IDENTIFICATION, UNDERSTANDING, AND RESPONSE: EXPLORING THE EXPOSURE EXPERIENCE

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ABSTRACT OF DISSERTATION

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Abstract

The modern world is so thoroughly chemicalized that chemical contamination is the expected state of being, yet only some people discover their exposure. This dissertation is about the exposure experience; the process by which people come to discover, understand, and respond to their chemical exposure. Chemical exposure takes place at the intersections of science and technology, health and medicine, economic production, governmental regulation, and everyday life. This means that exposed peoples must take multilevel action at these intersections to develop meaningful responses to their contamination. This dissertation explores the case of one Appalachian community’s struggle with Perfluorooctanoic Acid in order to highlight these multilevel actions and contribute to the exposure experience concept. It finds that the exposure experience is an information driven process which forms a cycle of understanding development and response such that each new action or information source can bring new meaning and new response actions. Based on this finding it is argued that research into cases of human chemical contamination need a longitudinal component in order to better capture the complexity and ongoing nature of the exposure experience.
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Chapter 1: Introduction to the Exposure Experience

Introduction

The modern world has produced a chemicalized regime of living (Murphy 2004). This means that chemical exposure is the expected state for everyone due to our thoroughly chemicalized system of production of and consumption. This is problematic because chemical contamination can lead to numerous health problems and disrupt normal patterns of life. However only some people discover that they have become exposed and can then have the opportunity to become aware of and respond to this exposure. This process, called the exposure experience, is not nearly as prevalent as chemical exposure because contamination is hidden at molecular, tissue, organ, and societal levels. Sometimes it is hidden by the regulatory and scientific apparatuses which we would expect to make visible this exposure. Those who discover their exposure find themselves at the intersections of science and technology, health and medicine, economic production, governmental regulation, and daily life, and they must undertake multilevel action at these intersections in order to create meaning and respond. These actions are constrained by power relations, existing knowledge, individual capacity and physical factors such as the specificities of the chemicals in question.

In these pages I will introduce readers to individuals who were contaminated with an “emerging contaminant,” a chemical for which health information is incomplete and still being developed. By examining people’s stories, I will further develop the concept of “exposure experience.” Specifically, this study makes three contributions to the exposure experience: 1) defining the exposure experience as a three-part process of identification, understanding, and
response; 2) identifying the role of informational portals and barriers which enable people to construct their exposure experiences; and 3) promoting the importance of situational context through which people interpret their exposure experience. This includes cultural beliefs, economic relationships, and environmental factors.

The development of the exposure experience concept is necessary due to two factors: 1) the combination of ubiquitous chemical exposure in the environment and 2) the increased ability to test, monitor, and report back to individuals and communities the data on their chemical exposure. This is done often in the absence of information about the meaning and possible harms of this exposure. Breaking down the exposure experience into its component processes allows for examination of the key actions and factors which give rise to the identification of a chemical exposure as a social fact, the gathering of information and construction of understanding about this exposure, and the development of exposure response.

This chapter will proceed with an introduction to my central case study, followed by a discussion of the key concepts of chemical exposure, biomonitoring report back, and the exposure experience. I will also draw on other related literature from medical sociology, social movements, and disaster studies where appropriate. The chapter will end with a description of the remaining chapters.

The Question

How do you know if you have been exposed to a toxic chemical? Were you to develop a stomach ache, a strange numbness in your arms, or even a type of cancer, would you
immediately jump to the conclusion that you were subject to chemical contamination that was causing your symptoms? Perhaps if you knew you were exposed to a specific chemical you may make a connection, but what if you didn’t even know that you had been exposed? These questions highlight the uncertainty which is replete throughout the exposure experience; the process by which people come to discover, understand, and respond to a chemical exposure.

By exploring how residents of the Mid-Ohio Valley approached these question of exposure we can gain insight into how they constructed their understanding of their exposure and developed meaningful responses. Specifically, community members were faced with widespread contamination of perfluorooctanoic acid (PFOA), widely known as “C8,” caused by the DuPont corporation. It is a complex story which starts with the production Teflon in the 1940s and continues to this day. Roughly thirty years after it began making Teflon DuPont learned that C8, a chemical important to Teflon production, was possibly harmful to workers and surrounding communities. Instead of bringing this information to light, DuPont instead chose to cover up the contamination until it was exposed in the early 2000s. This dissertation examines the process by which community residents came to uncover this hidden danger, gathered information about its meaning, and responded to their exposure. It speaks to how people, who live in chemicalized environments, come to construct meaning as they balance economic, environmental, and health concerns. It also examines how exposed people in communities dominated by large industrial employers interact with numerous parties in constructing their exposure experience, industry, regulators, the legal system, and other parts of the social structure. The residents of the Mid-Ohio Valley whose stories are contained here often stressed their communities’ need for DuPont and
the chemical industry. Ten years after they learned of their exposure, their strongest concern was how it could threaten DuPont as the economic base of the community.

Yet in the face of these structural concerns, Mid-Ohio Valley residents still took action to address their exposure. Their actions were most often not openly expressive. In particular, there were no anti-industry protests which are often associated with other cases of exposure. Instead, residents worked through and around intransigent regulatory bureaucracies (Lyons 2007), formed partnerships with academic researchers to launch a community biomonitoring experiment, utilized the legal system to challenge and win settlements from DuPont which allowed them to launch a second, larger biomonitoring study. In the communities it served, the Little Hocking Water Association, negotiated with DuPont on behalf of members regarding the water clean-up. This strategy culminated in DuPont paying for the construction of a new water filtration system. In these multiple ways, community residents were able to construct a clean water system, push forward C8 research, hold a corporate polluter responsible for its actions, and gain access to funds to compensate the medical care of those harmed by C8. These results were achieved without damaging the community’s economic relationship with DuPont, which was considered necessary for the community’s economic health.

