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Realities of environmental toxicity and their ramifications for community engagement

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Abstract

Research on community responses to environmental toxicity has richly described the struggles of citizens to identify unrecognized toxins, collect their own environmental health facts, and use them to lobby authorities for recognition and remediation. Much of this literature is based on an empiricist premise: it is concerned with exploring differences in how laypeople and experts perceive what is presumed to be a singular toxic reality that preexists these varying perspectives. Here, we seek to reexamine this topic by shifting the focus from facts to facticity—that is, by exploring the many types of knowledge that communities develop about toxicity and how these knowledges articulate with the ideas of scientific and governmental authorities about what kinds of information are valid bases for policymaking. In making this shift, we are influenced by work in semiotic anthropology and science and technology studies (STS), which emphasizes that lived experience generates distinct realities rather than different perceptions of the same underlying state. Using this framework, we present an analysis of oral history interviews conducted in 2013–14 in the small American town of Ambler, Pennsylvania. Part of Ambler’s legacy as a nineteenth- and twentieth-century center of asbestos manufacture is that it is home to two massive asbestos-containing waste sites, one of which was being remediated by the Environmental Protection Agency (EPA) at the time of this study. Our interviews demonstrate that even asbestos, a toxin with a well-established public narrative, is a fundamentally different object for different members

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of the Ambler community. For many of these individuals, the epistemology and practices of the EPA are incongruent with or tangential to their toxicity-related experiences and their consequent concerns for the future. As such, our findings suggest caution in framing the community engagement efforts of environmental health agencies primarily as facilitations of citizen science; this approach does not acknowledge the multiplicity of toxic realities.

Keywords

USA; environmental toxicity; risk; community engagement; citizen science; semiotic anthropology; ontological turn; asbestos

INTRODUCTION

Community response to environmental toxicity has been the subject of richly detailed ethnographic study (Allen, 2003; Auyero & Swistun, 2009; Brown, 1992; Checker, 2005; Edelstein, 2004; Fortun, 2001; Levine, 1982; Little, 2014). Often this work describes residents engaging in citizen science: positing a relationship between the local incidence of illness and an environmental hazard, forming activist organizations, carrying out ‘shoe-leather’ epidemiology, developing alliances with likeminded scientific experts, and pressuring authorities for official recognition and remediation. As such, a central theme of this vein of research has been a problematization of the division between the roles of layperson and expert in recognizing and acting upon toxicity. Indeed, in commenting on the significance of this body of ethnography, leading authors (Brown, 2003, 2007; Edelstein, 2004; Hoover, Renault, Edelstein, & Brown, 2015) have stressed its ability to demonstrate that environmental knowledge generated by laypeople should not be seen as less valid than that of experts. Operating in a domain characterized by intense uncertainty and trained in the powerful but limited tools of bioscience and epidemiology, experts are often unable to identify and effectively mitigate instances of toxicity; residents, living out their lives amidst their local surroundings, develop intricate understandings of this environment that can help fill the gaps inherent to risk assessment.

In describing the efforts of citizens to negotiate the arenas of science and policymaking, an important contribution of this literature has been its intent to describe the sociocultural construction of toxicity, health, risk, and expertise. This constructivist emphasis ostensibly sets it apart from ‘technoscientific’ (Lupton, 2013) work that adheres to the notion of environmental toxicity as a reality that can be represented with greater or lesser accuracy. (A clear example of the latter is the psychometric risk perception paradigm (Slovic, 2000, 2010), with its focus on identifying cognitive tendencies that bias the perception of environmental risk.) Yet there is often an uneasiness to the constructivist bent of ethnographic work on environmental health, an undercurrent of empiricism running beneath the general attempt to explore how ideas are grounded in everyday realities. This subtle internal contradiction has several causes. For one, as Joshua Reno (2011) has observed, the above-described motive of this work to emphasize the ambiguities inherent to environmental health science while celebrating instances of laypeople using their own data to successfully draw awareness to local toxicity remains premised on the disposition that there are “good

and bad ways of knowing” (Reno, 2011, p. 517). Second, many social scientists researching communities impacted by environmental toxins, thoroughly immersed in the plight of residents, themselves become activists dedicated to making residents’ voices heard through existing channels of authority as part of the effort to initiate or intensify cleanup efforts. Making change through these technocratic channels, as will be explored further below, requires an empiricist orientation. Third, the seminal ideas of Ulrich Beck (1992) and Anthony Giddens (1991) on environmental risk continue to inflect work in this area. In their assertion that the contemporary individual is increasingly concerned with the effects of the environmental damage associated with economic growth and distrustful of the ability of experts to gauge and remedy these effects, Beck and Giddens retain a focus on risk assessment and its accuracy.

The importance of achieving remediation of officially unrecognized environmental toxins—and of the role of qualitative research in aiding this goal—should not be underestimated, particularly when lack of attention to these health hazards is the result of race- and poverty-related discrepancies in power (Checker, 2016). However, we suggest here that the richness of ethnographic data on the lived experience of toxicity can be usefully turned in a direction less focused on disputes between citizens and authorities over what is true versus false. Not only can qualitative work describe how laypeople and authorities negotiate the facts of health risks, but it can also examine how facticity itself is constructed in these situations (Jasanoff, 1998). What assumptions underlie scientific and governmental ideas of what constitutes valid information and motives upon which to base environmental health policymaking? How do these deep-seated epistemic frameworks articulate with those of the community members who live each day amidst toxicity? And what does the nature of this articulation tell us about where and how power is exercised in the engagement of authorities with citizens?

