick. 2000. 'The social amplification of risk'. In *The Perception of Risk*, ed. Paul Slovic. Washington DC: Earthscan: 232-45

Kingston Jeff. ed. 2012. *Natural Disaster and Nuclear Crisis in Japan: Response and Recovery after Japan's 3/11*. Oxford: Routledge.

Kitakyushu. 2012. *Saigai Haikibutsu no Ukeire ni kan suru Q&A - Saigai Haikibutsu no Ukeire ni tai shite Gimon ya Fuan o Motsu Kata e* (Q&A Concerning the Acceptance of Disaster Waste - To People Who Have Doubts and Anxiety About the Acceptance of Disaster Waste) <http://www.city.kitakyushu.lg.jp/files/000146563.pdf>. (accessed 12 February, 2016).

Latour Bruno and Steve Woolgar. 1979. *Laboratory Life: The Construction of Scientific Facts*. Princeton: Princeton University Press.

Löfstedt Ragnar and van Marjolein Asselt. 2008. 'A Framework for Risk Governance Revisited'. In *Global Risk Governance: Concept and Practice Using the IRGC Framework*, ed. Ortwin Renn and Katherine D. Walker. Dordrecht: Springer: 77-86.

Loon Joost Van. 2000. 'Virtual Risks in an Age of Cybernetic Reproduction'. In *The Risk Society and Beyond*, ed. Barbara Adam, Ulrich Beck and Joost Van Loon. London: Sage Publications: 165-82.

Luhmann Niklas. 1993. *Risk: A Sociological Theory*. New Brunswick: Aldine Transaction.

Lyng Stephen. ed. 2005. *Edgework, the Sociology of Risk Taking*. New York: Routledge.

Maesele Pieter. 2010. 'Science Journalism and Social Debate on Modernization Risks'. *Journal of Science Communication* 9 (4): 1-5.

Matanle Peter. 2011. 'The Great East Japan Earthquake, Tsunami, and Nuclear Meltdown: Towards the (Re)Construction of a Safe, Sustainable and Compassionate Society in Japan's Shrinking Regions'. *Local Environment* 16 (9): 823-47.

Mikami Naoyuki. 2015. 'Public Participation in Decision-Making on Energy Policy: The Case of the 'National Discussion' after the Fukushima Accident'. In *Lessons From Fukushima: Japanese Case Studies on Science, Technology and Society*, ed. Yuko Fujigaki. Cham: Springer International Publishing Switzerland: 87-122

Ministry of the Environment. No date given. *100Bq/kg to 8,000Bq/kg no Futatsu no Kijun no Chigai ni tsuite* (The Difference between the Two Standards 100Bq/kg and 8000Bq/kg). https://www.env.go.jp/jishin/attach/waste_100-8000.pdf. (accessed 12 February, 2016).

-. 2011a. *Higashi Nippon Daishinsai ni kakaru Saigaihaikibutsu no Shori Hōshin (Masuta-puran)* (The Disposal Policy for Waste from the Great Eastern Japan Disaster (Master Plan)). http://www.env.go.jp/jishin/attach/haiki_masterplan.pdf. (accessed 12 February, 2016).

-. 2011b. *Saigaihaikibutsu no Kōiki Shori no Suishin ni tsuite (Higashi Nippon Daishinsai ni yori Shōjita Saigaihaikibutsu no Kōiki Shori no Suishin ni kakaru Gaidorain)* (Promotion of Wide-Area Processing of Disaster Waste (Guidelines For Promotion of Wide-Area Processing of Disaster Waste Generated by the Great Eastern Japan Disaster)). http://www.env.go.jp/jishin/attach/memo20120111_shori.pdf. (accessed 12 February, 2016).

-. 2011c. *Saigai Haikibutsu no Kōiki Shori ni kan suru Pamphlet* (Pamphlet About Wide-Area Processing of Disaster Waste). http://kouikishori.env.go.jp/disaster_waste/materials_movies/pdf/waste_koiki_pampj_20140326.pdf. (accessed 20 April, 2014)

-. 2012a. *Kōiki Shori Jōhō Saito* (Wide-Area Processing Site). <http://kouikishori.env.go.jp>. (accessed 22 September, 2012).

-. 2012b. *Saigai Haikibutsu no Kōiki Shori no Anzensei ni tsuite (Heisei 24 6 Gatsu 19 Nichi Dai 1.3 Han)* (The Safety of Wide-Area Processing of Disaster Waste (Heisei 24 June 19, Version 1.3)).
http://kouikishori.env.go.jp/disaster_waste/materials_movies/pdf/safety20120622.pdf.
 (accessed 22 September, 2012)

-. 2012c. *Saigai Haikibutsu Suikeiryō no Minaoshi Oyobi Kore o Fumaeta Kōiki Shori no Suishin ni tsuite* (Revised Estimate of the Amount of Disaster Waste And Promotion of Wide-Area Processing Based on that Amount).
<http://kouikishori.env.go.jp/news/pdf/20120521b.pdf>. (accessed 22 September, 2012)

Morrone Michele and Timothy W. Lohner. 2002. *Sound Science, Junk Policy: Environmental Health Science and the Decision-Making Process*. Westport: Auburn House.