**Chemical Exposure**

Chemical exposure is a certainty in the modern world. Contaminants are present in the foods we eat, the products we use, the air we breathe, the water we drink, and the ground and soil we walk on and grow our food in. Through all of these sources we inadvertently take chemicals into our bodies. They are the result of the highly chemicalized modern economy in which 70,000
different chemicals are in regular use, with over one billion pounds of pesticides, herbicides and fungicides used every day in the United States alone (Edlestein 2004, pg.3). This thorougly contaminated world produces what Michelle Murphy (2008) calls “chemicalized regimes of living (2008, pg 697).” She argues that today humans are “chemically transformed beings” because “molecular relations extend outside of the organic realm and create interconnections with landscapes, production and consumption requiring us to tie the history of technoscience with political economy” (2008, pg 697). This means that chemical exposure is the new normative state. The continued expansion of human economic activity has polluted our ecosystem so thoroughly that all living things are now being exposed to substances, both natural and anthropogenic, to which they otherwise would not have been exposed. According to the Center for Disease Control’s National Exposure Report 246 contaminants were detected in the serum of study participants, a representative national sample (CDC 2009, 2014). This number can be expected to grow as testing methods improve and hundreds of new chemicals every year are added to the soup (Edelstein 2004, p.3). Even polar bears in the arctic carry a ‘body burden’ of chemical compounds such as PCBs, which are the result of human activity at a far distance (Norstrom et al. 1988; Polischuk et al. 2002).

Exposure comes in many forms. Public attention is most often drawn to either large scale cases of “contaminated communities,” a term coined by Michael Edlestein (2004) to denote chronic toxic exposures of residential areas such as the famous case of Love Canal, NY, or to industrial disasters such as the horrific event at the Union Carbide Plant in Bhopal India, which killed thousands of people. However, exposure is also something everyone deals with in daily life. Just walking down the street in an area with heavy auto traffic will present one with toxic
carbon monoxide, nitrogen and sulfur oxides, ozone and diesel particulate matter, each of which can contribute to breathing disorders. Personal care products such as skin creams may contain toxic formaldehyde (Flyvholm 2005; Flyvholm and Anderson 1993), and antiperspirants can contain high levels aluminum salts which may contribute to breast cancer (Harvey and Darbre 2004; McGrath 2003). The food we eat is often packaged in plastic wraps which leech C8 (Trudel et al. 2008) and plastic containers which can leech bisphenol A (BPA) and other compounds (Biello 2008; Vandenberg et al. 2007). Non-organically grown produce may be grown in fumigated soils, treated with synthetic fertilizers and sprayed with a panoply of pesticides (Saxton 2015), and even organic food can have those contaminants due to pesticide drift.

Not only is chemical contamination widespread, it has been for a long time. Rachel Carson’s 1962 classic Silent Spring marked an awakening for science and the public about the connection between chemicals such as the pesticide DDT and environmental damage. Carson’s work can be thought of as the tip of the iceberg as polluted communities, chemical spills, cancer clusters, and exposure studies have discovered the hidden mountain of contamination lurking below the surface of everyday life. As this toxic iceberg became more apparent, our ability to understand the meaning of this contamination slowly began to develop. Previous to the awakening of modern environmental thought in the 1960’s and 1970’s (Shabecoff 1993) cases of chemical contamination were seen as atypical events; tied to specific places, industries, or substances in extreme concentrations. The adage of ‘the dose makes the poison’ is understandable in a common sense schemata when dealing with many of the early industrial contamination cases, such as cryolite (fluoride) poisoning in aluminum workers (Roholm 1937),
analine dye contamination in late 1800 Britain (Edelstein 2004), and black lung disease in coal miners (Smith 1981). However, due to advances in low dose toxicity, endocrine disruption, and chronic exposure, the scope of the problem of environmental contamination and body burden is starkly coming into focus. Not only are we discovering more chemicals which are problematic we are also discovering more pathways in which these chemicals are released. Even in trace amounts they can have harmful health and genetic outcomes (Morello-Frosch et al 2014; Rappaport 2011, Wild 2011). As Travis and Hester (1991, p. 815) argue:

> Until recently, trace levels of environmental contamination were thought to be relatively benign. However, a consensus is emerging that even trace levels of environmental contamination can have potentially devastating environmental consequences…We maintain that ambient levels of pollution have risen to the point where human health is being affected on a global scale.

Physician Theron G. Randolph, in his work *Human Ecology and Susceptibility to the Chemical Environment*, argues:

> The greatest single change in man’s surroundings during the past century has been the ever-increasing chemicalization of his environment. Although this process started off with coal-burning home-heating units, kerosene lamps, and fuel-oil-and gas-burning household utilities, it remained for the modern petrochemical revolution to stamp the imprint of the chemical environment on the present generation. In addition to automotive products, the chemical environment also includes the widespread use of solvents, synthetic drugs, dyes, plastics, and fabrics, as well as detergents, pesticides, and other
materials. Unparalleled chemical contamination of air, food, and water has resulted (Randolph 1966, p. 132)

This “unparalleled chemical contamination” for Randolph is anthropogenic. At other periods in the Earth’s history, the environment was so toxic it was not fit for life. The difference is that now human beings have developed the ability, through scientific and industrial means, to create ‘better (and worse) living through science.’ Humankind’s productive ability continually surpasses perceived limits, yet modern production is a dialectic model of creative destruction, bequeathing both wondrous products and pernicious pollution. Schnaiberg (1980), trying to explain the rapid deterioration of the United States environment after WWII, identified this dialectic as the “treadmill of production”; an ever intensifying process in which capital replaced labor in the productive process with technological and chemicalized solutions. It is this socioeconomic process that gives rise to the chemicalized environment and its health effects that Rudolph, as an allergist, was concerned about.