In orienting qualitative work on environmental toxicity towards these questions, two bodies of social theory are particularly helpful. We are influenced in part by the recent “ontological turn” in science and technology studies (STS). This framework is stringent in its refusal to explain cultural diversity as differences in ‘perspectives’ about a singular underlying reality, instead attuned to “forms of difference that cannot be reduced to a disparity of ‘worldviews’” (Woolgar & Lezaun, 2013, p. 322). It emphasizes the practices through which objects are brought into being, attending to the performative nature of these practices rather than their representation of some preexisting essential state. In doing so, the ontological turn stresses that multiplicity in practices generates multiplicity in realities (Law & Lien, 2013; Mol, 2002).

A more concrete idea of this multiplicity can be obtained through attention to semiotic anthropology (Mertz, 2007), a field focused on how signs confer meaning within and across communicative encounters. Like the ontological turn in STS, semiotic anthropology is preoccupied with examining the production of realities in context-specific practices. This approach sees the individual as constantly proceeding through semiotic encounters as s/he moves through life (Agha, 2007). These instances socialize him/her to certain conceptions of an object through, for example, the commentary of others characterizing this object in a particular way (Silverstein, 2003). Over time, the manner in which the individual conceives

of this object increasingly presupposes his/her previous interactions with it (Wortham, 2005). An individual thus brings a unique biography to each encounter with the object, which shapes his/her construal of its meaning in the present moment (Agha, 2005; Urban, 1991). As applied to the topic at hand, semiotic anthropology demonstrates that environmental toxicity is about far more than toxicity, or risk, or any other singular concept of influence among health researchers or practitioners (a notion also recently articulated by Peter Little (2014, 2016)). The multiplicity of meanings conferred to some component of an environmental health issue—be it the toxin itself, its sites, its health effects—are sedimented over lifetimes of semiotic encounters, instances emplaced in the particular contexts in which people live, that intricately construct the significance of these entities. For a given individual, an environmental hazard may be associated as much with walking to school in the morning, running a business, or raising one's children—along with all of the other factors salient in these daily situations—as with health or disease.

Taken in tandem, these two bodies of theory prevent the analyst from assuming, even if tacitly, that there exists a baseline shared reality that can be calibrated to by disparate parties as they negotiate the facts of environmental toxicity. The intense commitment of these approaches to the notion that all realities are constructed and so inevitably multiple is particularly helpful in unearthing the enactment of behaviors and things that are considered extremely stable and mundane. Here, we present a study of one such entity: asbestos. This ubiquitously useful mineral was perhaps the twentieth century's most poignant emblem of toxicity. In contrast to newly discovered environmental harms (e.g., vapor intrusion (Little, 2014, 2016)), asbestos' medical narrative is by now well established, and television commercials encouraging sufferers of asbestos-related mesothelioma, lung cancer, and lung fibrosis to participate in lawsuits are common.

The American town of Ambler, Pennsylvania was a leading site of asbestos industry in the late nineteenth through late twentieth centuries, leaving it with significant asbestos waste piles still visibly evident in the local landscape today. Through conducting oral history interviews with Ambler residents and with employees of the Environmental Protection Agency (EPA)—which in recent years has done the lion's share of remediation work on the Ambler sites—we seek to demonstrate that, despite the seemingly straightforward nature of asbestos qua toxin, understandings of what this substance does, how its effects can be evaluated, and the ramifications of its remediation are deeply rooted in the varied lived experiences of these individuals. While some residents have at times approached the issue of asbestos in ways resembling the citizen science described frequently in ethnographic studies of toxicity—by trying to engage in debates about which kinds of air or water monitoring should be used, for instance—much of the community response in Ambler does not fall under this paradigm. Accordingly, while the EPA has increasingly expressed a commitment to community engagement—viewing the citizen as a legitimate source of scientifically relevant information—this study demonstrates the epistemically fraught nature of engagement approaches that are based on empowering citizen science.

BACKGROUND

Ambler is a small commuter suburb of approximately 6,500 residents (76.5% white, 12.8% African-American (United States Census Bureau, 2015)) located about twenty miles from Philadelphia, Pennsylvania, USA. The asbestos factories in Ambler operated from the 1880s until the 1970s, when the contribution of inhaled asbestos to respiratory pathologies became widely recognized. At its peak, the town was a global leader in the production of asbestos-containing materials. Throughout the tenure of this industry, asbestos-containing waste was dumped in two large sites adjacent to residential, recreational, and commercial areas. In 1986, one of these sites—a dump dubbed “the White Mountains” by residents due to its dramatic topography—was added to the EPA’s National Priorities List (NPL), an index of environmental hazards deemed suitably harmful to public health that they are eligible for cleanup under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, informally called “Superfund”). Remediation of the site was concluded in 1993, as measures were taken to cover the waste piles with tarps, soil, and plantings and to install fences and warning signs.

