



Just passing through: the risky mobilities of hazardous materials transport

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Abstract. The scientific construction of risk is usually based on the probability of an event occurring in a specific location from a specific hazard. Hazardous waste transport is an example of a risk source that is fixed in neither time nor space, with materials traveling through the landscape. Residents living along fixed transportation routes likely to experience an increase in the amount and potency of hazardous materials traveling through their communities draw on distant places and spaces in order to define the risk they face as they try to make absent places and materials present. However, because those places and spaces *are* distant and absent, regulatory officials can resist their inclusion by arguing that only what is on site matters. This site of struggle over sources and construction of risks can best be understood through Law and Mol's spatiality of fire space. Using two North American case studies, this paper draws on the concepts of fire space and mobilities to explain the nature of the risk that mobile materials pose, including the disconnect between citizens' objections to increased hazardous materials transport and the environmental review and regulatory processes meant to prevent catastrophes from occurring.

1 Introduction

A large body of literature on the “risk society” (Beck, 1992; Giddens, 1990) and its many manifestations has explored the hazards and uncertainties of modern life from nuclear power plants to food. Not only is risk an unavoidable outcome of our modern technological society, but it is a form of knowledge construction, defined and constructed by the very science that proposes to manage it (Stanley, 2006; Beck, 2009). In contrast to catastrophes, which have already occurred and can be bounded in time and space, risks are potential catastrophes, justifying actions taken to prevent them from happening at all (Beck, 2009). How this potential is shaped and managed drives many aspects of modern life, from safety regulations to emotional responses.

Broadly speaking, there are two ways in which risks have been studied spatially: point sources such as factories, power plants, landfills, or earthquake faults (e.g., Freudenburg and Davidson, 2007; Haalboom et al., 2006; Parkhill et al., 2010), and distributed or diffused sources such as urban air pollu-

tion or global warming (e.g., Bickerstaff and Simmons, 2009; Bickerstaff and Walker, 2002; Hinchliffe, 1997; November, 2004). In both cases, the spatial nature of risk is more complicated than a single site; risk shifts through time and across space, leading to discussions of virtual risk or the concept of absent presence (Bickerstaff and Simmons, 2009; Hetherington, 2004; Irwin et al., 1999; November, 2008). However, in addition to fixed-point and non-point risks, there is a third type of risk to be considered: that posed by mobile objects or people. This paper argues that this kind of risk can best be expressed through what Law and Mol (2001) have called fire space. In this spatial configuration, objects are defined by their absence as much as by their presence, or even by their simultaneous absence and presence, as with the flickering flames of a fire. Furthermore, abrupt change is part of the configuration of fire space, in contrast to more gradual change in fluid or networked spaces (Law and Singleton, 2005).

This spatiality is particularly suited to examining risk related to transportation, where although infrastructure may remain fixed, vehicles are not constantly present but transition in and out of the landscape. Recent work on mobilities in sociology, geography, and related fields has started to unpack the meanings and effects of people and objects in motion, such as examining how places and corridors are “gathered” or performed around sites of travel (Bishop, 2002; Jones, 2005) or demonstrating how even non-travelers are affected by transportation infrastructure (Fotel, 2006).

While Law and Mol’s spatialities of region and fluidity (see also Law and Singleton, 2005) have been explored by geographers to some extent (Bear and Eden, 2008; Medd and Marvin, 2008), fire space has rarely been employed beyond their original article (though see Maintz, 2008 and Kortelainen, 2010). This paper does so by integrating the mobilities literature with Law and Mol’s concept of fire space as a means of understanding the special risks posed by hazardous materials (hazmat) transport and how those risks are handled in policy and environmental review. Two case studies illustrate different aspects of these risks: a controversy over increasing freight traffic on a route through the Chicago suburbs, and plans for the transport of nuclear waste to a proposed repository at Yucca Mountain, NV.

During the environmental review process, opponents to the proposed projects drew on comparisons to other sites, bringing absent places and incidents into the present time and place to justify why the proposed risk was unacceptable. They also emphasized that the temporary presence of the railcars and hazardous materials made this a different kind of risk than a fixed source such as a nuclear power plant. Existing regulations and policies, however, meant that project proponents could take advantage of the temporary and mobile nature of the risk to put certain forms or sites of analysis as outside the scope of environmental review. They argued that because the probability of an incident happening was vanishingly low, it was not worth analyzing. In other words, citizens were arguing for fire space to be included in policy analysis, despite the official environmental review process that denies the existence of this spatiality and its intersection with existing territories and networks.

