The Power of Place: How Local Engagement with Geological Disposal of Radioactive Waste Re-situated Technoscience and Re-assembled the Public

Catharina Landström

Division for Science, Technology and Society, Department of Technology Management and Economy, Chalmers University of Technology, Sweden/catharina.landstrom@chalmers.se

Stewart Kemp[1]

Abstract

Intrigued by the role of geographical location in public engagement with science we examine the West Cumbria Managing Radioactive Waste Safely (MRWS) Partnership's undertaking of one of the most extensive local public engagements with environmental risk science in the UK. The case study highlights this three-year long local engagement as a process that changed both science and the public. Differently from other invited public engagements controlled by scientists in spaces set aside from the everyday, the Partnership's lay members led a process unfolding in the place that was potentially at risk. In contrast to public participation as experiments staged by experts the Partnership had the authority to demand that scientists addressed issues of local importance. The analysis uses the framing notions 're-situating technoscience' and 're-assembling the public', to capture how scientific knowledge claims were modified and a new local public emerged, at the intersection of public engagement with science and public participation in environmental risk governance in a specific place.

Keywords*:* public engagement, radioactive waste, place-making

Introduction

The discussion of public engagement with science and technology in STS has recently approached time and space in ways drawing attention to new issues. Case studies show how time limitations and spatial arrangements can prevent public influence on science and technology governance in engagement events arranged to facilitate it (Felt and Fochler, 2010). Standard time-space configurations of public engagement with science have been conceptualised as experiments, highlighting that events are staged outside the realm of everyday experience and carefully controlled by scientists (Bogner, 2012; Laurent, 2016).

The spatial configuration of public engagement with science is also a dimension of environmental risk governance (Bulkeley and Mol, 2003). Case studies in this field show how scientists and technical experts retain control of events organised as rational debates, privileging formal

scientific representations of local environmental processes, risks and mitigation options (Aitken, 2009; Davies et al., 2011).

This paper brings these two discussions together to examine the role of geographical location in public engagement with science in the context of environmental risk governance. The analysis is developed in a case study of geological disposal of radioactive waste in the UK. Although geological disposal is the long-term solution preferred by most scientists, technical experts and policy makers, it has been politically impossible to site facilities in many countries (Shelley et al., 1988). After decades of public protest blocking the siting of geological disposal facilities in the 1990s many governments turned towards more collaborative approaches (Bergmans et al., 2015). The UK embarked on a new strategy of voluntary local involvement in the 2000s (Mackerron and Berkhout, 2009). The Managing Radioactive Waste Safely (MRWS) strategy, centred on local democratic decision-making, led to a public engagement programme in Cumbria (Chilvers, 2007).

The West Cumbria MRWS Partnership (the Partnership) was created to involve the local community and it undertook one of the most extensive public engagements with environmental risk science in the UK when examining the potential consequences of siting a facility for geological disposal of radioactive wastes in the area (West Cumbria MRWS Partnership, 2012). Underpinned by a formal delegation of decision-making power from national Government to local Councils, this organisation could summon scientists and technical experts to attend events conveniently located for members of the public. The Partnership also decided how much time the local public needed for their interrogation of the scientific case for geological disposal and to understand the potential consequences for the local community. The authority granted to this local, lay, organisation distinguishes the Partnership's work from engagement activities organised and led by scientists to address issues in science and technology policy, and from participation in environmental risk governance, in which scientists and experts decide where and for how long to interact with lay publics. This difference is significant enough to warrant the introduction of two new terms – 're-situating technoscience' and 're-assembling the public' – to capture the dynamics of public engagement with science in a place at risk.

In the following we first overview literatures on time-space relationships in public engagement with science, technology and environmental risk, we finish this section with explaining the conceptual tools 're-situating technoscience' and 're-assembling the public'. Next, we outline the methodological approach and overview the materials analysed. After this we introduce the Partnership and undertake detailed discussion of the process of engagement it carried out and consider the changes brought about in the science and the public. In the concluding discussion we clarify the significance of the analysis of this case for the understanding of public engagement with environmental science generally.

Time and place in public engagement with science

The issue of how time and place shape public engagement with science and technology has been brought to light in discussions about the construction of participating publics. For example, examining the participatory governance of genetic testing Braun and Schultz (2010: 407) argue that public participation in science and technology governance has become "synonymous with discrete, formal, government-sponsored arrangement". They understand the temporal discreteness and the well-defined sites of 'invited' participation as the opposite of 'uninvited' participation which is diffuse in time and space. This difference between the time and place dynamics of invited and uninvited participation is further elaborated in Bogner's (2012) argument that public participation in technology policy function as laboratory experiments. He explains that invited participation experiments are "organised by professional participation specialists, taking place under controlled conditions and largely without reference to public controversies, political participation demands, or individual concerns" (Bogner, 2012: 510). The defining feature of participation as laboratory

experiment is the "isolation from political and life-world contexts, and its methodologically controlled design" (Bogner, 2012: 512).

Viewing public engagement with science and technology as laboratory experiment draws attention to the ways in which their spatio-temporal configurations are controlled by scientists and decision makers. Felt and Fochler (2010: 220) discuss how such public engagement experiments function as "political machineries" that "frame or pre-scribe particular kinds of roles and identities for the participating publics" . Their case study clarifies the relationship between the time allocated and the quality of the engagement, and they found that the overall duration of activities influenced the "degree of reflexive deliberation possible" (Felt and Fochler, 2010: 220).