In 2004, developers proposed to build a high-rise building on a second dump site called BoRit. Concerned with the aesthetic effect a high rise would have on the neighborhood and the safety of building atop asbestos waste, a group of local residents calling themselves Citizens for a Better Ambler began to research the history of the asbestos dumps. They learned that BoRit had not been addressed by the initial Superfund remediation. The high-rise plan was abandoned in 2005 amidst opposition by residents and revised financial assessments taking into account the costs of asbestos protections or cleanup during construction.

Shortly thereafter, Citizens for a Better Ambler began lobbying the EPA to investigate BoRit. As a result of this activism, an EPA Community Advisory Group (CAG) was formed. CAGs are designed by the EPA to act as formal conduits of communication between the agency and local stakeholders in remediation such as townships, businesses, and community groups. The broad mandate of the CAG is explained by the EPA thusly:

A Community Advisory Group (CAG) is made up of representatives of diverse community interests. Its purpose is to provide a public forum for community members to present and discuss their needs and concerns related to the Superfund decision-making process. A CAG can assist EPA in making better decisions on how to clean up a site. It offers EPA a unique opportunity to hear—and seriously consider—community preferences for site cleanup and remediation (United States Environmental Protection Agency, 2016b).

The CAG model is one major component of the EPA’s contemporary emphasis on what the agency terms “community involvement”, a move away from a paternalistic approach to toxicity assessment and cleanup and towards one that “encourage[s] and enables community members to get involved [...] collaborate[s] with the community to address concerns [...] incorporate[s] community input into planned actions”, and “explain[s] to the community what EPA has done and why” (United States Environmental Protection Agency, 2011, p. 5).

When the BoRit CAG assembled in 2007, members appealed to the EPA to have the site added to the NPL. The EPA added BoRit to the NPL in 2009 based on the possibility that local residents could be exposed to airborne asbestos (United States Environmental Protection Agency, 2016a). Beginning in 2010, the agency carried out several rounds of air, water, and soil sampling in and around the site. At the time of our interviews, the EPA was addressing short-term dangers posed by BoRit by covering exposed waste. Concurrently, the agency was determining a course of action for long-term remediation. Regular interaction between EPA representatives and local residents, businesspeople, and activists had been ongoing throughout the agency's presence in Ambler.

METHODS

The data used in this study were obtained from oral history interviews. In comparison to semi-structured interviewing, the oral history approach is less focused on specific research orientations and consequently features significantly less guidance from the interviewer. While we prefaced our initial communication with each interviewee by explaining our interest in exploring Ambler's asbestos sites and the activities centering on them, our interview questions did not focus exclusively on asbestos, its health effects, or its remediation. Rather, we elicited broad accounts of interviewees' major life experiences—for example, those related to employment, local politics, relationships, and health/illness—and allowed their understandings of and involvement in the asbestos issue to emerge as part of these narratives. Our use of oral history's more open-ended approach was motivated by our theoretical orientation, namely its emphasis on the idea that lifetimes of experience in diverse settings construct multiple realities of environmental health. The methodological implication of this position was a reluctance to pre-frame research as being about toxicity or about risk. Rather, we pursued it as a process of inductively understanding the breadth and logic of interviewees' ideas in the contexts of their own unique biographies.

We interviewed 23 individuals, including 20 current or former residents of Ambler or the surrounding area and 3 EPA employees involved in the Ambler asbestos remediation process (see Table 1 for interviewees' demographic and residency characteristics). Interviews were conducted between November 2013 and September 2014. Participants signed an oral history release form at the time of the interview and upon completion of the transcripts. All procedures were approved by the institutional review board of the University of Pennsylvania.

Like the interviewing methodology, our sampling approach was guided by our theoretical framework. We used purposive sampling with the central criterion of capturing a disparate range of experiences and orientations that could relate to the local asbestos problem. Our interviewees had lived in different neighborhoods of Ambler and the surrounding region—areas characterized by diverse geographies, resources, and histories. They had varying lengths of occupancy in the region, from being born and raised there seventy or more years ago to having moved in within the last decade. Some participants had older relatives who had worked in the local asbestos factories, and some of these relatives had suffered and died from pulmonary diseases possibly related to asbestos exposure. Interviewees' interest in the asbestos piles and their remediation stemmed from several roles: employment with the EPA,

involvement in local politics, ownership or employment in local businesses, activism via Citizens for a Better Ambler and/or the CAG, simply living in the area, or a combination of these.

Interviews were transcribed by a professional transcription service, reviewed for accuracy, and entered into *NVivo 10.0* (QSR International Pty Ltd.) for coding and analysis. Codes were derived by a close reading of the first five transcripts. Each code was defined and then applied to the entire corpus of transcripts. Coding was independently performed by multiple members of the research team, and codes were compared to evaluate consistency. Discrepancies between coders were discussed until consensus was reached on how they should be rectified. After coding, the entire team was brought together in a series of meetings to summarize code content and to reach consensus on the broader significance of themes.