The paper begins by exploring some of the various spatialities of risk as they have been presented in the literature. This is followed by a brief discussion of mobilities, particularly with regards to the relation between fixed infrastructure and mobile people and objects. The next section outlines the concept of fire space within geographical research and how it offers an alternative spatiality relevant to mobile risks. The fifth section explains the first case study, involving the acquisition by the Canadian National railroad of a beltline railway bypassing Chicago. The second case study, concerning Yucca Mountain, highlights opponents’ concerns over not the *storage* of spent nuclear material, but its *travels* over great distance. The discussion section brings together the two case studies and explains the implications for policy-

making, while the conclusion summarizes their contributions to the literature on both mobilities and risk spatialities.

2 Spatialities of risk

Geographers and other social scientists have explored a number of different spatialities in their theorizing, including scale, place, space, territory, and networks. These approaches encourage us to think about space relationally: for example, scales are not pre-formed hierarchical units, but are produced through various social interactions (Cox, 1998; Jones, 1998; Swyngedouw, 2004). Similarly, places are not territorially bounded, but arise from flows of people, ideas, and non-humans that are temporarily anchored or stabilized in a specific location (Massey, 1994; Sheppard, 2002). A network topology does not only refer to fixed infrastructure such as roads or water pipes, but the ever-changing connections between people and places that constitute the nodes of the network as well as the links (Leitner, 2004).

Furthermore, these multiple spatialities need to be considered not only separately (within their individual limits) but in combination (Kortelainen, 2010; Leitner et al., 2008). Leitner et al. (2008) invoke the standard geographical frameworks of place, space, scale, and networks as well as newer ones like mobilities (see below) to demonstrate that actors involved in contentious politics draw on all of these, sometimes at once, both to make their case and for strategic purposes. Similarly, Kortelainen points out that an “old-growth forest” can be defined as a territory, a network, or a fluid or fire space; paying attention to who is doing the defining and how is key.

Until recently, work on the spatialities of risk was based on local place or territory (November, 2008), whether the site of the risk’s production or of its effects. Understood as a combination of physical objects or processes and the discourses surrounding them, risk refers to an event which has not yet taken place, but which nevertheless shapes attitudes and actions in multiple locations because of the possibility of it occurring (Beck, 1992, 2009). November argues that much of the risk literature neglects the ways in which risk shapes space, suggesting that maybe risk should itself be considered an actant.

We can also consider how time and space are *folded* into people’s understandings of risk, making past or distant events relevant to their lived time and space or, alternatively, pushing away risks that are physically close to them (Bickerstaff and Simmons, 2009). This topological approach suggests that the relationship between proximity and risk is not based on Euclidean distance, but that folds bring other times and spaces into the present (similar to the concept of connectivity in November, 2004), part of “*the mundane and routine ways in which hazardous facilities move in/out of proximity as part of everyday life*” (Bickerstaff and Simmons, 2009, p. 867).

There are other topologies that may be relevant to the spatiality of risk, such as fluid and fire spaces. For Law and Mol, “*fire is a metaphor for thinking about the dependence of that which cannot be made present – that which is absent – on that which is indeed present*” (Law and Mol, 2001:615). As an object, fire itself is presence and absence at the same time: it is visible, puts forth heat and light, and undeniably has and leaves behind material traces of its presence, but it is not a stable object that can be pinned down at a specific place at a specific moment. What is here in this place, what we can see and interact with, is composed in part of something that not only is not here, but *cannot* be here. “Topologically, then, our argument is that in fire space a shape achieves constancy in a relation between presence and absence: *the constancy of object presence depends on simultaneous absence or alterity*” (Law and Mol, 2001:616; italics in original). They summarize this idea in terms of “conjoined alterity”, or simultaneous absence and presence.