In summary, the chemicalized environment is a result of the modern capitalist mode of production. It is a physical/social/political/economic process that has developed such momentum that it would take a tremendous amount of social friction to stop, slow, or change the direction of said chemicalization. Also, much of what is already in the environment would remain. Some of the chemical substances produced, such as polyfluorinated carbon compounds (PFCs) and nuclear waste, have half-lives of thousands of years, meaning they will be active factors in the environment much longer than those who benefited from their creation. The exposure experiences developing from this ubiquitous contamination, some visible, some
invisible, will unfold as a result of the specific context of exposure and that exposure’s discovery. We should not only expect more classic cases of contaminated communities like the one seen in the Mid-Ohio Valley but also more cases of individual and dispersed population level exposure.

**Experiencing Exposure**

Our chemicalized environment creates both a certainty of chemical exposure and vast uncertainties over the meanings of these exposures. Many of us will exist in this ‘chemical soup’, embodying substances at such low levels that they may have no discernable effect, though in the absence of sufficient longitudinal data we do not yet know enough about such effects. Others, perhaps due to high levels of certain chemicals, genetic related weaknesses to a chemical or family of chemicals, or chemical interaction inside their bodies, will experience an effect that may be a biomarker of exposure or an actual health effect. If effects are perceived, one must then make a connection between symptoms and exposure. As an example, breast cancer, a disease with mounting evidence of environmental causation (Brown et al. 2006; Brody et al. 2007; Wolff et al. 1996), produces not only the disease, but in concurrence, personal emotional, social/interpersonal, economic, and political meanings for the individual and society (Klawiter 2004; McCormick 2009; McCormick et al. 2003; Zavestoski et al.2004). While one can expect similar physical, personal, social, economic, and political issues to emerge when dealing with cases of chemical contamination, how they do so in practice -- the “exposure experience” -- (Altman et al. 2008; Adams et al. 2011; Judge et al. In Press) is still an emerging concept. It is goal of this dissertation to explore and deepen the understanding of this concept so that it may be
employed in a more widespread manner to meet the emerging crisis of our chemicalized environment.

**Biomonitoring as a Portal to View Exposure**

“There are things known and there are things unknown, and in between are the doors of perception.” — Aldous Huxley. *The Doors of Perception.*

The contamination of the physical world must be perceived as first a reality, and second as a social problem. But identifying contamination as an uneven process, which very much depends on the nature of the specific chemicals to which people and the environment are being exposed. Many of the ‘pre-environmental movement’ cases of contamination such as the aniline dye crisis in England in the late 1800’s (Edelstein 2004, p. 2) and the Great Smog of London were characterized by easily visible changes in the physical environment. Similarly, major cases of community contamination in the more recent past, such as Woburn (Brown and Micklese 1997), Love Canal (Levine 1980), and the Akwesasne reservation in the St. Lawrence Watershed (Laduke 1999) were discovered only when high rates of acute physical symptoms were linked by residents to chemicals in the environment. In each of these cases residents fought with unresponsive regulators, partnered with experts, and eventually took legal action in order to forge the legitimacy of their exposure. Making chemical contamination *understandable* and *actionable* for the general public, regulators, and the legal system is a difficult process. Chemical contamination is often not discoverable without access to detection technology and expert knowledge to interpret this information.
While the barriers to exposure discovery remain, the ability to discover chemical contamination is growing. The change is coming simultaneously from experts and community members. Advances in biomonitoring technology and practice, and the testing of people for embodied chemical exposure, allows for more in-depth view of chemical contamination of an expanding variety of chemicals (Morello-Frosch et al. 2009). These developments are accompanied by an increased willingness of biomonitoring researchers to partner with community groups to test for chemicals and report back their findings to the community. Taken together, the practice of community-based participatory biomonitoring report back creates an important new mechanism to view chemical contamination, an ‘information portal,’ which raises new questions about the meaning of chemical contamination. This section will proceed with a short history of biomonitoring research. It will then delve into the question of the meaning of biomonitoring research and the development of the “exposure experience.”

Biomonitoring begins its history in the occupational studies of worker exposure in industries such as cryolite (Morrello-Frosch1997), Evang 1938) and in government mandated health studies of both workers, for example, coal miners (Rosner and Markowitz 1987), and of citizens, for example, blood lead monitoring (Rosner and Markowitz 1987; 2012). These early studies yielded important information that was leveraged by communities, social movement organizations, and politicians in pushing for environmental and workplace regulations (Jackson et al. 2002). Government biomonitoring studies continue today. The National Health and Nutrition Examination Study (NHANES), for example, combines biomonitoring for chemicals with epidemiology, medical, and nutritional science, examining 5000 U.S. citizens a year to give a representative picture of health and exposure in the United States (CDC 2009). The Centers
for Disease Control (CDC), using data collected from NHANES has released four *National Reports on Human Exposure to Environmental Chemicals* and, as of March 2013 has released data on 246 chemicals.¹

Such a large-scale government study is just one variety of biomonitoring study. As biomonitoring capacity has expanded, greater varieties of audiences, including community groups, academics, and even the legal system, have undertaken biomonitoring programs for purposes of advocacy, political pressure, and assessment of legal liability. For example, the “Is It In Us Study” was undertaken by a coalition of environmental organizations spearheaded by Commonweal Biomonitoring Resource Center and the Coming Clean Body Burden Work Group (Coming Clean 2007). “Is It In Us” studied thirty-five Americans from seven different states for three separate types of chemicals: BPA, phthalates, and polybrominated diphenyl ethers (PBDEs), a common type of flame retardant.² Every participant was found to have at least seven of the twenty chemicals tested for in their body. One participant carried seventeen of the twenty possible chemicals. These results, with permission of the participants, were then posted online along with a picture and short biography of each participant with the goal of raising awareness of the pervasiveness of environmental contamination among the U.S. population.