RESULTS

The ambiguity of risk

Risk is the core concept of epidemiology and an increasingly central influence in contemporary biomedicine (Armstrong, 1995; Aronowitz, 2015; Clarke, Shim, Mamo, Fosket, & Fishman, 2003). In these contexts, risk factors are identified through the quantitative correlation of exposures with outcomes; in turn, thresholds of acceptable exposure to these factors are determined, below which negative outcomes occur with a probability that is low enough to be acceptable. A major theme in social scientific work on environmental health has been the aim to describe how individuals understand risk and how these understandings shape their responses to toxicity.

In our interviews with Ambler residents, we found that the concepts of risk marshaled in scientific and policymaking circles did not provide them with a straightforward means of evaluating the effects of asbestos on their current and future lives. In contrast with the guiding orientation of psychometric research in risk perception (Slovic, 2000, 2010)—and in line with Mary Douglas's (Douglas & Wildavsky, 1982) foundational anthropological argument about risk subjectivity—interviewees' difficulty in construing risk assessments was not caused by a tendency to misunderstand probabilities. Rather, these assessments were often inapplicable to their lived experiences of environmental toxicity.

Echoing earlier observations made by philosophers of science (Gorovitz & MacIntyre, 1976; Toulmin, 1976), Michel Callon and coauthors (Callon, Lascoumes, & Barthe, 2009) have argued that comfortably framing a decision in probabilistic terms requires perfect information: one must have exhaustive knowledge of all available choices, all of the forces in play in each of these potential paths of action, and the nature and likelihood of interactions between these forces. Clearly, few if any situations in which an individual is considering the risk of developing a particular illness through carrying out a particular behavior meet these criteria. Studies of the clinical encounter, for example, have described how the use of risk statistics by the physician to frame therapeutic options induces a profound ambiguity for the patient because of the inherently imperfect nature of knowledge about these options (Gifford, 1986; Hunt, Castaneda, & de Voogd, 2006).

We suggest that the ambiguity induced by risk assessments is experienced even more acutely when people are faced with interpreting the danger posed to them by an environmental toxin. In the clinical encounter, a physician draws on population-level data such as the results of randomized trials to generate a prognosis and treatment plan for an individual patient, an extrapolation that creates an inherent space of uncertainty. In environmental health, an authority such as the EPA uses population-level data such as the results of epidemiologic studies or sampling measurements to generate a prognosis and a plan of action for a *population*—all of the individuals potentially exposed to a given toxin. For example, an EPA employee closely involved in remediation of the Ambler BoRit site described the results of air sampling:

We're in the hundreds, if not close to a thousand, air samples collected here, and none of them showed levels that we should be concerned of. [...] For the workers—you know, the ones doing the [remediation]—we're like magnitudes of order below the OSHA [Occupational Safety and Health Administration] level.

In the capacity of his training and employment, this EPA employee was socialized to a set of technical criteria for evaluating risk at specific sites. So long as measurements of the Ambler asbestos piles did not exceed policy standards—e.g., OSHA regulations—he was satisfied that BoRit did not present a significant aggregate risk to the community. But for those living and working in the area, this mode of evaluation created a double-layered ambiguity different from that present in the clinical scenario. They had to not only think about how the general rules developed by the EPA through work at numerous sites applied to their single local site, but additionally translate the general observations the EPA relayed to them about this local site's effect on the surrounding population to their individual bodies and those of their loved ones.

Enumerations of risk derived from population-level measurements are one type of information used to assess toxicity and make decisions about its management. This epistemic framework, however, was not necessarily pertinent to the realities articulated by our interviewees. These individuals had through their particular lived experiences constructed their own ways of considering the prospect of becoming sick from asbestos exposure. Several interviewees had known or heard of people in Ambler who had developed illnesses possibly related to asbestos. This personal tally of local cases provided a disorienting counterpoint to the EPA's explanations. One long-time resident, whose mother died of pulmonary fibrosis possibly related to asbestos exposure from working at a local asbestos factory, wondered about the contemporary danger posed by the waste in light of a local acquaintance more recently developing an asbestos-related disease:

I'm not qualified to say whether there is [a risk] or not, but I'm going to say probably there is a health risk. How that is I'm not sure, because is the biggest health risk [posed to] the people that worked at the plant? Or how about the five-year-old today that's playing near there? I don't know. I mean, I was shocked to hear about _____. I mean, he's 47 years old. [...] So maybe this is a continuing health risk. But I don't know.

Illnesses experienced by themselves and by relatives over years of living and working in Ambler also figured heavily in how interviewees understood the potential effects of asbestos

toxicity. The two interviewees below, both of whom had lived in Ambler for decades, separately speculated whether asbestos exposure could be responsible for pathologies they and those close to them had suffered from that were not those well known to be associated with asbestos:

My sister just died of cancer three years ago. She had cancer for seven years. They said it was some kind of thing with her head. [...] I knew _____ has died of the asbestos, and then some guy named _____ died of the asbestos. [...] It's supposed to be mainly for the lungs or something. But what else is that stuff doing? You know, what else is it doing that people are dying in their fifties?