Nagashima Miori. 2015. 'Risuku no Fukakujitsusei to Fukakujitsusei no Risku: Kokusaiteki Kagaku Hyōka to iu Sabu Seiji' (The Uncertainty of Risk and the Risk of Uncertainty: The Sub-Politics of International Scientific Evaluation). In *Kakusan Suru Risuku no Seijisei: Soto Naru Shiza-Uchi Naru Shiza (The Politics of Spreading Risks: External Viewpoint-Internal Viewpoint)*, Miori Nagashima, Glenn Hook and Piers Williamson. Nara: Kizasu Shobo: 37-75.

Nuclear Safety Commission. 2010. *Dainishu Haikibutsu Maisetsu no Jigyō ni kan suru Anzen Shinsa no Kihonteki Kangaekata*. (The Safety Investigation's Basic Approach To Burial Of Secondary Waste). <http://www.nsr.go.jp/archive/nsc/info/20100809.pdf>. (accessed 23 September, 2012)

-. 2011. *Tōkyō Denryoku Kabushikikaisha Fukushima Daiichi Genshiryoku Hatsudensho Jiko no Eikyō o Uketa Haikibutsu no Shorishobun nado ni kan suru Anzen Kakuho no Tōmen no Kangaekata* (Present Approach to the Maintenance of Safety Regarding the Disposal Etc. of Waste Affected by the Accident at Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant).

http://www.nsr.go.jp/archive/nsc/info/20110603_2.pdf. (accessed 23 September, 2012)

OECD. 2003. 'Emerging Risks in the 21st Century: An Agenda for Action'.

<http://www.oecd.org/futures/globalprospects/37944611.pdf>.

(accessed 20 January, 2016).

Osaka. 2012. *Osakafuiki ni okeru Higashi Nippon Daishinsai no Saigai Haikibutsu Shori ni kan suru Shishin* (Policy Concerning Processing in the Osaka Region of Disaster Waste from the Great Eastern Japan Disaster).

<http://www.pref.osaka.lg.jp/attach/14725/00107079/shishin.pdf>.

(accessed 12 February, 2016).

-. 2013. *Saigai Haikibutsu Shori ni kan suru Q&A ni tsuite* (Q&A about the Processing of Disaster Waste). <http://www.pref.osaka.lg.jp/shigenjunkan/saigaihaikibutu>.

(accessed 25 January, 2016).

Renn Ortwin. 2005. 'White Paper on Risk Governance: Towards and Integrative Approach'.

Geneva: International Risk Governance Council. www.irgc.org

(accessed 17 August, 2015).

-. 2008. *Risk Governance: Coping With Uncertainty in a Complex World*. London:

Earthscan.

Renn Ortwin and Katherine D. Walker. 2008. 'Lessons Learned: A Re-Assessment of the

IRGC Framework on Risk Governance'. In *Global Risk Governance: Concept and Practice Using the IRGC Framework*, ed. Ortiwn Renn and Katherine D. Walker. Dordrecht: Springer: 331-67.

Rosa Eugene A. 2003. 'The Logical Structure of the Social Amplification of Risk Framework (SARF): Metatheoretical Foundations and Policy Implications'. In *The Social Amplification of Risk*, ed. Nick Pidgeon, Roger E. Kasperson and Paul Slovic. Cambridge: Cambridge University Press: 47-79.

-. 2008. 'White, Black, and Gray: Critical Dialogue with the International Risk Governance Council's Framework for Risk Governance'. In *Global Risk Governance: Concept and Practice Using the IRGC Framework*, ed. Ortwin Renn and Katherine D. Walker. Dordrecht: Springer: 101-118.

Saitama. 2015. *Saigai Haikibutsu no Kōiki Shori ni kan suru Q&A - Saitamaken de no Ukeire ni tsuite* (Q&A about Wide-Area Processing of Disaster Waste - About Acceptance in Saitama Prefecture).

<https://www.pref.saitama.lg.jp/a0507/saigaihaikibutsu-qa/index.html>.

(accessed 25 January, 2016).

Samuels Richard J. 2013. *3.11: Disaster and Change in Japan*. Ithaca: Cornell University Press.

Sapporo. 2012. *Higashi Nippon Daishinsai ni yori Hassei Shita Gareki no Ukeire ni tsuite* (Acceptance of Debris Produced by the Great Eastern Japan Disaster).

<http://www.city.sapporo.jp/kinkyu/20120323mayor.html>. (accessed 25 January, 2016).

Sjöberg Lennart. 2000. 'Factors in Risk Perception'. *Risk Analysis* 20 (1): 1-11.