The combination of expanded testing capabilities with an ever expanding rainbow of understudied chemicals in use creates an interesting atmosphere where capacity has outpaced report-back procedures, ethical guidelines for report back, and the ability to interpret the

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¹ The CDC maintains updated reports on its website [http://www.cdc.gov/exposurereport/index.html](http://www.cdc.gov/exposurereport/index.html).

meaning of exposure reported back (Altman et al. 2008; Brody et al. 2007; NRC 2006). For example, a 1999 EPA study of 3000 high production volume chemicals utilized in the U.S. found that only 7% had complete toxicity profiles (USEPA 1999). In a 2006 report the National Research Council of the National Academies cited a present need to understand how people respond to exposure information in light of this data gap (NRC 2006). This marked a moment in which the progression of multiple social factors including technological, informational and ethical changes. For biomonitoring researchers, it was part of the progression of technology and ongoing discourse with IRBs about the ethical issues of report back. Some scientists believe that exposure information should not be reported back at the individual level, especially in the absence of established health guidelines, such as those developed for mercury and lead. Their concerns, which are sometimes shared by IRB members, are that doing so is incomplete science and that it may cause undue concern or hysteria (Brown et al. 2010; Morello-Frosch et al. 2009). Other more progressive practitioners assert that researchers have an obligation to report back their findings, even in the absence of developed health guidelines (Brody et al. 2007). It also marked increased acknowledgement of a chemicalized environment and our comparative inability to provide cause and effect understanding of what chemical exposure means. Taken together, there is a need to develop deeper understanding of how people understand and respond to exposure information.

The Dualistic Role of Science

For Michelle Murphy (2006, 2008) science plays a dualistic role in the chemicalized world. It can be utilized to make invisible contamination, such as that of C8, visible and thus
actionable. In this way the biomonitoring studies in the Mid-Ohio Valley proved contamination and allowed for response actions. At the same time, science plays a part in obscuring chemical externalization and contamination, producing zones of imperceptibility. What this means is that the way in which scientific practice is undertaken and used produces an inability to see chemical contamination. For example, in her landmark study of the EPA (2004, 2006), Murphy argues that the very instrumentation and measures used to detect chemical exposure in the were unable to detect chronic exposure because they were imbued with understandings of high concentrations of certain single chemicals being the problem rather than constant, low doses of a mixture of chemicals. More insidious, are findings that science at the EPA was politicized towards the benefit of industry and that scientist who spoke out could have their careers threatened.

Murphy promotes the idea that science is not value neutral, not a “view from nowhere” (2004 pg. 274). Rather science is socially and politically constructed. Studies which show exposure can be questioned via industry-based counter studies. Lay-produced studies are seen as illegitimate because they are not produced by experts or as seen as coming from biased sources. Without proper translation even scientific studies themselves can be difficult make assessible for community members who may not have the technical knowledge to understand the findings or the specialized knowledge of where that study fits within a field of research.

In the C8 case science played the role of both portal and barrier. Biomonitoring studies proved contamination and opened the door for further legal response which could lead to compensation. However, DuPont also used scientific practices to obscure chemical exposure by attempting to set safe levels for community exposure. Further, DuPont’s close relationship with
state regulators, discussed in chapter four, helped to produce a form of regulation that was unable to recognize C8 as a contaminant even though DuPont knew that it was dangerous and that surrounding communities were greatly exposed.

**Exposure Experience Research**

To conceptualize how people deal with embodied exposure and the mediating role of science in shaping these realities, Altman et al. (2008) proposed the “exposure experience”, defined as “the embodied, personal experience and understanding of chronic exposure to environmental pollutants” (Adams et al. 2011). Exposure experience is an adaptation of “illness experience,” a concept developed by medical sociologists to explain the multifaceted, often ambiguous aspects relating to understanding and living with disease; challenging diagnostic definitions and working to change treatment approaches; and the effect of social structure (Bell 2008; Lawton 2003). Illness and exposure experiences include the public’s understanding of science, as people assign meaning to their daily experiences from a wide array of sources including personal history, interaction with experts, and the media (Hilgartner and Bosk 1988; Irwin and Wynne 1996). Through studies of lived and embodied exposure experiences, researchers have found that biomonitoring and household exposure results are interpreted within the contexts that shape participants’ everyday lives, including personal background and the places where one lives, works, and plays (Adams et al. 2011; Altman et al. 2008).
Place: Shared Eco-Social History

Place matters in the understanding of biomonitoring results and the overall exposure experience, in that people in close geographic proximity often assert shared meanings linked to a common area, which influence their understandings. For example, Adams et al. (2011) found that low-income residents bordering an industrial facility were unsurprised at high levels of contaminants from the facility, but were surprised to learn about contaminants from consumer products. Residents of a more rural area who assumed their environments were more pristine and had tried to shop for healthy products were even more surprised to learn about hormone disruptors in their household air and dust. Similarly, Altman et al. (2008) found participants in a household exposure report-back study interpreted their individual results through a “shared history of living in a region viewed as a contaminated place,” and had to rethink conceptions of pollution as they learned about contaminants in their homes coming from consumer products rather than a nearby military base.