Addressing the geographical location of engagement experiments specifically Felt et al. (2016: 7) argue that "[I]nsufficient attention is given to the importance of concrete 'localities', where knowledge is produced and distributed". In their view "[P]laces always express the (power) relations of the people inhabiting them; they are open to some while difficult to access for others; they allow for engagement but also for distancing; and they spawn or restrain specific types of collective action" (Felt et al., 2016: 7). Understanding all localities as permeated with historically evolving culture they insist that "[I]n acknowledging place, we must also develop greater sensitivity to objects and scientific knowledge as carriers and expressions of certain cultural arrangements, values, and power constellations" (Felt et al., 2016: 7).

The critique of invited public participation, and its isolation from decision-making captured by the simile laboratory experiments, highlights the ways in which these activities are set apart from everyday activities and controlled by scientists and governments. Looking in a different direction Callon et al. (2009) focus on the uncontrolled space of the 'wild', where publics participate in processes with fuzzy time-space boundaries. To conceptualise this 'uncertain world' further the notion of 'place-making' suggested by Pierce et al. (2011) is useful. They argue, similarly to Felt et al. (2016), that localities in which people live are constituted in complex historical nature-culture relationships. According to Pierce et al. (2011) places are continuously made through "social, political, and material processes by which people iteratively create and recreate the experienced geographies in which they live" (Pierce et al., 2011: 54). Informed by this notion we argue that scientists engaging with the world must recognise "the flexible, multi-scalar and always developing meanings of place; meanings that are produced via socially, politically and economically interconnected interactions among people, institutions and systems" (Pierce et al., 2011: 59). Environmental science that becomes involved with local risk governance has to engage with place-making.

Place-making involves many processes other than public engagement with science and technology. There are other politics of participation in operation. Of particular relevance to this paper is the right of affected publics to participate in local environmental risk governance, mandated in national and international environmental policy (French and Bayley, 2011). Critics note that such engagements often involve a bare minimum of consultation, arranged in ways that preserve the privilege of science-based experts who normally advise decision-making (Wesselink et al., 2011).

Despite the many barriers to lay people's influence on science and expertise, in the context of environmental risk management, public engagement has the potential to change the knowledge produced and the way in which research is done. In some cases local public engagement have resulted in the co-production of new knowledge (Tsouvalis and Waterton, 2012).[2] The requirement to include publics in environmental decision-making has also prompted new scientific approaches, such as participatory modelling (Hare, 2011). Case studies show that publics can successfully engage science in place-making that address environmental risk, but that engagement activities "seeking to enhance citizen capacities need to be citizen-led, in terms of both the substantive content explored and the process deployed" (Selin et al., 2016: 6). Such engagement processes benefit from local residents' "ability to reimagine local environments and chart a sense of responsibility for action", and their interest to "act with regard to potential

futures, based on contemporary observations, buttressed by past experiences" (Selin et al., 2016:10). When science participates in local place-making it can support local publics and efforts to address local environmental problems (see Whatmore and Landström (2011) for a case study of re-distribution of expertise in flood risk management).

To increase the understanding of the involvement of science in place-making, and public engagement with science in the 'wild', we examine the work of the West Cumbria MRWS Partnership. In this case a local, lay organisation, had the authority to decide the time and place for activities that brought scientists and local publics together to consider the possible consequences of siting a facility for geological disposal of radioactive waste in the locality. This well-documented process enables examination of what long-term public engagement with science can mean for both science and the public when they are brought together in a place that is also the matter of concern.

The ability of the Partnership to demand that the technoscience[3] experts answered the questions raised by local people in ways that satisfied the engagement process designed to build trust in the community brings to light themes not previously discussed in the literature. To address them we introduce two notions intended to capture distinct aspects of the changes brought about in this public engagement process. One – 're-situating technoscience' – concerns the impact of local engagement on science, and the other – 're-assembling the public' – addresses the transformation of 'the public' in a specific place. The two notions draw on well-known concepts introduced by Donna Haraway (1988) and Bruno Latour (2005), respectively.

'Re-situating technoscience' is a notion that allows us to consider the impacts engagement with publics can have on scientific and expert practices. It builds on Haraway's notion of 'situated knowledges' that, among other things, insists that scientific knowledge is shaped by the context in which it is created (Haraway, 1988). The technical devices, scientific debates, social, political and economic relationships through which new scientific knowledge emerges imprint it with a specific perspective. Since none of these circumstances can be general, or universal, all scientific knowledge originates in concrete discursive and historical locations that enable it to 'discover' some things while it cannot 'see' others.

We connect to Haraway's notion as we try to capture the changes occurring in technoscience when it becomes involved with local place-making. That science and technology can change in encounters with local publics is demonstrated by the emergence of environmental participatory modelling (Whitman et al., 2015). This resonates with Cohen and Ottinger (2011) criticising the assumption in many studies of public participation that scientific knowledge is "relatively stable, its shortcomings predictable and enduring", instead they urge us to realise that science is "flexible, contingent, and continuously under revision", changing through interaction with publics (Cohen and Ottinger, 2011: 8). Re-situating technoscience is a notion that "directs attention to the ways in which scientific experts are prompted to do things differently when they become involved with local publics in environmental risk governance" (Landström et al., 2011).