Utilizing fire space as a theoretical framework is not simply a question of whether an object or subject is stable or not – Latour and others have long argued that what we see as stable objects and subjects are actually quite mutable and subject to redefinition by humans and non-humans alike (e.g., Latour, 1987, 1999; Hinchliffe et al., 2005; Franklin, 2006). The distinctiveness of fire space is that it depends on something being both absent and present at the same time – not in the sense of hauntings or ghosts of what *used to be* present (Gordon, 1997; Edensor, 2008; Gunder, 2008) – but across space as well as time. Furthermore, these absent elements have only sporadic influence over the object or space at the center of analysis. As Maintz (2008) has argued, the virtual space of an online learning community is shaped in part by distant physical places and people who only occasionally and indirectly play an active role in the community. This sporadic, absent presence “flares up” at times rather than being a constant influence. In a different context, Law and Singleton write that “*Fires are energetic and transformative, and depend on difference – for instances between (absent) fuel or cinders and (present) flame. Fire objects, then, depend on otherness, and that otherness is generative*” (Law and Singleton, 2005:333). In contrast to more fluid spaces or objects whose characteristics change slowly and incrementally, Law and Singleton’s fire objects may flicker abruptly from one state or configuration to another.

This dual nature of fire space – as simultaneous presence and absence, and as a space of abrupt transition – makes it an appropriate lens through which to view controversies over the risk of hazmat transport. Bickerstaff and Simmons (2009:870) conclude, “*We might also point to the potential for extending analyses beyond fixed material infrastructures, to include more mobile physical or symbolic absences and presences.*” How might risks with a physically mobile component be different from those fixed in space? For example, hazardous waste in transit only has the potential to harm neighboring communities when the waste is physi-

cally present, moving along train tracks or highways. This is different than for neighbors of a nuclear power plant, where Euclidean distances through air and water are constant, or from hazardous waste that is in storage, whether temporary or permanent. It is also different from a pipeline, where the material passing through cannot be seen and therefore can be presumed to always be present. Finally, unlike risks with the potential to be ubiquitous, such as climate change, an incident can only occur along a limited corridor.

However, this does not mean that the *risk* only exists when the waste is present; for concerned neighbors, fear of an incident may arise at other times, influencing their daily lives through awareness of the potential for a catastrophe (Bickerstaff and Simmons, 2009). By their nature, objects in motion are less stable and are harder to know and understand; therefore, even more uncertainty exists with regards to the risks they pose along the corridors through which they travel than that which is inherent to any modern risk (Beck, 2009). The following section explains how the mobilities literature might be relevant to this question of risks in motion.

3 Risky mobilities

While mobilities themselves may not be new, recent global changes such as the increased travel of objects and people, virtual travel, faster travel, and the ways that movement can be wrong or inappropriate (disease, terrorism, etc.) have led geographers, sociologists, and others to consider the importance of mobilities to the construction of societies and places (Adey et al., 2007; Cresswell, 2006; Edensor, 2003; Fotel, 2006; Jones, 2005; Law, 2006; Sheller and Urry, 2006; Urry, 2000, 2004). One of the most significant contributions of this work has been to consider how transportation constructs space and place in terms of vehicles, networks, nodes, corridors, and travelers.

For example, Fotel (2006:733) draws on Massey’s power-geometry to explore how a Copenhagen neighborhood is affected by traffic: “*Their lives are defined on the premises of others’ mobility and they are increasingly pushed aside, reduced to living with the side effects that others’ mobility causes.*” In a different context, Malaysia’s national expressway can be described in terms of presences and absences: the high speed of the traveler making the surrounding landscape unreadable, or the difficulty of making visible the protests of those disadvantaged by the new motorway (Williamson, 2003). This conjoined alterity, where the speed and ease of travel is only possible because of the travelers who are *not* present because they are on slower-moving roads, constructs the expressway as a different kind of space, and perhaps the image or identity of the nation along with it.

However, it is not only the presence of transportation vehicles and infrastructure, but their *potential* presence, that shapes the landscape. The long-proposed Alice Springs-Darwin railway, for example, has “gathered” the corridor it

is planned to travel through although no track has yet been laid (Bishop, 2002). In particular, the contradiction between the long-standing nationalist project of conquering the land with iron rails and the present-day nation-building project of reconciliation with Aboriginal peoples is experienced from both the inside and outside of the corridor. Travelers and goods might be passing through, but the infrastructure will stay fixed on the landscape, along with the hopes and fears it engenders in travelers and neighbors by its physical presence as well as the absent presences of travelers.

Of course, it is not only infrastructure that matters to mobility, but the people and goods that travel along that infrastructure. While the mobility of objects and individuals can pose a risk via transmission of disease (Ali and Keil, 2006; Law, 2006), there has been little critical consideration of how mobility itself contributes to the construction of risk. In particular, the transport of freight, particularly hazardous materials, has effects on the places it passes through ranging from nuisance to injury to death. Freight trains exist in fire space because they are always passing through and not fixed in place, but yet are also always *potentially* present and therefore constantly constructing risk for neighboring communities. Were a spill to occur, the event would become a point source of pollution, understandable in standard terms – but to use Beck's terms, it would then be no longer a risk, but a catastrophe, bounded in time and space and contributing to other constructions of risk in other times and places. The case studies below show how combining the concept of fire space with the mobilities literature can better explain the nature of the risks involved in hazmat transport, the opposition to proposals to add hazmat shipments to existing infrastructure, and the policy response to both.