Eco-social experiences are informed by prior experience with chemical exposures but even these can produce multiple narratives. Auyero and Swistun (2007, 2009) argue there may be multiple shared, even contradictory understandings of local exposure vectors, sometimes resulting in denial of some causes of exposure. This multiplicity of meanings is understandable in light of several factors: 1) Eco-social experiences must be enacted, shared, and transmitted. 2) Different stakeholders, such as industry, government agency, or community groups, construct narratives that promote alternative frames of exposure issues. 3) The exposure experience involves complex, often incomplete scientific and medical information that creates the necessity
to draw on alternative sources of meaning to create interpretations that allow people to deal with and respond to contamination. 4) People’s interpretation is affected by their individual background, including education, economic relationships, and even stage of life, such as older people being more concerned for future generations than for themselves, having ‘lived their lives’.

Auyero and Swistun (2007, 2009) provide valuable insight as to why patterns of resistance to contamination do not emerge; a point that is not strongly dealt with by contaminated communities or environmental justice literature. They argue that polluted realities, meaning experiences of daily life in which pollution becomes part of ones’ expectations, are “socially and politically produced; the meanings of contamination are the outcome of power relations between residents and outside actors” (Auyero and Swistun 2009, pg 5). This polluted reality is supported by local social relations, infrastructure, and the state. The inability for local doctors to explain and treat un-diagnosable illnesses, the failure of regulation by regulatory authorities, and other experiences of daily life help construct and maintain these polluted realities and add to the confusion of living in such an eco-social experience. For Auyero and Swistun this uncertainty discourages the formation of “shared oppositional consciousness” (2009, pg 4) and leaves residents in a state of waiting for more information and action. As we will see, Mid-Ohio Valley residents can be thought of as in a similar state of waiting. They are waiting for new scientific information about the effects of C8 exposure. Other residents are waiting for the results of their lawsuits for medical monitoring. This quality of waiting contributes the ongoing nature of their exposure experience.
While the work of Auyero and Swistun is useful, their analysis is not completely suited to dealing with the case of the Mid-Ohio Valley. The problem is that the case they analyze is quite different than the case of the Mid-Ohio Valley. In the Mid-Ohio Valley, as we will see, there were patterns of response to discovery of a chemical exposure. This is different from the case of the Argentinian community Auyero and Swistun write about where there was little response to chronic exposures that had become part of everyday life. Furthermore, the capacity of the state and the contaminated communities in the Mid-Ohio Valley are much greater than in Flammable Argentina.

**Citizen Science and Activism**

Illness experience literature has transcended the purely medical arena into social change and politics, as scholars have shown how affected peoples come together to push for medical recognition, different treatments, and expanded resources (Brown and Zavestoski 2004, Brown et al. 2004; Hoffman 2003). Zavestoski et al. (2004), for example, studied the process by which Gulf War veterans met with medical uncertainty and institutional intransigence but were ultimately successful in pushing for the definition of Gulf War Illness as a recognized disease. Brown (2007) expanded on this work, looking at how affected communities of breast cancer patients, asthma sufferers, Gulf War veterans, and their supporters worked in challenging the dominant medical views of their diseases using citizen science and organizing as health social movements to raise awareness and pressure for changes in medical definitions. What this literature shows us is that in the face of scientific uncertainty, lay people can themselves produce not only important scientific information but can also leverage this information to create social
movements that challenge existing definitions and push for resources. This process can be an empowering process emotionally, intellectually, and practically through the development of new networks, knowledge, and skills. It also shows that one way that people deal with uncertainty about the effects of environmental contamination is to organize around the meaning of that contamination.

**Community Impact and Response**

Research on the community impact of chemical exposure highlights how contamination can disrupt normal patterns of life, affect views of community identity and place, cause fear and anxiety, and prompt collective responses. That research also shows how social structures through such factors as institutional racism can construct patterns of exposure which differentially affect social groups. (Altman et al. 2008; Bullard 1990; Couch and Kroll-Smith 1991; Edelstein 2004; Erikson 1976). Michael Edelstein’s landmark book *Contaminated Communities* is particularly influential for understanding the exposure experience. Writing in 1984, Edelstein viewed the contaminated environment through the lens of “contaminated communities” such as Donora Pennsylvania, Love Canal New York, Woburn Massachusetts, and hundreds of other less famous but similarly horrifying stories. Edelstein, bonding systems theory with Goffmanian symbolic interactionism, constructed a social process model of contamination. Edelstien argues that exposure causes “environmental turbulence” in the lives of community members which disrupts both patterns of daily life “taskscapes” and cognitive outlook “lifescape” (p.27) for community members and creates stresses for the society as individuals, families, organizations and institutions interact and respond.
To explain and map how the turbulence is experienced Edelstein employs a basic model of disaster process to examine chemical exposures with three stages. The process begins with the pre-disaster stage which includes the origination and the incubation of contamination. In this stage, technological based production creates negative externalities which “incubate” until they are discovered as a social problem.³ Once a problem is “discovered” the second, or disaster “stage,” is that in which the contaminated community learns of their exposure and must deal with the fears and stress this ‘sudden’ disaster produces. In this part of the process contaminated communities become subject to the experts and agencies which research, inform, and respond to exposure, and where affected residents experience the comparative lack of expertise, authority, and resources. These bodies assert meanings in relation to the exposure, including drawing social boundaries marking whom is exposed and to what which for Edelstein creates stigma. Further, the experts and institutions assert possible meanings about the exposure which must be interpreted by the members of the community as they develop collective action in response to the exposure. This interaction between the exposed, the experts, the regulators, and the polluter leads to the third stage of mitigation and lasting impacts as people establish a new “post disaster equilibrium.”