The concept 're-assembling the public' is inspired by Latour's (2005) discussion of the constitution of particular publics in specific networks. Rejecting the idea of an always 'already there' general public, that provides a context for science and technology, Latour argues that publics emerge together with their matters of concern. The discussion of constituted publics has also highlighted how things, material and abstract, can bring new publics into being (Marres, 2012). In the present paper the notion re-assembling the public captures change, while paying attention to what has come before. It adds to the concept of place-making discussed above by also drawing attention to the past, indicating that there could already be publics relating to technoscience in a locality. Environmental risk management has been a societal activity since the 1960s, relying upon science and technology to address hazards (Beck, 1992). The governance of environmental risks has often sparked controversy, particularly when involving physical interventions in localities, processes constitutive of publics critical of technoscience (Wynne, 2014).

Public engagement with science in such places involves re-assembling the public, constituting a different public from those historically established in opposition to technoscience proposals relating to local environmental risks.

We insist that successful re-assembling of publics must originate locally. The institutions involved with previous failures cannot play a lead role (Whatmore and Landström, 2011). We also argue that re-assembling a local public takes time, as illustrated by Papazu's (2016) study of how the inhabitants of the Danish island of Samsø reconstructed the local economy around renewable energy. Confronted with a failure of national decision making to secure a future for the island to remain populated, a few local people developed a vision of a new energy future that could reinvigorate the local economy and secure the future of the island community. Working towards the new vision the local public was re-assembled, over time, in a way that enabled the development of new local expertise and the construction of new energy systems on the island.

The concepts of re-situating technoscience and re-assembling the public highlight two distinct (possible) effects of local public engagement – changing science and changing the public – both occurring in the process of place-making. Both notions are prefixed 're-', to indicate the importance of time. We are interested in how long-term engagement with science in specific localities with the local public impacts on both parties.

Historical interpretation of the recent past

Considering that the issue of geological disposal remains unresolved and controversial in the UK, we decided to rely on documentation of the activities of the West Cumbria MRWS Partnership produced at the time, by the actors involved.[4] This approach differs from more common social science use of archival materials as complementary (Welch, 2000), but we wanted to study the recent past as the past, not primarily as a backdrop for the present.

The actors involved with the MRWS policy and the Partnership generated extensive documentation, made publicly available in on-line repositories that were created at the time to provide the local public access to the process and today preserved as historical record. That we could 'follow the actors' through digital archives dedicated to the MRWS process saved us from having to devise on-line search strategies to locate widely dispersed documents (Huistra and Mellink, 2016). The key electronic archive for this study was created by the West Cumbria MRWS Partnership at the time as part of the commitment to transparency, it is left for posterity and public access at http://www.westcumbriamrws.org.uk/. This archive holds all electronic documents relevant to the work of the Partnership and the documents produced by other actors involved with the MRWS process in west Cumbria. Materials from the Nuclear Decommissioning Authority and the Committee on Radioactive Waste Management are of particular interest to the present paper.[5]

The electronically stored documentary materials in the archive comprise policy documents, reports, meeting records, news publications, letters, information leaflets and more. We subjected these documents to qualitative interpretation. Informed by critical hermeneutics as developed by historians, we read the texts from the archive as traces of past actions (Ricoeur, 1973). Tamboukou (2014: 618) explains that when using this interpretive approach "the researcher's questions, interpretations, theoretical insights and analytical tropes emerge as intra-actions between space/time/matter relations and forces within the archive".

In addition to the study of archived documents, the case study was informed by the extensive academic literature on radioactive waste management in different national contexts, published from the 1980s to the present. The disposal of radioactive waste has been controversial since such waste was first produced and the issue has prompted a rich social science literature that we use to contextualise the discussions reported in the archived documents. Adding to the understanding of context and process was the experience of one of the authors of being a member of the MRWS partnership, thus having access to more detailed information about the local context

referred to, but not explained, in the primary documents.[6]

Managing Radioactive Waste Safely: the UK policy for geological disposal 2009-2014

The West Cumbria MRWS Partnership, in operation from 2009 to 2012, came into existence through a Government strategy initiated in 2001 and articulated in a 2008 White Paper. The White Paper was based on the 2006 report of the Committee on Radioactive Waste Management (CoRWM), set up in 2003 to advise the Government on the long-term management of higher activity radioactive waste in the UK.

The MRWS strategy can be understood as part of a wider international trend to involve local actors, such as elected councils, businesses and publics, with environmental risk governance. The notion of governance indicates a shift from top-down government driving decision-making and implementation, to multi-sited, multi-level networks (Meadowcroft, 2002). Processes referred to as governance have been defined as "a continuum of systems governing, in which state and non-state actors play a variety of roles" (Bulkeley, 2005: 877). The new, less top-down, environmental risk governance offered the UK government the opportunity to try a different approach after decades of failure to implement geological disposal of higher activity radioactive wastes. The policy reorientation was designed by CoRWM, in a comprehensive review (CoRWM, 2009).

Setting an example for involving a broader range of actors CoRWM's own work included public engagement as laboratory experiments (Bogner, 2012). They organised several events to which lay people were invited to deliberate on the challenges of radioactive waste (Burgess et al., 2007). CoRWM's approach to public engagement slowed down the reasoning in a way that is necessary for public engagement to have effect according to Felt and Fochler (2010). Slowing down reasoning in extensive public engagement has become a feature of radioactive waste programmes internationally in recent decades, by necessity as in the Swedish KBS process (Sundqvist and Elam, 2010) or by choice in the case of the Canadian Nuclear Waste Management Organisation (NWMO, 2005). Following extensive public engagement and analysis of scientific and technical knowledge CoRWM produced a final report that provided the foundation for the MRWS strategy, emphasising voluntary local participation, transparency and self-determination (Chilvers, 2007).