I mean, the problem is, I guess, from my point of view, is we don't know exactly what the health risks are. If everybody talks about the mesothelioma, which is the cancer, are there other health risks? I mean, I have suffered with asthma all my life. Is that why?

The long latency period between exposure and the development of asbestos-related illnesses was also a topic of conversation when interviewees turned to the contemplation of their own health. This was particularly the case for long-term Ambler residents, who, even if subscribing to the EPA's current sampling results, could neither know the exact nature of their past exposure nor do anything in the present to alter it. Consequently, long-term residents expressed resignation about their risk of developing an asbestos-related disease and even a desire not to receive information that may allow them to further engage in the activity of estimating the probability of this occurrence. One woman who lived most of her life in West Ambler, in a home highly proximal to the BoRit waste, described her reaction to a request from a curious resident involved in Citizens for a Better Ambler:

[She] asked me one time, she said, "Can we put one of those equipments on your porch to see how high the level of asbestos is?" And I said no, because why would I want to know that, after all these years? You know, if I've got it, I've got it. I mean, nothing I can do about it. [...] So I don't want you putting that on my porch, and I'm going to worry myself to death, thinking, oh, I got a high level of asbestos.

What is asbestos, and what can it do?

While the general medical narrative of asbestos—its inhalation can lead to lung disease—is widely disseminated, our work in Ambler demonstrates that what appears to be a singular substance actually has multiple realities. Our interviewees' trajectories of socialization to the local asbestos sites differed drastically. Several respondents lived in the region before the health risks posed by asbestos were widely recognized, while others moved in after the first EPA remediation had been completed, when most of that site was surrounded by fencing and warning signs. Some of the individuals who were born in the area during the first half of the twentieth century had experience playing in and around the asbestos waste sites as children. Their notions of asbestos were in part directly impressed upon them by the piles themselves—the consistency of the waste, how it felt against their skin, what they were doing and thinking as they came in such close contact with it. Our two oldest interviewees, men born in Ambler in the '30s and '40s, spoke separately about this process of 'bodily learning' (Kirmayer, 1992) as they recounted playing on the piles as youths:

I wasn't afraid of it because of my childhood. I mean, hey, I played in it. [...] You could make a snowball out of this asbestos, because it was almost like putty, you know? Once it got wet. But slick as hell. Nobody's going to tell you stories like this. [...] But I lived it; I was there. And we did so many things. On one of the sides, we start digging, and we dug like a cave in the asbestos. I mean, now all my guys that I know that we did it, they're all—we're still living.

[A]s kids, we would go out and play in the neighborhood. The White Mountains were there. We'd play on the mountains. I mean, I'd be up to my knees in that stuff, you know. We never considered it a problem [...] I guess if you've lived through something like that, it doesn't become as important—that's probably a bad word, but I'll say it anyway—as important to you as it is to someone that's coming into town, and they say, "There's asbestos here." It's frightening, but we've lived through it.

Experience of the asbestos waste while participating in fondly remembered childhood activities—throwing 'snowballs' or digging caves with friends—leads the site to connote innocence and innocuousness for these men. Both of them reflexively comment on how their views of the waste have been shaped by their childhood interactions with it, observing that they consider the piles less of an urgent health hazard than do many of the other (newer) residents they have encountered. The epistemic basis of how these individuals understand the site is also revealed in statements such as "[A]ll my guys that I know that we did it, they're all—we're still living" and, "I guess if you've lived through something like that, it doesn't become as important". That they and their friends were repeatedly exposed to asbestos but have not developed symptoms of an asbestos-related disease is clearly of evidential significance to them in forming their perceptions of the danger posed by the piles.

All of the Ambler-area residents we interviewed were familiar with the association of asbestos with health problems, whether through interaction with the EPA during remediation, through their own research, through mass-media coverage of the topic, or through contact with family members, friends, and/or acquaintances who suffered from asbestos-related illness. Much of the bioscientific discourse about asbestos focuses on the development of asbestos-related disease through the inhalation of airborne fibers. A scientist employed with the EPA who was involved with the 1980s–90s remediation of the Ambler piles explained this idea:

Asbestos is a problem mostly because of airborne fibers. When it is contained in an intact matrix, like an asbestos cement pipe, or a tile, or a shingle, or even an automotive brake, it's not really a hazard. It can't get into your lungs. However, when it becomes airborne, when it turns to dust and gets into the air, then it's a problem because it can be inhaled.

Repeated encounters with this understanding of asbestos waste led a portion of our interviewees to voice a committed adherence to the notion that asbestos fibers should be prevented from becoming airborne at all costs. They often used metaphors of containment to describe the importance of limiting exposure of friable asbestos to the air. These metaphors linked asbestos and the asbestos site to a conceptual schema in which the fibers are a

dangerous presence whose destructive agency is only unleashed if the barrier separating them from the atmosphere is disturbed. Two such metaphorical constructions:

It's like having a poisonous spider in a jar. You know, here it is in a jar. It can sit here all day long not doing me any harm. If I take the lid off and it crawls out, people will get very excited. [...] If it's not in the air, it's not a problem.

[Speaking about the idea of anchoring the foundations of the proposed high-rise building in the BoRit pile:] It seemed to be just, you know, creating—just waking up the demons of asbestos by doing construction there.