³ Not all pollution will rise to the level of disaster. Danger must be perceived and in cases where we are not looking, their undetectable amounts, there are no detection methods, there is no willingness to test, we will not perceive these externalities as a possible threat. Secondly, chemical contamination often occurs at levels which are unlikely to cause harm and further, it is much harder to tie harm to chemical contamination unless there is some outside information or frame which prompts this interpretation or the contamination has reached a level in which there are perceptible symptoms. Even if contamination has caused perceptible symptoms people may attribute that to contamination, may deny that it is related to contamination, or may lack the necessary information skills and resources to investigate the relationship. Finally, these are complex questions that exist in an arena of multiple chemical exposures, of genetic issues, and of lifestyle issues such that we will never know the full extent of the effects of chemical contamination.
The disaster stage model employed by Edelstein can be adapted with some modification to all cases of exposure, be it legacy exposure, workplace exposure, or exposure in the form of chemicals from consumer goods. What Edelstein calls the disaster stage, when separated out as discovery, acceptance, and community action, works as a model for the exposure experience process.

Individuals who are not living in a contaminated community can still discover exposure just as they can gather information about it and respond to it as individuals. For example, one can read about a chemical that may be in a personal care product and then research it through fairly accessible online databases. One such database is that hosted by the group Coming Clean, which catalogues many harmful chemicals in products and provides health risk information. Once a person has researched the chemical, assuming there is some information provided, they can then ponder whether their concerns are valid based on personal views, and make a decision about how to respond to this exposure. That meets the definition of an exposure experience, and while it is not one of the classic cases which we would recognize as such, the increasing contamination of the modern world, combined with the increasing testing capability means that we will likely have more cases of contamination in various forms, and thus need a model that can account for the variety.

To create such a model, I have made several modifications to Edelstein’s model. First, I consider that exposure discovery is a multistage process unto itself, which begins with suspicion, the “exposure impetus” and ends with proof of exposure. Discovery in my model is a distinct process which is part of a larger process of developing information and understanding about
exposure which begins at the same time as discovery and does not end, even when response activities are underway, as responses create new understandings about one’s exposure and its legacy. Whereas Edelstein’s next stage after discovery is “acceptance,” I substitute the understanding process. Acceptance is a problematic term. While Edelstein does not mean that people blindly accept their exposure as passive subjects, he does assert that they become dependent on experts and institutions which deal with exposure. This does not fully capture the agency that exposed parties have in constructing meaning of their exposure and it is here I draw heavily from the illness experience material discussed above. The victims of illness and exposure are not silent pawns, rather they actively seek out information and develop understanding of their exposure which they can continually update as new information is accessed. It is based on this constructed understanding that individuals can then choose what they think is a proper response based on the situation. They may choose to not actively seek out more information or they may choose to become a lay expert. Further, as they interact with other community members, they are asserting norms of action which others can respond to either in kind of differently. It is through these interactions that collective actions are formed.

The exposure experience model that I present is different from historical treatments of chronic community contamination, workplace exposures, and acute chemical disasters in that it flips the focus from chemicals being ‘out there,’ or separate from the exposed population, to the embodiment of chemical exposure. This is much like illness experience literature which flipped the study of illness from the medical understanding to the patient experience. By studying the exposure experiences of individuals and groups we can greatly expand our understanding of several important phenomena: how individuals come to understand and utilize exposure
information, the effect of local context and larger social structures on the exposure experience, how researchers can develop better report back strategies, and how collaborators can develop better guidelines for community researcher partnerships.

**Importance of Process Stages**

In order to highlight and contextualize each of the stages which make up the exposure experience, it is useful to look at a recent example of communities exposed to chemical contamination. I use the example of the Freedom Industries exposure of the Charleston, WV area with the coal processing chemical Methylcyclohexanemethanol (MCHM) from storage tanks leakage into the Elk River. On January 9th, 2014 residents of Charleston began complaining to the Department of Environmental Protection about a licorice smell coming from the tap water, this is the moment of lay discovery. Lay discovery is when non-experts develop evidence of exposure, disease etiology, or some other information about a social problem (Brown 1995). It occurs as a product of an interruption of the normal patterns of daily life which cause non-experts to question basic assumptions; in this case the smell caused people to question if the water coming out of their taps was safe. Lay discovery is often ignored or otherwise devalued as non-scientific by authorities, however it can be a powerful organizing tool and can prompt expert verification of information or even lay/expert partnerships. (Brown 1995, 1997).

In the case of the Freedom Industries spill, lay discovery led people to attempt to verify their suspicions by contacting designated authorities, namely the West Virginia Department of Environment Protection (WVEPA) (Kroh 2014). The WVEPA responded by testing the water
and tracking the leak to Freedom Industries. Overall, 300,000 people were affected, losing access to their water for days, with over 160 people seeking medical attention.

This however is not the end of the exposure experience. Those exposed are left in a situation which we will come to understand as not so different from those exposed to C8. They cannot be certain about possible health effects from their exposure. The resulting discourse in the wake of the Freedom Industries case shows a systemic lack of regulatory supervision in WV, such that the tank from which MCHM leaked had not been inspected since 1991. This structural issue was both constitutive of the exposure and, as seen in the press coverage, part of the meaning of the exposure experience. To truly know how exposed individuals interpret it, one would need to conduct an ethnographic study of the episode, something that is not part of regulatory agency practice. The study should take place over a protracted period of time to assess how interpretations have changed as information about the long term effects of exposure has been developed and the efficacy of the response can be assessed.