Slovic Paul, Finucane Melissa L., Peters Ellen and Donald G. MacGregor. 2004. 'Risk as

Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk and Rationality'. *Risk Analysis* 24 (2): 311-22.

Tokushima. 2012. *Tokushima Meyasubako (2012-03-15) Kankyōseibika kara no Kaitō* (Tokushima Comment Box (2012-03-15) Answers from the Environmental Improvement Department). <http://www.pref.tokushima.jp/governor/opinion/form/652>. (accessed 22 September, 2012).

Tokyo. 2013. *Higashi Nippon Daishinsai ni yoru Saigai Haikibutsu Shien no Kiroku - Q&A* (Q&A - Record of Support for Disposal of Disaster Waste from The Great Eastern Japan Disaster). <https://www.kankyo.metro.tokyo.jp/resource/disaster-waste/311/qa.html>. (accessed 25 January, 2016).

Toyama. 2013. *Higashi Nippon Daishinsai ni yoru Saigai Haikibutsu no Kōiki Shori ni tsuite (Q&A)* (Wide-Area Processing of Disaster Waste from the Great Eastern Japan Disaster (Q&A)). http://www.pref.toyama.jp/cms_pfile/00011673/00699783.pdf. (accessed 12 February, 2016).

Tsuchida Takashi, Mizugami Junichi, Kikuchi Yoshiaki and Hiroyuki Yoshino. 1998. *Hanshin Awaji Daishinsai ni okeru Gareki no Shori Katsuyō ni kan suru Chōsa to Kōsatsu* (Survey and Examination of the Disposal and Use of Debris from The Great Hanshin Awaji Disaster). Tokyo: Kōwan Kūkō Gijittsu Kenkyūsho.

Ungar Sheldon. 2001. 'Moral Panic Versus the Risk Society: The Implications of the Changing Sites of Social Anxiety'. *The British Journal of Sociology* 52 (2): 271-91.

Walklate Sandra and Gabriel Mythen. 2010. 'Agency, Reflexivity and Risk: Cosmopolitan, Neurotic or Prudential Citizen?'. *The British Journal of Sociology* 61 (1): 45-62.

Williamson Piers R. 2015a. 'Protecting People's Livelihoods, Restarting Nuclear Reactors:

'Risk Recalibration' in Prime Minister Noda's 8 June 2012 National Address'. *Japan Forum* 27 (4): 498-518.

-. 2015b. 'Shihaiteki Deisukōsu ni okeru Risuku Gensui: Asahi·Yomiuri Shinbun ni okeru Tōden Genpatsu Kiki Shoki Hōdō no Hikaku kara' (The Dominant Discourse of Risk Attenuation: A Comparison of Initial Reports about the TEPCO Nuclear Crisis in the Asahi and Yomiuri Newspapers). In *Kakusan Suru Risuku no Seijisei: Soto Naru Shiza·Uchi Naru Shiza (The Politics of Spreading Risks: External Viewpoint·Internal Viewpoint)*, Miori Nagashima, Glenn Hook and Piers Williamson. Nara: Kizasu Shobo: 131-76.

Wynne Brian. 1991. 'Knowledges in Context'. *Science, Technology, & Human Values*, 16 (1): 111-21.

-. 1996. 'May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide'. In *Risk, Environment & Modernity: Towards a New Ecology*, ed. Scott Lash, Bronislaw Szerszynski and Brian Wynne. London: SAGE Publications Ltd.

-. 1996b. 'Misunderstood Misunderstanding: Social Identities and Public Uptake of Science'. In *Misunderstanding Science? The Public Reconstruction of Science and Technology*, ed. Alan Irwin and Brian Wynne, B. Cambridge: Cambridge University Press: 19-46.

Yamagata. 2011a. *Saigai Haikibutsu nado no Yamagataken nai e no Ukeire ni kan suru Kihontekina Kangaekata* (Basic Thinking about Acceptance of Disaster Waste in Yamagata Prefecture).

https://www.pref.yamagata.jp/ou/kankyoenergy/050010/files/waste/higashinihondaishinsai/saigai-w_kangaekata.pdf (accessed 12 February, 2016).

-. 2011b. *Saigai Haikibutsu nado no Yamagataken nai e no Ukeire ni kan suru Kihontekina*

Kangaekata (Q&A) (Basic Thinking about Acceptance of Disaster Waste in Yamagata Prefecture (Q&A)).

<https://www.pref.yamagata.jp/ou/kankyoenergy/050010/files/waste/higashinihondaishinsai/kangaekata-QandA.pdf>. (accessed 12 February, 2016).

Yoshioka Hitoshi. 2011. *Genpatsuryoku no Shakaishi: Sono Nihonteki Tenkai* (A Social History of Nuclear Energy: A Typically Japanese Development). Tokyo: Asahi Shinbun Shuppan.