For those interviewees who described this schema for understanding how asbestos becomes dangerous, it in turn shaped how they reasoned about solutions to this potential danger. Specifically, those who invoked containment metaphors to describe asbestos believed that capping the BoRit site with the asbestos waste in place was preferable to attempting to remove it and haul it away. The latter remediation approach could result in breakages of the various boundaries that keep the asbestos in its various containers. Said a woman involved in local government who had lived her whole life in Ambler:

I can't imagine wanting to live anywhere in Ambler and having ten years of asbestos-hauling trucks four, five days a week, fifty-two weeks a year, going along my street. The tarp might come off, something might have spilled out the top [of the truck]. And, you know, it just seems like a way of kind of doing the opposite, whatever the opposite is, of quarantining the asbestos.

Encounters with science and government

Last, we turn our focus to realms of lived experience not directly related to issues of health and illness but highly pertinent in constructing our interviewees' concerns about asbestos toxicity and its remediation. How Ambler residents understood the work undertaken by the EPA was strongly shaped by their histories of interaction with scientific and governmental authority. The diversity of these interactions resulted in disparities across our interviews in the qualities that participants associated with technical and political expertise and, in turn, how they perceived the EPA's approach for assessing the asbestos piles, translating these assessments into cleanup decisions, and explaining this process to the local community.

Our interviewees did not frequently challenge the EPA's discourse and policy on technical grounds. Statements like the following were common when they discussed their opinions of the EPA's methods for site assessment and cleanup: "I guess my thoughts are I'm not an expert at it. [...] I mean, ultimately the EPA has the expertise, and we're just anxious to see what the ultimate determination is through that scientific process." These expressions of reservation about one's ability to credibly engage with the science of environmental toxicity—what Mike Michael (1996, p. 111) has called "discourses of ignorance"—served as compressed accounts of some residents' perceived diminished position vis-à-vis scientific authority. These individuals had been enculturated to certain criteria for being able to credibly opine on matters 'scientific', and they did not deem themselves as meeting these qualifications.

However, a portion of our interviewees did more readily take up the role of citizen scientist and engage with the EPA in technical terms. These activists had greater comfort grappling with the agency's measurements and with the etiquette of scientific discourse, due in large part to experience in careers that required more formal education and a daily engagement with information generated by scientific institutions. These interviewees did not often question the legitimacy of the metrics used by the EPA and other authorities to assess environmental hazards. They viewed these measurements as deriving sound knowledge. Rather, they at times believed the EPA, in applying these measurements, was not upholding what they saw as the standards of scientific practice. For example, one of the major qualities that these interviewees associated with science was thoroughness, and consequently they successfully pushed the EPA to perform additional air and water sampling when unsatisfied with the temporal and geographic resolution of previous measurements. They also characterized good science as being consistent—i.e., what is accepted as best practice in a particular field should be applied uniformly across that field. The fact that the 1980s–90s EPA remediation had focused on only one of the two major dumps in Ambler caused confusion and frustration. Similarly, the apparent discrepancies in how the BoRit site would be addressed in comparison to the earlier cleanup pointed to inconsistent application by the EPA of scientific best practice. As one activist who moved to the area well after the first site was remediated stated about the current appearance of this site:

It's been left in a standard which today EPA is saying there's no way we can remediate [BoRit] and leave it looking like that. [...] If that was to be a new Superfund listing, what is there now would be deemed totally unacceptable. But because it was remediated, it is now deemed an acceptable site, and that to me has no logic to it.

While some respondents challenged the EPA's site assessment protocol, aspects of the agency's behavior not directly related to the science of environmental risk mitigation were questioned by all of the residents, businesspeople, and activists who spoke with us. Interviewees understood the EPA and its actions as not solely technical in nature, but also motivated by and having ramifications for sociocultural, political, and economic dimensions (Fischer, 2000; Irwin, Dale, & Smith, 1996; Latour, 1987; Michael, 1992; Wynne, 1996). For Ambler-area residents, scientific expertise was only a fraction of the overall qualities associated with the EPA, which was otherwise seen as composed of people with the same concerns and vulnerabilities as anyone else. Interviewees articulated a number of past experiences that made them wary of the EPA. For one, they suspected that the EPA's chosen strategies for attenuating risk were financially motivated. Said one respondent who was involved in local government and so was familiar with the budgetary constraints dealt with by public officials: "The EPA's goal here is to make this safe for human health at the cheapest possible cost. [...] [I]f they can do that by capping it, that's what they're going to do." Similarly, participants drew on their own employment experiences to commiserate with EPA employees, whom they perceived as beholden to the same hierarchical workplace power structure as any other worker:

They're people doing their job. I can't fault them for it. They do whatever their higher-up tells them to do. [...] A lot of times when they're talking to us, we'll say

something, and they'll say, "Yeah, that's right." And they don't say anything more, except what you can infer from that is, "Yeah, but I can't do anything about it."