This legacy of ineffectual regulation as seen in the Freedom Industries case is what Adams et al. (2011) refer to as community context. They define community context as something that “involves the community’s history with local industry, the nature of environmental problems in the community, and the role of local advocacy organizations and report back process.” Community context then is an acknowledgement that each specific space-time, each social interaction, each episode of contamination is the subject of numerous forces. The goal of the researcher is then to identify the key factors that have the strongest influence on the exposure experience.
Exposure Discovery: Crossing the Liminal Barrier

In a Durkheimian sense, the essential social fact from which this study begins is the intersection of physical and social reality where a person becomes aware that they have been exposed to a chemical contaminant. This fact of exposure prompts a new definition of the situation, an “exposure experience” where parts of a person’s life, outlook, and social activities are influenced by one’s contamination. The first step in the process is the crossing of a liminal barrier where a person consciously entertains the possibility that they have been exposed to a chemical. Depending on the person’s experiences and their contextual situation (including employment, community situation, family situation) this possibility may be summarily dismissed. Others will entertain the possibility, leading to information gathering activities. For exposure to cross the liminal barrier into consciousness there must be something that prompts the question of possible exposure as exposure is an abnormality -- an occurrence that while ubiquitous is still experienced as outside of usual daily life. I call this information which prompts the question of whether one is exposed or not the “exposure impetus”. The exposure impetus leads to questions which prompt information gathering regarding the possibility of exposure and can lead to exposure discovery. Discovery is the development of exposure as a social fact, a reality which a person or community must then learn about, in order to understand, and respond to.

Discovery of exposure can be self-identified, as in the case where people know they were exposed to a chemical, such as through an occupational exposure at a chemical plant. In such cases, workers are aware that they are at risk of exposure and there are often specific procedures
governing the use of and exposure to contaminants. In cases of acute exposure chemical workers are very likely to discover their exposure, while cases of chronic exposure will likely be harder to prove and polluting companies have incentive to obscure discovery (Markowitz and Rosner 2012). Second, discovery may also be prompted by official sources, such as emergency warning systems or emergency statements, as with the DuPont case. The vast majority of community members’ exposure impetus came from letters from their water service or media coverage of the resulting response. Third, biomonitoring studies can provide vast and detailed exposure information to both individuals and communities.

In these first three forms of discovery, the ‘fact’ of an officially defined exposure is present, but this is not always the case. Exposure information can also be sought in response to the presence of exposure cues, such as rashes, an uncommon smell in the air, a strange taste in drinking water, or a cloud of vapor hanging over one’s home. In these cases people faced with these cues, which are interruptions to expected patterns of daily life, must interpret these cues, by either choosing to ignore, rationalize, or seek more information. How people choose to proceed is a result of an incalculable numbers of factor which include their personal experience, community context, including economic outlook and resources to name a few. Community members can participate in ‘lay science’ in order to develop exposure information such as the use of cancer cluster mapping by breast cancer activists on Cape Cod or air sampling by ‘Bucket Brigades.’ Research has shown that partnership between lay groups and experts can be influential in the discovery and interpretation of exposure (Brown 1992, Brown et al. 2004). Due to the highly scientized fields of chemistry, toxicology, and medicine, access to scientific or expert information is essential to gaining legitimacy of exposure claims. Claims are only
‘proven’ when experts discover the presence of toxics through methods which scientific consensus deem worthy. Due to this scientized environment, exposure discovery is often either expert-led or expert-involved, and this is the case for the C8 exposure experience. Expert involvement brings with it expert legitimacy, which in turn, can act as access to regulatory and legal arenas during the understanding and response processes but they can also help to strengthen and expand the identification process to a larger population as we will see in chapter 2.

Discovery and Constraint

Separating discovery from the larger process of understanding contamination allows for specific attention to be given to the factors which aid and inhibit the identification of contamination. To start, the role of dominant ideology in shaping how people perceive their socioeconomic environment must be explored, as scholars have found larger employers in economically disadvantaged areas to be extremely influential (Gaventa 1982; Phillimore and Bell 2005; Shriver et al. 2014). Elites in economically disadvantaged areas can exercise proactive and coercive mechanisms to influence quiescence over the disadvantaged population, including dominating how environmental problems are perceived. Indeed, my preliminary study showed that a majority of respondents felt that the chemical exposure could represent an existential threat to the community due to loss of jobs, were DuPont to close the Washington Works plant.

Another factor which influences discovery of exposure is the control of information. Chemical production is very much a hidden process. It takes place most often in gated chemical plants, behind steel tank walls, controlled by closed computer systems run by technical and
chemical experts. The components of chemical reactions, known as precursors, can be intellectual property, allowing them to be hidden from the public, only brought to attention when regulators deem necessary. Even if the general public were to gain access to these plants or the names of the chemicals and processes in use, high levels of expertise are needed to understand the meaning of what is being produced. Confounding the issue of meaning is that there are endless new chemical compounds synthesized for which there are no existing health or safety information. Finally, exposure information can be obscured through interpretive schema, or frames, which inhibit individuals and communities desire to search for issues and interpret them as social problems. The importance of framing is discussed in-depth in the understanding section.

While there can be many barriers to exposure discovery, there are also portals which lead to discovery information. Portals vary and can include official information channels, personal connections, media reports, legal action, and public information sources. In the case of the Mid-Ohio Valley exposure episode it was a combination of official information sources, legal action, media reports, and lay-expert research partnerships which provided the information needed for discovery and understanding processes.