Adopted in several countries in the 1990s and 2000s so called 'voluntaristic' siting policies for geological disposal of radioactive wastes have been subjected to social science scrutiny (Blowers and Sundqvist, 2010; Durant and Fuji Johnson, 2009). Some critics argue that voluntarism is another attempt to manipulate the public (Fuji Johnson, 2009). Others point out that the scientific belief (not tested in practice) that geological disposal will actually provide safety over the very long term has not been opened up to challenge in public deliberations (Durant and Stanley, 2009). It has also been argued that the invitation to the public to participate is a purely instrumental move to deal with the failure to site geological disposal facilities (Blowers, 2010).

The voluntaristic process in the UK started with the White Paper, published by the UK Government in 2008, extending an invitation to local authorities, as representatives of communities, to submit Expressions of Interest (EoI) to take part in the MRWS process and explore the possibility of siting a geological disposal facility (Defra et al., 2008). Cumbria County Council, Copeland Borough Council and Allerdale Borough Council separately submitted such EoIs. Moving to coordinate their actions the three councils formed a joint body in 2009 – the West Cumbria MRWS Partnership – to examine the implications of hosting a Geological Disposal Facility (GDF) in the area and to engage with local publics.

Historically entwined – geological disposal of radioactive waste and west Cumbria

Radioactive waste has been part of the history of west Cumbria for a generation and the local memory of controversies about GDF siting did influence local publics' views on the MRWS

strategy, regardless of the UK government presenting it as new and voluntary (Bickerstaff, 2012; Blowers, 2017). It was the controversy erupting around the previous GD programme that prompted the policy rethink resulting in the MRWS strategy. Against this backdrop it was critical for the Partnership to work in a way that engendered trust and legitimacy. However, it was not a neutral conduit. By not accepting the outcome of previous controversy as having settled the issue, the Partnership demonstrated an ambition to intervene in this aspect of local place-making, albeit not pushing for any particular decision.

The Partnership drew on CoRWM's way of working, they scrutinised expert knowledge claims and deliberated with publics. Like CoRWM, the Partnership used social science-based expertise to undertake a variety of public engagement activities. The consultant firm, 3KQ[7], was the lead, guaranteeing that the local programme was expertly devised, managed and documented (PSE Sub-group, 2009). Differently from CoRWM the Partnership members were lay people with regard to the technoscience specialisms involved, but they had the mandate to question scientists and technical experts until they were satisfied with the answers. The many Partnership activities brought experts and local residents together in a concerted effort to make scientific knowledge about geological disposal of radioactive waste in principle address questions about what was likely to occur in the specific locality, should a GDF be sited there.

The Partnership arranged events, talked to people and communicated in different media, in a process that went on for three years. Their work programme aimed, on the one hand, to examine existing technoscientific knowledge. This meant learning about geological disposal (GD) and about what scientific experts knew of the potential impacts on the locality of constructing and operating a disposal facility, as well as about long-term safety. Whilst on the other hand, also find out what local residents thought about participating in the siting process and of the possibility of such a process leading to a proposal for constructing a repository in their area. While integrated in the actual process these two activities were reported as separate streams, which corresponds with our interest in illuminating the two distinct aspects of change – in technoscience and the local public. In the next section we focus on how technoscience was re-situated with regard to two specific questions – inventory and geology.

Re-situating technoscience in west Cumbria

To examine technoscientific knowledge about GD the Partnership devised a systematic investigation process with sections focussing upon, in turn: the inventory; geology; design and engineering, and safety, security, environment and planning (West Cumbria MRWS Partnership, 2012). The inventory and the geology are both complex issues, historically embroiled in controversy and particularly interesting for the present study as they concern core scientific knowledge about the issues.

The inventory is a key feature of a GDF because it describes the type and amount of radioactive waste that is to be disposed of. It has potential for controversy when linked to the building of new nuclear power plants because types and volumes of wastes would then remain open-ended (Blowers, 2010). However, the MRWS strategy explicitly excluded discussion of future waste from new nuclear power stations, limiting investigation to existing waste and projected waste from existing operations.

Examining the inventory the Partnership asked the technoscience experts: "(i) what might go into a facility; (ii) what level of influence the community would have over changes, e.g. increases or decreases in the amount or kinds of waste, and (iii) principles for how the inventory might be changed" (West Cumbria MRWS Partnership, 2012: 68). Given the legal requirement to keep close tabs on radioactive waste we would expect that the experts had the answers to these questions readily at hand, but that was not always the case.