4 The absent presence of Alberta's Wabamun Lake in Chicago's suburbs

In the fall of 2007, the Canadian National railroad (CN) submitted a proposal to the Surface Transportation Board (STB) to purchase the Elgin, Joliet, and Eastern railroad (EJ&E) from US Steel. Though railroad regulation was significantly reduced in the US by the 1980 Staggers Rail Act, the STB retains the authority to approve railroad acquisitions and mergers. CN's main goal in purchasing the EJ&E was to obtain a bypass route around downtown Chicago and to access three regional rail yards. In so doing, they would increase train traffic from around five trains a day to twenty to thirty-five, and average train lengths would also increase. The type of material being transported would change from primarily coal and steel to more intermodal containers and hazardous materials.

The STB decided that CN would have to prepare an environmental impact statement (EIS) because of the potential for significant impacts on a relatively large population. As part of the EIS process, a series of eight public hearings were

held around the Chicago region in the fall of 2008. The analysis that follows is based on public transcripts of those meetings and written and e-mailed comments during the official comment period from 1 August to 30 September 2008, along with the EIS itself.

The draft EIS concluded that while there was an increased likelihood of a hazardous materials release occurring along the EJ&E line because of the transaction, the chances were still very remote. Additionally, because train traffic would be shifted from one line to another, the reduced risk on the urban CN lines with their higher neighboring population density more than offset the increased risk on the suburban EJ&E line at the regional scale. The document noted that local governments are responsible for managing hazmat emergencies, and CN has plans in place to provide any necessary information to local emergency response providers in case an incident occurs.

One of the major concerns with regards to a hazmat spill is groundwater quality, and a section of the draft EIS was devoted to this topic. However, the state of Illinois's groundwater protection program only applies to fixed-point sources of pollution. *“By definition, sources and routes of contamination are fixed facilities. As such, the controls of the well-head protection program do not appear to apply to rail lines”* (STB, 2008:3.12–7). In other words, because hazardous materials are just passing through, they are not subject to the same category of regulation as fixed sources.

Many speakers at the public hearings were not satisfied with this analysis, particularly in towns where drinking water comes from local aquifers. Many of the speakers mentioned a series of accidents that CN suffered in Canada in the early 2000s, especially Wabamun Lake in central Alberta in 2005, where forty-five train cars derailed, spilling hundreds of thousands of liters of refined oil into the lake and local wells (Brooymans, 2005). Speakers not only brought up Wabamun Lake as an example of what had happened elsewhere on CN tracks, but emphasized that the same thing could happen near their homes and watersheds. In contrast to the draft EIS's language of a small increase in the tiny probability of an incident, speakers brought Wabamun Lake and other distant places into the Chicago suburbs:

“Look down the railroad tracks running through Cuba Marsh and our town and imagine the destruction of our drinking water if an accident occurs. Barrington's shallow aquifers cannot withstand the same contamination voiced by CN on Wabamun Lake and its residents.” (Catherine Quigg, resident of Barrington, IL)

“The EIS should illustrate disaster scenarios. In other words, don't just tell us that it is unlikely that catastrophic train wrecks will occur. Tell us how many people and children in Wayne and any other community will be injured and killed if there is a train derailment and a hazardous chemical

release and fire and explosion results.” (Debra Schoen, resident of Wayne, IL)

”In a train accident on August 22, 2008, in Luther, OK, traffic was blocked in a three-mile radius as a precaution. . . a three-mile radius [at this curve in the EJ&E tracks] includes approximately thirty-one public or private schools and twenty-one parks, not to mention local business or residential areas.” (Robin Meier, resident of Mundelein, IL)

Speakers were also concerned not only about the physical nature of the spill, but the fact that reports by the Canadian government have found defective vehicles, poor communication regarding safety issues, and a reluctance on the part of workers to speak out about potential hazards. In the case of Wabamun Lake, CN was put under stricter scrutiny by the provincial government for its slow response to the spill, failing to notify nearby residents for several days (Brooymans, 2005). Commenters feared a similar situation should a spill occur in the Chicago suburbs.