Moreover, a subset of our interviewees believed that the EPA and the state and local governments the agency was working with to organize remediation were not equally prioritizing the needs of Ambler's various demographics and neighborhoods. This notion was particularly emphasized by residents of West Ambler, a heavily African-American neighborhood situated closest to the BoRit waste. These residents recounted a lengthy history of interactions with government authorities that they believed culminated only in inaction or purposeful neglect regarding the civic needs of Ambler's African-American community. One such resident:

So everything is like when it comes to us—and I'll say African-Americans—when it comes to us, it's like, "It's going to take time. [...] We don't have the funds now." But then I always see new things [being built]. When they put sidewalks all around the whole township except West Ambler, I question that.

As residents of a mostly African-American neighborhood, their history of politico-economic marginalization and disappointing communications with authorities heavily informed the way that West Ambler residents interpreted the intent and actions of the governmental authorities involved in asbestos remediation. Contemporary interactions with these authorities were only meaningful in relation to past experiences of neglect. Another long-time West Ambler resident stated her belief that the EPA remediations would not have happened without a trend of white gentrification in the area, which has been necessary to bring the local asbestos issue to political attention:

I remember when they came in and they cleaned all that white stuff out of there, got it all out, and they laid dirt down, whatever way they did, whatever process they went through. [...] [I]t was really the township that requested it, because by this time, now more white people were coming into the community, and they're complaining that they're buying properties with asbestos on it. [...] Ms. _____'s house, white people own that now. My cousin _____'s house, white people own that. So now they're listening. You know? Now they're listening.

Like this woman, all of the West Ambler residents we interviewed worried that the designation of their neighborhood as "risky" was ultimately leading towards displacement of long-term residents in order to usher in new higher-cost housing after cleanup was complete. These findings parallel those of Melissa Checker's (2005, 2007, 2016) extensive work on environmental justice movements undertaken by American communities of color, which are disproportionately affected by toxicity. Checker has observed that remediation of toxins is frequently linked to "redevelopment incentives" (2016, p. 102). Like the communities described by Checker, West Ambler residents were deeply skeptical of this motive for remediation, as their past experiences caused them to doubt that they, their families, and their neighbors would reap any benefits of redevelopment.

In other ethnographic work on toxicity in the environmental justice vein, Barbara Allen (2003) and Merrill Singer (2011) have described African-American residents in Louisiana's "Chemical Corridor" who suffer from numerous health ailments and identify local chemical

plants as a significant contributor to them. They are frustrated at the perceived unresponsiveness of government bodies to taking greater measures to lessen pollution, an indifference they attribute to their ethnicity and poverty. The West Ambler residents we interviewed had a similar history of unsatisfying interactions with political authorities. However, their distrust of the EPA and state/local authorities did not stem only from concern about the ability of these authorities to mitigate their neighborhood's exposure to toxicity. Rather, West Ambler residents viewed the focus on attenuating toxicity, and the attendant technical explanations used to justify remediation strategies, as obfuscating motivations that were actually sociopolitical in nature.

DISCUSSION & IMPLICATIONS

We set out in this study to examine community response to environmental toxicity using a theoretical orientation, derived from STS and semiotic anthropology, which discourages us from viewing differences in thought as variations in perspective about a singular underlying reality. In place of this empiricist orientation, we have emphasized that lived experience constructs multiple toxic realities. Use of this framework shifts our attention away from debates over the truth of particular pieces of data—what Brian Wynne (1996, p. 61) calls “propositional contents”—and towards an examination of what kinds of information and experience are relevant and powerful for various actors in thinking about what toxicity is and how it should be remediated.

Our research on asbestos toxicity in Ambler, a small American town grappling with the legacies of manufacturing while trying to imagine late industrial futures, has shown that even a material whose meanings appear most certain is actually a deeply fractionated object. In considering the danger asbestos poses, risk assessments derived from population-level research are one highly ambiguous type of information (Beamish, 2001) considered alongside other knowledges of health and illness. More importantly, the risk of illness is just one realm of meaning relevant to the asbestos problem; considerations of how this toxin should be dealt with are shaped by an extremely broad array of experiences related to scientific expertise, governmental authority, and ethnic and socioeconomic inequality. We used oral history interviewing as a means of accessing this breadth of experience by situating individuals' socialization to asbestos and asbestos toxicity amidst the everyday settings in which they have carried out their lives. This method has its limits: an interview offers only a very compressed account of the experiences that shape realities, and the way that these experiences are described is inevitably inflected by more recent events in the interviewee's life.

Nevertheless, our findings raise important questions about the manner in which citizens and governments interact around environmental toxicity. The EPA's contemporary stress on interfacing directly with local communities affected by toxins is part of a broader shift in the philosophy of environmental health agencies (Little, 2009) away from a paternalistic approach. This change is in large part a corrective response to well-publicized cases of citizen science, such as those occurring in Love Canal (Levine, 1982) and Woburn, Massachusetts (Brown, 1992), that have brought public attention to communities damaged by toxicity but neglected by government. The case of the Ambler BoRit site in some ways

comfortably fits the narrative of citizen science followed by more attentive government action. The activists we interviewed made collective efforts to develop scientific knowledge of the asbestos piles; they gained a degree of comfort in using the epistemic frameworks and technical discourse of science to articulate their concerns to authorities; and in doing so, they successfully appealed to the EPA to gain federal recognition of BoRit and initiate efforts to remediate it.