The Partnership's eleventh meeting in August 2010, with 37 attendees (including thirteen observing members of the public), aimed to 'develop an understanding of the inventory, the process for altering it and how the community might influence it' (3KQ, 2010: 3). At the meeting the technoscientific experts from the Nuclear

Decommissioning Authority (NDA), and the Department for Energy and Climate Change (DECC), the government branch responsible at the time, did a joint presentation and an independent expert addressed the issue from a different perspective. The session brought to light several uncertainties and the meeting report explains that:

> Clarification was sought regarding the percentage of waste that is currently held at Sellafield[8]. The responses that were given made it apparent that there is no clear figure because it depends on what wastes are included, and how they are calculated/measured (e.g. by volume or activity). Concerns were raised that the Partnership has been operating to date on the basis that around 70% of existing waste that is earmarked for geological disposal is already held in West Cumbria. The Partnership asked for this to be confirmed or clarified as a matter of urgency. The NDA agreed that they would confirm the proportions currently held at Sellafield by volume, activity and types of waste. (3KQ, 2010: 19)

The NDA (2010) produced a technical note responding to the Partnership's questions in November 2010. That it took nearly three months to provide seemingly basic information about the existing radioactive waste shows that NDA and DECC were unprepared to engage with issues of concern to the local community. Standard techno-scientific representation of radioactive waste treated the UK as a whole, reflecting requirements to report to national government and international oversight agencies. Information about the geographical distribution of the waste was not readily available even though CoRWM (2006) had explained that questions about where waste was stored would need to be answered when engaging with local communities. Still, it was not until actually encountering local residents – who knew that waste was stored in a facility in the area and requested more exact detail – that the experts could be convinced to address the issue. We understand this encounter as re-situating techno-science to include geographical specificity in the waste inventory.

The geology of west Cumbria was an issue of historical contention that could have sparked public controversy. The MRWS process started with a geological unsuitability screening by the British Geological Survey (BGS), and they submitted a draft report to the Partnership for review in June 2010 and a revised, final report in September (Steering group, 2010; BGS, 2010). The Partnership had commissioned two technical expert reviews of the draft and held a meeting to discuss the draft and the reviews (Walker, 2010). The commissioned experts questioned some of the BGS's representations of distinctions between different elements (e.g. fresh water versus brine aquifers and the explicit inclusion of shale gas in 'oil and gas resources'). Partnership members raised questions that brought the societal context into the discussion, asking for example for a "plain English summary version" (Walker, 2010: 2-3) as they found the text difficult to understand. Another request concerned the provenance of the geological knowledge claims, as there was a need to be "clear about the Nirex[9] information and how it has been dealt with" (Walker, 2010: 2-3). Local residents referred to the past controversy wondering about the links to the failed siting process by Nirex and the Partnership emphasised the need to make sure that the use of knowledge produced in that process was transparent. The BGS map was also found to be insufficiently clear as "the partial exclusion zone is going to be difficult to explain to the public" (Walker, 2010: 2-3). Partnership members found that "there is a danger that this map will be reproduced by journalists in a simpler format showing areas 'in' and 'out' which may lead to misconceptions that we are in the site selection stage, and also misinterpretations if they don't summarise it accurately" (Walker, 2010: 2-3).

In the examination of the geology the Partnership demonstrated an acute awareness of the local history of controversy over the siting of a GDF. In contrast the BGS again appears unprepared to engage with lay people in this place with its unique history regarding this issue. The techno-science experts lacked linguistic and visual vocabularies to communicate with audiences who did not share their disciplinary background. The BGS revised their report and brought it back to the Partnership for discussion at a meeting in November 2010 (Willis, 2010). The overall conclusion was that knowledge about the geology was limited at the

time, but that not all of west Cumbria had been proved unsuitable. The Partnership would decide whether they agreed that there was sufficient volume of rock within west Cumbria that could potentially be found suitable to enable further participation in the MRWS process, subject to satisfaction with other outcomes in other strands of inquiry, public consultation and local authority decisions. The BGS had managed to re-situate their knowledge claims in a way that allowed them to represent claims about the local geology in a manner comprehensible to local residents and sensitive to historical context. However, this was not the end of the matter.

The examination of the knowledge about the geology in west Cumbria was reported in the Partnership's regular newsletter. They presented a report of the BGS unsuitability screening opposite an account of the view of Dr David Smythe, that all of west Cumbria had been found unsuitable in the 1990s (West Cumbria MRWS Partnership, 2011). Now retired, Smythe had been deeply involved in the earlier controversy that ended with the rejection of Nirex's application for planning permission for a Rock Characterisation Facility, the first stage in GD (Smythe, 2011). Smythe's claim prompted CoRWM[10] to write a letter to the Partnership highlighting the uncertainty of knowledge about the suitability or unsuitability of most of west Cumbria's geology (CoRWM, 2011). Alerted to the issue NDA held an informal meeting at their offices in Oxfordshire, with a former planning inspector who had worked with the Nirex inquiry in the 1990s, to clarify the knowledge about the geology of west Cumbria (NDA, 2011). Two experts from the Nirex inquiry also presented at a meeting with the Partnership Steering Group to clarify the implications of the knowledge generated by the former inquiry (3KQ, 2012). The opposing views on the potential suitability of the west Cumbria geology were discussed at a seminar on the 20th June 2011, arranged by the Partnership and attended by 100 people (3KQ: 2011). An independent expert commissioned by the Partnership to scrutinise the BGS report, presented a critique of Smythe's claims (Dearlove 2011). This critique was challenged by a letter from Smythe's former collaborator Stuart Haszeldine (2012).

This episode illustrates how the past can be brought into the present in a place-making process that involves long-standing matters of concern. Geological disposal has a long and contentious history in west Cumbria, and while national government and technoscience experts can regard past controversy over the issue as closed this is not the case in the local community. Past controversy over the siting of a GDF in a locality can be re-opened in response to new developments of the unresolved issue of radioactive waste disposal (Bickerstaff, 2012). However, in this case the disagreement did not escalate into public controversy. A Partnership meeting on June 23, after the public seminar, concluded that it was not possible to reach agreement on the question of geology and that the 'PSE Sub-Group should discuss the options further and come up with a recommendation for the way forward' (3KQ, 2011a). Thus disagreement was contained without being forcefully closed down, or allowed to disrupt the Partnership's programme.