After the public comment period closed, the SEA prepared its final EIS. A final EIS has to take into account all comments that are made on the draft EIS; in this case, over 9500 comments were received through mail, e-mail, phone, and public hearings, although a significant percentage of these were form letters (STB, 2008). First, the final EIS concluded that *“the Proposed Action involves a domestic regional railroad; therefore SEA’s analysis has properly focused on the transport of hazardous materials within the region that would be directly affected”* (STB, 2008:2–66). In other words, the Canadian incidents were ruled irrelevant because it was the purchase of an American regional railroad that was being discussed; the international border was a clear line of demarcation that was not to be crossed in the EIS.

Second, the unknown effects of a hazmat spill along the EJ&E line would have to remain that way: *“performing an analysis of an unknown (and unknowable) hazardous material or a combination of such materials in an unknown location under unknown weather conditions is speculative, particularly given the series of rare events that would have to occur”* (STB, 2008:3.3–30). In particular, this would be analyzing a *“worst case scenario”*, which is not required to be part of an EIS. This conclusion on the part of the STB fits with Beck’s (2009:115, italics in original) theorizing of the *“non-knowledge society”*, where *“the product of more and better science”* is insufficient knowledge about the effects of that science.

In short, the SEA refused to engage with incidents that happened outside the region of the transaction itself, keeping absent places out of the discussion despite residents’ explicit inclusion of those places in their constructions of risk. Furthermore, because the transaction represented a transfer of traffic from one line to another, the higher population densities along the existing, urban CN line meant that were a spill to occur along the suburban route, fewer people would

be affected. Finally, the *“unknown (and unknowable)”* presence of trains carrying hazardous materials was to be taken for granted rather than queried or used as a basis for further action.

5 The (rail)road to Yucca Mountain

Yucca Mountain in western Nevada was the proposed site of a repository for nuclear waste from over 120 locations across the US. Over 160 million people currently live within 75 miles of a temporary nuclear waste storage facility (US-DOE, 2008). While these facilities provide sufficient shielding from radiation from the waste, they are not equipped for tens of thousands of years of long-term storage (as has been shown in at the Fukushima plant in Japan). By centralizing the location of the waste in a facility specifically designed to handle it over the extreme long-term, the overall risk of exposure is lowered. Such a policy has been legislated by the US since the Nuclear Waste Policy Act of 1982 (USDOE, 2008). Of course, the decision over where to locate such a facility has been extremely controversial. After the DOE studied nine sites over the course of five years, Yucca Mountain was selected in 1987 as the sole repository site. As of 2010, after funding was pulled for the project, the DOE withdrew its application to the Nuclear Regulatory Commission for a license for operating the repository, which effectively ended the project (Tetreault, 2010).

Considerable work had been done to produce Yucca Mountain as a disposal site (Bloomfield and Vurdubakis, 2005). The site had to be produced as empty despite ongoing struggles over Native American land rights, as tectonically secure despite being part of the active Basin and Range formation, and as an appropriate location to deposit hazardous material that must not be disturbed for tens of thousands of years despite the fact that this has never been done before (Kuletz, 1998).

However, in recent years, the controversy moved into a different realm: how to get the spent nuclear material from many different Point As to the one approved Point B. As Kuletz wrote well over a decade ago, *“Although these massive repositories remain relatively hidden in desert lands, nuclear waste itself will become much more visible as it becomes mobile, passing through everybody’s backyard in transit to these sites”* (Kuletz, 1998:97–98). In particular, given existing road and rail infrastructure, the hazardous material would need to travel through multiple metropolitan areas to reach the repository. Even more so than for the EJ&E case, it would not be prudent to make information public about where and how material would be traveling at any given time. This double bind of being potentially exposed to hazardous materials without being able to know where and when they are passing nearby became a source of conflict for residents of not only Nevada, but many locations along the likely routes of nuclear material to Yucca Mountain.

The analysis here is based on public comments submitted to the draft supplemental EIS produced for the transportation of materials to the repository. These documents were prepared after the DOE decided in 2004 on rail as the primary mode of transport for materials to Yucca Mountain, necessitating the construction of a new rail line to the site and thus a separate environmental review process. Public comments were gathered between 8 April and 1 June 2004, and 13 October and 12 December 2006¹. The original plan would have used existing rail lines in southern Nevada to minimize the construction of new track. This was strongly opposed because all spent nuclear material coming from the east would have gone through downtown Las Vegas. The new rail line would have meant the construction of over four hundred kilometers of new track from the Union Pacific line in eastern Nevada across to Yucca Mountain.