However, our research cautions against an uncritical celebration of the greater responsiveness to citizen science professed by the EPA and other government agencies. Opening up official scientific practice to citizens is a productive shift away from the kind of insular technocratic governance described so forcefully by Beck (1992), in which political decisions rely solely on the opinions of credentialed experts. But our findings stress the limited nature of this kind of citizen participation. For one, citizen science is a privileged mode of behavior (Auyero & Swistun, 2009; Lash, 1994); as evident in this study, those without the exposure to scientific norms provided by formal education and white-collar employment are typically not predisposed to relate to authorities in this manner. Even more vital is the fact that framing an issue as predominantly technical can elide its sociocultural, political, and economic aspects, a phenomenon described recently in the context of environmental toxicity by Little (2014, 2016) and Checker (2016) as well as in the earlier work of Wynne (1996). The danger in conceiving of community engagement primarily as citizen science is that this focus does not acknowledge the diversity of community members' lived experiences or of the post-remediation futures they imagine. A prominent theme across our interviews was the opinion that the full range of the Ambler community's concerns was not being considered due to the EPA's narrow definition of the types of information that provide valid bases for policymaking. One resident's quote about the EPA's process for determining a remediation strategy for BoRit is highly characteristic: "The EPA is going to do what the EPA is going to do. [...] They remediate it to the tests that show that what they're doing is correct, and then they're going to present to you why they're not going to do anything else. That's how it goes."

The citizen science model of community engagement relies on an additive model of knowledge (Stirling, 2009) that assumes the information gathered by citizens and that by authorities articulates, like pieces of a puzzle coming together to create a greater whole. The theme is one of experts and laypeople working together to do better environmental health science. Ethnographic work has played an essential role in parsing the historical development of this mode of interaction as laypeople have struggled to gain legitimacy as actors capable of contributing important data to efforts to identify and mitigate toxicity. It continues to demonstrate citizen science's messy reality: the lurking uncertainty and fear of residents who suspect their communities are being affected by toxicity, the delicate contingency of efforts to organize community activism, and the continuing strength of technocratic authority in determining the facts of health and illness.

Yet if the goal of ethnographic work on environmental toxicity is to "give voice" (Brown, 2003, p. 1789) to communities, its capabilities extend beyond the unpacking of citizen science. It reveals realities that are incommensurate with scientific facticity, relativizing citizen science as one limited way of incorporating laypeople into environmental health

governance. In turn, ethnography can inspire the formulation of alternative approaches for community engagement that incorporate a fuller range of lived experiences and imagined futures. To effectively do so, these approaches must be based on the understanding that educating citizens so that they can more easily understand and involve themselves in the official production of scientific knowledge, while valuable, is nevertheless prescriptive: it validates certain realities of toxicity while potentially invalidating others. The confusion, resignation, and dissatisfaction that residents often experience and express in response to communications from environmental health authorities about a local source of toxicity are indications that certain important aspects of their realities are being dismissed or not acknowledged. The tendency among some analysts to portray these reactions as biases that obscure access to a singular scientific truth places them in a position of inferiority when they are actually the result of a unique history of semiotic encounters involving a tremendous diversity of concerns (sociocultural, economic, political). As this diversity becomes increasingly apparent, so does the urgency of providing forums for citizen-government engagement that allow for transparent discussion of the wide array of considerations (technical and non-technical) that inevitably influence and follow from environmental health decisions.

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RESEARCH HIGHLIGHTS

- Shifts research on community responses to toxicity away from empiricism.
- Examines diverse experiences of asbestos toxicity in a small American town.
- Finds that a singular, well-known toxin is actually an object with many realities.
- Reveals the limits of the citizen science approach to community engagement.
- Stresses ability of social science to inspire new modes of community engagement.

Table 1

Profile of interviewee sample showing age at the time of interview, period(s) of residency in the Ambler area, gender, ethnicity, and role in relation to the local asbestos issue.

Gender	Ethnicity	Age	Period(s) of Ambler Residency	Role
Male	White	60	1974–1975	Activist / resident
Male	White	70	1943–	Activist / resident
Female	White	50	1999–	Activist / resident
Male	White	58	2008–	Activist / resident
Female	White	59	1952–	Government / resident
Male	White	51	2002–	Government / resident
Male	White	54	n/a	Business
Male	White	71	1942–1960	Business / resident
Female	White	60	1955–1985; 2011–	Resident
Female	White	63	1975–	Resident
Male	Black	62	1951–1971, 1979–1990	Resident
Female	White	68	1998–	Resident
Male	White	59	1994–	Resident
Female	White	59	1997–	Resident
Female	White	55	1987–	Resident
Male	White	81	1932–1960	Resident
Female	Black	63	1951–	Resident
Female	Black	60	1953–1971, 1973, 1990–2	Resident
Female	Black	57	1956–1972, 1982–2008	Resident
Female	Black	64	1949–2008	Resident
Female	White	u/k	n/a	EPA employee
Male	Hispanic	u/k	n/a	EPA employee
Male	White	u/k	n/a	EPA employee