As demonstrated by these two examples, the Partnership's critical scrutiny of technoscientific knowledge about GD impacted on the experts because it concerned the circumstances at hand in the locality. Engaging with the specific place challenged the technoscience experts to explain how their knowledge applied there and address the questions the Partnership considered important, not the questions the scientists viewed as relevant. The dispute over geology demonstrates the authority of the Partnership. Instead of allowing scientists with opposing views to lead the process into public controversy the issue was moved to a sub-forum where the experts could continue to disagree in the absence of new evidence.

Re-assembling local publics

The events arranged by the Partnership to examine the scientific and technical knowledge about GD were undertaken within the same overall local engagement process as a series of activities aiming to find out about how local publics viewed whether the councils should participate in the search for a GDF site. These activities were components in a Public and Stakeholder Engagement (PSE) programme with three 'rounds'

addressing all aspects of GD, underpinned by the principle "that it was important not to engage with people for the sake of engaging, or as a 'tick box' exercise" (West Cumbria MRWS Partnership, 2012: 43). Organising a wide range of face-to-face engagement activities the Partnership's PSE programme differed significantly from the one-off events common to public participation in science and environmental management (Felt and Fochler, 2010; French and Bayley, 2011; Newig et al., 2016). The Partnership commissioned expert consultants to conduct different activities, using both qualitative and quantitative social science methods, as well as deliberative techniques. The PSE programme was comprehensively recorded, with reports presenting and summarising each stage, each activity and each meeting. Because communication of the Partnership's work was an integral part of PSE, some of the archived materials, such as the newsletter discussed in the previous section, provided a running commentary at the time.

The first round of engagement – PSE1– running from November 2009 to March 2010, had among its key objectives to "Build the understanding of stakeholder organisations and the public" and to "Seek input from stakeholder organisations on the Partnership's work programme, Terms of Reference, Criteria and PSE Plan" (West Cumbria MRWS Partnership, 2010: 5). In posing this question the Partnership took a similar path to the NWMO (Nuclear Waste Management Organization) in Canada that was tasked with formulating a new policy (NWMO, 2005). However, the NWMO asked a national public about the principal issue of how to approach nuclear waste disposal, in contrast the Partnership asked the local communities about their views on undertaking a GDF siting process in their area. That this fundamental question was posed sets this engagement process apart from the type of events described in the literature, that invites a representative sample of the general public to participate in deliberative experiments controlled by scientists and experts (Bogner, 2012; Braun and Schultz, 2010; Felt and Fochler 2010).

Another PSE activity shows the Partnership visiting already established local public spaces to give presentations to Neighbourhood Forums (NF). In these evening meetings Partnership members gave a standardised slide presentation that explained GD, the role of the Partnership and the PSE programme. Representatives from NDA, CoRWM and the Environment Agency for England and Wales (EA)[11] also attended many NFs. In total over 500 local residents attended these events (3KQ, 2010b). Presenting at NFs would in Callon et al's (2009) terminology amount to going into the 'wild', we view it as scientists and experts involving with place-making.

Quotes in the NF minutes show the range of views expressed by members of the local community. For example, there was suspicion of the government's commitment to voluntarism: "You've read and you'll know section 6.5 of the (MRWS) White Paper; it says if an agreement can't be reached Government will do whatever they think is necessary" (3KQ, 2010b: 9). Questions were raised about the process: "Who will make a decision on behalf of the community?" (3KQ, 2010b: 10) and about the current situation: "70% of the country's waste is already stored at Sellafield – how long can it continue to be stored there until space runs out?" (3KQ, 2010b: 14). Memories of previous attempts to site a facility in the area lingered: "We went through surveys years ago; I don't know the exact findings but there were flaws. That was 15 years ago. This area was identified as a potential site; it was not suitable so is this now the political place to put the waste?" (3KQ, 2010b: 11). There were also voices in support for siting a facility in the locality: "I haven't got a problem with it to be honest. Sellafield do a good job. West Cumbrians know what they're doing and we've all pulled together to make it work. I do think Sellafield has been managed really really well. I'd hate to see what West Cumbria would be like without Sellafield. I would like to see one stipulation to be that a lot/the majority of jobs go to local people?" (3KQ, 2010b: 13).

The different views among local people attending NF meetings show that there was not one united public in the locality. In addition to the diversity of publics showing in the Partnership's accounts there was a historically established public opposed to GD that did not get involved. Local campaigners – including some environmental NGOs rejecting GD in principle – declined invitations to formally engage with the Partner-

ship (West Cumbria MRWS Partnership, 2010). This can be understood as a rejection of the Partnership's rationale of opening up the question that opponents of GD regarded as closed.

Sensitivity to the diversity of local publics is visible in the quantitative attitude surveys conducted by the polling organisation Ipsos Mori that complemented face-to-face activities. The first survey, carried out in November 2009, covered what in any other context would have been described as a representative sample of the population in Copeland and Allerdale. However, reminding us of how contentious the issue of determining the community's views was, the report cautions that: "It should be remembered at all times that a sample and not the entire population of Cumbria residents took part in the survey. Consequently, all results are subject to sampling tolerances, which means that not all differences are statistically significant" (Ipsos Mori, 2010: 11). Ipsos Mori found that 82% of the people surveyed thought that GD was the best option for higher activity wastes. 52% knew that the Partnership was talking to government about possibly looking for a site in West Cumbria and 50% were in favour of this. 47% were positive about siting a GDF in West Cumbria while 26% were opposed.