According to the environmental impact assessment process, analysis only needs to consider new infrastructure itself, not what it connects to. There was therefore no formal opportunity for people to comment on the implications of transporting nuclear waste to Yucca Mountain outside of the site and new railway themselves, which are contained within the state of Nevada. Nevertheless, public comments were received from around the country expressing concern about this very point:

“DOE seems to want to look at the transportation issue as an issue local to the Yucca Mountain site. DOE forgets that the waste has to start at the nuclear power plants like Salem, Hope Creek, New York state sites and Pennsylvania sites.” (Marvin Lewis, resident of Philadelphia)

Two of the arguments made against the proposed action were based on the conjoined alterity of Yucca Mountain due to of the transport of hazardous materials “across the country” or over “long distance”. Although this may sound like two sides of the same coin, there was a subtle difference. First, the argument about transporting materials *across the country* attempted to make Yucca Mountain a national and not a state or local issue. For example, because the proposed rail line would connect to the existing Union Pacific mainline, residents of Utah pointed out that the majority of shipments would be passing through central Salt Lake City, but there was no analysis addressing this point. Similarly, residents of California noted that routes from nuclear plants in their state would be over roads that may not be durable enough for frequent, heavy truck traffic. In other words, while the storage site itself may or may not be risky, the routes that bring nuclear waste to Nevada should be considered as part of the site:

¹In 2005, the Walker River Paiute Band reversed an earlier decision not to allow review of a route through their land, necessitating an addendum to the DEIS and therefore an additional public comment period.

“Accidents do happen and why should you put the entire country at peril by bringing waste across the United States into our small state.” (Anne Balum, resident of Henderson, NV)

“And moving nuclear waste across the country from nuclear power plants in the east to remote Indian land in the west endangers all Americans with the threat of a nuclear accident on our highways and rails.” (Kathleen Cashel, resident of Washington, DC)

In contrast, people who commented on the *long distances* involved spoke in terms of those journeys providing more opportunities for exposure to radioactive material. Instead of referring to a larger territory being involved, the argument here had to do with the fact that even if there is only a small probability of an incident occurring during transport, the longer distance and condition of being mobile means that there is a higher probability of *something* going wrong:

“Each site (like Yucca Mountain) should have surrounding states only use the site. That way it would be less of a risk driving a short distance rather than across so many states to get to Nevada.” (Bev Bedoe, resident of Las Vegas)

“No study has been done on specific risks of transporting the waste by road or rail to Yucca Mountain over a thirty-year period, through forty-three states, more than one hundred cities with population over 100,000 and within one-half mile of over 50 million people.” (Lisa Gagnon, resident of Blue Ridge, GA)

This last comment also refers to concerns about what the analysis leaves as unknown. Because the scope of the supplemental EIS only covered the new rail line to be constructed in Nevada – as well as reasons of national security – the exact routes that waste shipments would take to get to Nevada were not disclosed. However, given the national rail network, it is not hard to figure out that all rail shipments would still pass through Salt Lake City, Reno, or Las Vegas on their way to Yucca Mountain. Additionally, the location of existing nuclear power plants and their temporary storage sites suggest many of the routes that must be taken elsewhere in the country:

“DOE cannot possibly evaluate whether transportation will be safe and secure unless it first designates transportation routes to Yucca Mountain, NV, then assesses state and local governments’ ability across the country to deal with nuclear waste emergencies predictable in the post-2001 world. It’s a false claim about an unknown proposition.” (Iona Chelette, resident of Joshua Tree, CA)

“As I write this letter, a freight train is passing within 200 feet of my home. Here in the Toledo,

OH, area rail tracks routinely pass within a few feet of many residential neighborhoods. The current plan to move the waste must have the consent of those who will be most endangered in an accident.” (Joseph DeMare, resident of Maumee, OH)

These citizens' argument was that Yucca Mountain as a place and an object of study should be defined to include distant places and routes and that full consideration of the risks of storing nuclear waste in Nevada must include places outside of Nevada whose physical distance contributes to the transport risks involved; in other words, that Yucca Mountain and the routes leading to it exist in fire space. For these people, the potential nuclear waste storage site did not exist only in Nevada, but in places like Pennsylvania, California, and along the routes and waterways that connect them all.