Concluding PSE1 the Partnership found that challenges had been brought to light, two of particular interest to this paper. The first was the insight that people in the locality had not forgotten the bad experience with Nirex (this was particularly important in relation to the debate about the local geology as noted above). The second finding was about the need to clarify decision making. It was considered critical to make clear who would be mandated to decide about what, and when. This points to a general problem with the shift from government to governance, with more actors getting involved in decision-making, responsibility and accountability can become unclear (Swyngedouw, 2014). This also resonates with the difference of this process from participation as experiment (Bogner, 2012) where the objective is to gauge public opinion on a set question without considering wider issues, such as future decision-making processes.

The second PSE round (PSE2), running from November 2010 to February 2011, focused on enhancing public awareness. Although it would be possible to argue that a majority of the people surveyed supported the work of the Partnership and even the siting of a GD facility in the area, it was not clear how people understood the issue. The Ipsos Mori survey had found that only 27% of respondents knew that the government was looking for a community to volunteer to host a GDF and only 20% were aware that talking to the government did not mean committing to host a repository. Featured in the Partnership's newsletter (West Cumbria MRWS Partnership, 2010a) these figures indicated that public understanding was limited, implying that the support for GD expressed in the survey may not be stable and that views could change in response to any argument, correct or incorrect, relevant or not.

Again a wide range of local activities were organised, for example, 10 one-day events organised by 3KQ, the consultant firm commissioned by the Partnership to facilitate the process and support it throughout. Each such one-day event had four main elements: i) an explanatory exhibition; ii) specialists from DECC, NDA, BGS and the EA responding to questions from the attendees; iii) presentations with discussion and iv) written interaction that made it possible to record views and ideas expressed for further consideration (3KQ, 2010c). Another face-to-face format was Stakeholder Organisations Workshops with objectives including "to demonstrate how public input to date has led to real changes" (3KQ, 2011b: 3). A third interactive method, Residents' Panels, organised by consultants Vision Twentyone in February 2011, had aims including to "establish what would give local people confidence that The Partnership presents information in an open and transparent manner" (Vision Twentyone, 2011: 2). The question of what it would take for local people to trust the Partnership matters for how local community support for the Partnership's recommendations could be assessed and how much support is needed for a recommendation to be made.[12] The second opinion survey by Ipsos Mori showed that although awareness had increased, confidence in the Partnership was unchanged, but support for locating a GDF in West Cumbria had slightly decreased (Ipsos Mori, 2010a).

In the process of re-assembling the public PSE2 stabilised a local public, by ensuring that people were well informed and confident to voice consistent views on the issues. PSE1 had shown that while there was potential for a public that would be positive to the locality taking part in a siting process, this attitude was not necessarily based in a clear understanding of the issue, the process or the potential local consequences. Educating the local residents could facilitate the emergence of a potentially self-aware public constituted through a specific matter of concern (cf. Callon et al., 2009).

In PSE3 the re-assembling of the local public was tested in formal public consultation. A draft of the Partnership's final report was published and discussed in a variety of forums ranging from group deliberations, to written submissions from individual members of the public and a third survey by Ipsos Mori. Gauging people's views on whether the three councils should opt to participate in the search for a GD site the survey found that:

> In Copeland, 68% thought the search should continue, and this was significantly higher than both Allerdale (51%) and the rest of Cumbria (50%). Conversely, the proportion in Copeland who thought that the search should not go ahead was lower than in the other areas (23% vs 37% in Allerdale and 35% in the rest of Cumbria). (West Cumbria MRWS Partnership, 2012a: 151)

Controversy about these findings threatened when a local resident submitted a critical letter that questioned the statistical representativity and the sampling methods. Ipsos Mori (2011) answered this letter in detail. The cautious language used in the survey and reports indicate the importance of transparency regarding how the local community's views were identified, interpreted and represented. It was made clear that it would always be impossible to achieve consensus on a community-wide scale.

Operationalising the White Paper's requirement of a 'credible' level of support in a local community deciding to participate in the MRWS process the Partnership used the notion of 'net support', enabling the process to progress when favourable survey responses outweighed the unfavourable. The Partnership were not trying to construct a singular opinion supporting a siting process in the area that would replace the historically established local public opposing GD, but to find out if local residents, who were not already committed to opposition, could be in favour of a decision to participate in such a process. In the end, the views remained diverse even within the Partnership itself:

> Overall, most Partnership members are satisfied that the opinions and advice given in our Final Report reflect the public and stakeholder views we have received. However, some members feel this is not the case on some topics and this has been noted in the relevant chapters. (West Cumbria MRWS Partnership, 2012: 10)

The divergence of views noted in this quote is discussed in detail in the sections of the report addressing the topics on which consensus did not arise.

The long-term engagement with local residents undertaken by the Partnership did not invent new public engagement methods, but combined established techniques iteratively in a programme that also made the local community visible to itself via the on-going publication of activities and findings. At the end of the Partnership's work programme the visible public in west Cumbria was not the same in terms of knowledge and views as it was before it commenced. Although opposition to siting a repository in the area remained, the local public had re-assembled in a way where those in favour of exploring the possibility of participating in a siting process had become visible.