For the DOE, however, Yucca Mountain was only a location in Nevada, and the object of environmental study was only four hundred kilometers of rail to be built through the desert. There was no absent presence in the DOE's analysis, for places outside Nevada were literally beyond the scope of the study, and the comments quoted above were all deemed irrelevant.

6 Just passing through

The CN/EJ&E and Yucca Mountain environmental review processes illustrate two aspects of how fire space can be used to understand the risks of and opposition to hazmat transport. On the one hand, there is the simultaneous presence and absence of risk, and the fact that risk in a specific place can only be constructed through drawing on incidents that happened somewhere else. On the other hand, there is the ever-moving and ever-changing nature of the threat; while the infrastructure is always present, the vehicles carrying waste are not, as distinguished from other risk sources like nuclear power plants or pipelines. There are therefore policy implications because of the peculiar spatiality of these risks.

Fire space involves making use of things that are *not* here to understand what *is* here. Citizens in the EJ&E case drew on their knowledge of CN's safety record in Canada, which the STB had not considered in its report, to argue that their communities were at risk. Were these locations within the Chicago metropolitan area, inside the official purview of the environmental review process, citizens would not have had to do the work of making them present, and the EIS might have considered risk differently. Similarly, opponents of Yucca Mountain drew on non-nuclear hazardous materials spills in order to argue that the new rail line should be considered as part of a larger route and not merely a four-hundred-kilometer-long piece of infrastructure. Additionally, the distance involved from current storage sites to the long-term depository was part of the problem. Were transcontinental rail lines and nuclear power plants *not* so far away from Nevada, the risk would not be the same.

There is also the issue of mobility. If the fight was over the siting of an incinerator, landfill, factory, or pipeline, where the material component of the risk was fixed, that would be one thing. In both cases presented here, the rail infrastructure itself does not pose a threat, only the materials being carried along it inside closed containers. The safety measure of keeping information about hazmat shipments and their locations unknowable only added to the uncertainty that mobility poses and therefore increased the risk in many people's minds, if not in official calculations. Furthermore, the fact that the material component of the risk is only sporadically present was interpreted in different ways: to residents, it meant a constant level of risk and uncertainty, whereas to regulatory officials, it meant a vanishingly small probability of an event at a particular location. Were the hazardous waste contained in one location, as in the Yucca Mountain repository or the temporary storage facilities at nuclear power plants across the country, the topology of risk would be different.

In fact, in drawing the boundaries of study for an environmental impact statement, the STB and DOE both insisted that only that which is *constantly physically present* can be studied. Only the new train tracks in Nevada, only CN's operations within the Chicago metro area, were deemed relevant to the proposed action. Additionally, because trains are not usually present along a given railway, the STB and DOE considered the risk they pose to the communities they pass through as negligible in quantitative terms. Rather than considering that residents understand risk differently when it is in motion and therefore sometimes physically present and sometimes not, the government's analysis ignored the possibility of residents being negatively materially affected (through lowered property values, for example) because of the unique spatiality of hazmat transport risk.

While fire space might seem like a very abstract concept, it is thus quite relevant for policymaking. It is precisely the absent presence of a hazmat spill that makes every state reluctant to have radioactive material passing along its train lines. While stored at a nuclear power plant, radioactive waste is a stable quantity, fixed in space: it can be mapped and quantified and shielded, at least for the short term. But while on the move, it has to be obscured and hidden, even denied, as part of that same protection, and the lengths of the corridors being traveled make physical barriers or shields cost-prohibitive. Although drawing on distant places might also be a common strategy for activists opposing a fixed facility such as an incinerator or a power plant, the difference here is that while the infrastructure is already and always present, the key material component of the risk – the train cars carrying hazardous materials – is not. Furthermore, rather than the low-level, constant risk that climate change poses in terms of sea level rise or increased weather volatility, the flickering nature of fire space matters here: trains are either present or they are not.

This is therefore not merely a question of including far-away places as part of the analysis. These places and

materials *cannot* be physically present in Chicago's suburbs or in Yucca Mountain, or the calculation of risk to nearby residents would not be the same. Part of the problem is the tension between the low calculated probability of an incident occurring at any given location, as understood by experts, and the all-or-nothing understanding of local residents with regards to an incident. If the site of the hazard was fixed, as with the nuclear waste repository itself, the material component of the risk would be constant and could be shielded or mitigated (not that this is easy for a repository that has to last tens of thousands of years, particularly given seismic hazards). But along a rail line, most of the time there is no material component to the risk at all. It is only when a train goes by that the chance of an incident happening even exists, and therefore the same kinds of shielding or mitigation are not feasible from an economic or aesthetic point of view. Fire space is thus a fundamental part of hazmat transport – even if the relevant regulatory agencies do not recognize it.

This is not to say that fire space is the only relevant spatiality to considering hazardous materials transport (Kortelainen, 2010). The topology of networks also obviously matters: first, in the rail lines themselves and the national and global networks of nuclear production and container shipping they connect to, and second, in the road and pedestrian networks that may be temporarily disrupted by a passing or stopped train, a concern voiced by emergency services personnel at public meetings regarding the CN acquisition. Networks may connect places, but they also create barriers between others (Law, 2006; Medd and Marvin, 2008).

Territorial or regional space matters as well. Yucca Mountain illustrates the difference between territorial space in terms of the struggle against the siting of the facility itself (including struggles over Native American sovereignty and land rights) and the need to transfer waste to the site along the national rail network. Again, the rail lines themselves are not the problem²; it is the presence or absence of nuclear waste on the railcars that use those lines. In the case of the EJ&E acquisition, local jurisdictions that extend across both sides of the tracks, such as school districts or fire protection districts, might find their functions disrupted by a train. After the approval of the final EIS, the only communities that continued to fight were those where the tracks run right through their downtowns, in part because of the fear of what frequently blocked crossings or even a hazardous materials spill would mean for the city as a whole.

² This is not to say that there were not potential impacts from the infrastructure itself; nearby ranchers were worried about the impacts on their grazing land of the embankment supporting the tracks, and art enthusiasts expressed concern about Michael Heizer's massive earth art installation "City", which is being built near the proposed route.

7 Conclusions

The transport of hazardous materials is contentious because of the potentially deadly consequences of an accident in a location that is unprepared to handle it. When proposed actions would increase the number of shipments and/or introduce new and more hazardous substances to the route, objections are to be expected, which is why an environmental review was conducted in both the case of the acquisition of the EJ&E by CN and the proposed rail line to Yucca Mountain. In both cases, opponents argued that absent places needed to be included in the analysis. To them, risk could not be constructed based solely on what was contained within a localized territory. For members of the public, local places like the suburbs of Chicago or Yucca Mountain are partially constructed by absent places, and this conjoined alterity (Law and Mol, 2001) should be considered in any environmental analysis.

However, the policy structures beneath the environmental review process are not equipped to handle absent presence. EISs have a defined scope based on the spatiality of territory as established and backed by the US government, not the abstraction of fire space. Both EISs were approved in 2008, and CN finalized its purchase of the EJ&E in early 2009. Post-acquisition monitoring of CN by the Surface Transportation Board, however, has found serious deficiencies in their required reporting of trains blocking at-grade crossings (Eldeib, 2010), suggesting that the performance of risk (Healy, 2004) is on-going beyond the initial environmental review process. Furthermore, a minor derailment in November 2011 along the former EJ&E line prompted a second federal review of CN's operations along this line and renewed fears of a major spill (Pyke, 2011).

However, funding was denied for the Yucca Mountain project, and the USDOE withdrew its application to the Nuclear Regulatory Commission in March 2010, effectively ending the project. In part, this withdrawal was due to strong opposition to the project not only from the state of Nevada, but all along the routes leading to the depository site. A more flexible environmental review process that was able to incorporate concerns about the absent presences of hazmat railcars and nuclear power plants might have been able to achieve more public support. A more comprehensive and responsive environmental review process would acknowledge that rather than being solely a quantitative value, risk exists in fire space: it is absent and present at the same time, able to leave a mark without being tangible (Gunder, 2008), unlike hazardous materials that are (temporarily or permanently) stored in a fixed location.

These case studies therefore argue for expanding the spatialities we consider with regards to contentious politics (Leitner et al., 2008). The conflicts over CN and Yucca Mountain are about physical substances and the risks they pose, but they are also about how we *know* those substances and risks – and where they are located. The mobility of

these particular risks puts them outside or alongside of the familiar spatialities of territories, networks, and scales. The substances that the railcars contain are not present on the routes they travel in the same way that they are in the buildings where they are produced or where their final waste products are deposited – but nor are they absent from those routes. Fire space can therefore help us better understand the risks that mobilities of goods and wastes pose, the difference between infrastructure and what is carried on or in that infrastructure, and the nature of public concerns and appropriate policy responses.

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