Concluding discussion

This paper has highlighted the role of place, in the sense of geographical location, for public engagement with scientific expertise in relation to environmental risk. We introduced the notions of re-situating technoscience and re-assembling the public to discuss two aspects of the West Cumbria MRWS Partnership's three-year examination of the possibility of participating in siting a facility for geological disposal of radioactive waste. We argued that this involved technoscience in local place-making, in a way not discussed in the

literature. Previous research has critiqued invited participation for leaving scientific ways of working unchanged (Felt and Fochler, 2011; Laurent, 2016). In contrast, uninvited participation has been found to prompt changes in research practice through public controversy (Wynne, 1996; Callon et al., 2009; Cohen and Ottinger, 2011). The analysis of the Partnership adds nuance to the binary of invited and uninvited participation.

Focussing, first, on re-situating technoscience the case study showed that the local history of public controversy over geological disposal prompted critical debate about issues usually defined as 'technical'. This time public controversy did not ensue, instead technoscience experts changed to accommodate interaction about local matters of concern. We contend that this pivoted on the Partnership's authority to demand that scientific experts engaged with the issues that mattered to the local community and communicated in ways that could be understood by non-scientists. When scientists disagreed about issues beyond the empirical evidence they were relegated to the margin of the engagement process. Technoscience was re-situated, from reflecting scientific practice, discourse and interests, to taking the place at risk, with its unique history, seriously. The re-situated knowledge claims were continuous with existing technoscience knowledge, but articulated with consideration to the specific place-making dynamics of west Cumbria.

Previous research has highlighted the ways in which public engagement with science and expertise is usually set apart from everyday life and local concerns, captured in the simile made with laboratory experiments (Bogner, 2010). In contrast, Partnership members brought science and technical experts to the places people visit every day – schools, village halls, libraries – to find out about community members' views. The understanding of the local community gained in face-to-face interaction was supplemented, not displaced, by social science methods adapted for the specific local programme by experts on public engagement (Chilvers, 2013).

Focussing on re-assembling the public brought to light how the long-term engagement process changed 'the local public'. The Partnership worked in a place where historical controversies had constituted a public opposed to exploration for siting a GDF. To simply gauge this public's views would immediately have excluded further involvement with the MRWS process. Instead, the Partnership addressed people who might not otherwise have had time to get involved, or who did not believe that their views would matter. Opponents of a GDF in the area did not disappear, but other viewpoints emerged. Adding to the understanding of constituted publics the analysis recognises local history and specificity, insisting on there already being publics in places where concerns about environmental risk arise. This aspect of public engagement may be specific for environmental risk governance in which place matters in a different way than in many other processes involving technoscience futures.

The concepts re-situating technoscience and re-assembling the public were used to analyse different aspects of the same process. One targets change in the conduct of scientists and technical experts, the other illuminates change in the local social order. The case study demonstrated how these concepts can facilitate examination of the relationship between science and publics in environmental risk governance. Often public engagement with science and technology in this area follow the format of experiments controlled by experts (Felt et al., 2016), but this case shows that democratic delegation enabling local communities to lead is possible. This issue deserves more STS attention, as current trends in environmental policy involve delegation of risk management to local authorities who have to reconcile science-based expert knowledge with local public engagement.

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Notes

1 Former Executive Co-director, Nuclear Legacy Advisory Forum (NuLEAF)

2 'Co-production' is here used with reference to the discussion of lay people in scientific research by Callon (1999).

3 In this case we use the term 'technoscience' because the scientific experts involved in the process were presenting knowledge claims regarding an imagined technical construct and its possible impacts on the environment. The science involved produced knowledge about a technology.

4 In this study we do not inquire about the activities of opponents of geological disposal, as such or in the locality, because there are numerous, incisive academic studies of anti-geological disposal activism in the UK and elsewhere, see for example Blowers (2017).

5 The other organisations involved in the MRWS process maintained their own websites in that period, but have now removed them or changed their content. The version of CoRWM discussed in this paper has left a faint trail at http://webarchive.nationalarchives.gov.uk/*/http://www.corwm.org.uk/. Some of the documents published by NDA in the MRWS process can be accessed from https://www.gov.uk/government/organisations/nuclear-decommissioning-authority.

6 The co-author's work with the Partnership was not social science related and the Partnership completed its work before the research on which this paper is based commenced.

7 Chilvers (2013) discusses how social science methodological innovations for public engagement are taken up by expert consultants and provided on a commercial basis. The archive testifies to the critical role of 3QK in facilitating the Partnership's work. In addition to organising events, identify technical experts and make sure information flowed among the people involved, they also documented every detail of the programme.

8 Sellafield in west Cumbria is a nuclear fuel management and decommissioning site owned by the NDA, most of the higher activity waste from nuclear power production in the UK is currently stored in this facility operated by Sellafield Ltd.

9 Nirex was a body set up by the UK nuclear industry in 1982 to examine geological disposal, it became embroiled in a major public controversy in west Cumbria.

10 After the launch of the MRWS strategy CoRWM was re-formed to provide independent advice to government and scrutiny of the MRWS process.

11 The EA was at the time lead regulatory authority with regard to GD in England and Wales.

12 It is to be noted that after extensive consideration the Partnership decided against making recommendations and chose instead to present *findings*.