**Exposure Experience Understanding**

As people seek more information about their discovery of exposure they are constructing understandings of their exposure. This process is affected by personal experiences and structural opportunities, or to employ the work of C. Wright Mills, the intersection of biography and history (Mills 2000) Biography is the accumulated knowledge, skills, resources, and faults that
each of us collects as we construct our daily lives. It includes not only educational and occupational background as well as the social networks people develop while engaged in these pursuits. For example, a background in chemistry, or as was more often seen in the C8 case, occupational experience with industrial chemicals, were strong sources people drew on to make sense of C8 exposure.

Structural opportunities or history, on the other hand, are outside the province of the individual. Mills employed the concept of history to denote the accumulated social activities that precede the individual and provide the given social context and structures in which they live their lives. History includes seemingly countless factors including the physical properties of the exposed chemical, the current understanding of science of the nature of that chemical and its health effects, accessibility of expert information and skill to the exposed public, and the political and economic power of the exposing entity. While the totality of the history that precedes any chemical exposure is likely too vast to study, I found that people report factors which they felt most influenced their understandings. This self report, while flawed and selective, gives the social scientist a portal into at least some of the key structural factors which influence the exposure experience.

For Mills, the ability to see the interaction between biography and history in the creation of social life was the purpose of sociology, what he termed the “sociological imagination.” The exposure experience is an application of this concept, an attempt to view exposure at the intersection of the individual and society. Such a concept gives ownership over the meaning of exposure to the exposed individuals while at the same time highlighting the social context in
which it is produced. In doing so, exposed individuals are seen not just as victims but as active participants in constructing the meaning of and the response to chemical exposure.

The importance of this sociological approach to the exposure experience is made apparent when one looks at the data I collected while interviewing participants in the community-based participatory research project, the CEET Study. This study was a small biomonitoring project undertaken to determine the presence, level, and source of C8 in the Little Hocking community. This study was undertaken because community members had begun to respond to multiple sources of exposure impetus, which were telling them their community may be contaminated. In the 16 CEET interviews, only one person, an academic by occupation and training, said he conducted an internet search about the chemical C8 in response to exposure discovery. More commonly people told of learning about C8 through media reports. Upon discovery people in the C8 exposure area first reached out to family members or neighbors, many of whom had personal connections to people who had worked at the plant. Indeed, 5 of the 16 interviewees had worked at the responsible DuPont plant, and 9 interviewees were part of ‘DuPont Families,’ meaning that an immediate family member worked for DuPont. Through interaction with other affected community members, individuals cumulatively created the public exposure episode. As we will see in Chapter 4, it was the construction of this exposure discourse which led to the creation of the CEET study, a community attempt to establish scientific information about the extent, sources, and health outcomes of their exposure (Emmett et al. 2006a,b.) Participation in this and the larger C8 Health Project, a 69,000 person biomonitoring study undertaken as a result of legal action against to DuPont to determine the extent of C8, were

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4 Center for Environmental Excellence and Training at the University of Pennsylvania, hereto for the CEET Study.
both an understanding construction experience and a type of response to exposure. Similarly, participation in the class action lawsuit was an alternative way to construct ones understanding and response.

The Processes of Constructing Understandings

The exposure experience is a result of defining one’s situation as having been exposed to some type of chemical contaminant. This definition of the situation is constructed through the discovery process and given meaning through the understanding process. They arrived at definitions, which can change over time, and will be influenced by the interpretive frames through which they view the world. Framing refers to the shared understandings, beliefs, identifies and narratives which are mobilized by groups to influence interpretations of ‘what is’ and promote ‘what should be done’ (Benford and Snow 2000; Snow et al. 1986; Zald 1996). The central tenet of framing is that frames must emerge previous to collective action, since before they can act people must choose to do so. This requires paying attention to the understandings that people develop to explain their contamination and, where possible, how they understand the actions that they take. It also encourages the search for evidence about whether groups promote frames, and where possible, how individuals respond to these frames. Preliminary data shows that respondents in this study had no social movement activity and there was no local environmental group.
Response to chemical exposure at any level is a complex construction of actions informed through the exposure experience process which then seeks to make some change in the status quo of post-discovery chemical exposure. These responses may be at multiple levels, be they for the individual, the exposed community, the exposing party, or the greater society. It is perhaps better to think of responses or “patterns of response actions” rather than singular constructions of response, since collective response is the result of individual action in concert with other actors, such as state regulators, exposing parties, and the legal system. Single individuals and collective actors can enact multiple responses over time, adapting strategy to fit changes in the science, the exposed community, or other factors which influence exposure.

Exposed individuals must be seen as actors with individual capacities, goals, and physical realties, who share place-based eco-social contexts (Altman et al. 2008). These exposed parties exist in given historically constructed contexts in which they will be consistently at an informational disadvantage compared to polluting parties. Still, exposed parties can utilize social networks, mobilize resources, and take advantage of available opportunities to help improve their ability to prompt action and gain concessions.

Exposed individuals are but one actor in the exposure experience, as they interact with other powerful entities including the polluter, state agencies, the legal system, and outside groups including academia, activists, and public intellectuals. That interaction leads to specific response patterns, as we will see in later chapters.
Research Questions

1: How did Little Hocking Water Association (LHWA) community members respond to C8 contamination in their community?

I came to this area expecting certain types of expressive protest and dissatisfaction with DuPont. I did not find these actions, but that does not mean that community members did not act to respond to their exposure. This led me to trace the specific actions community members took, both on personal and collective levels. Rather than look for something that was not there and critique its absence, to understand the exposure experience I needed to find out what did happen from the views of the people closest to the action.

What I found was a tremendous amount of action, but types that did not fit my mental model of response to chemical exposure, which was heavily influenced through social movement and environmental justice frameworks. Nor did I see the classic quiescence described by Gaventa (1982) in his landmark work on Appalachia. Instead I saw institutional action and use of lay-expert partnerships; measured pragmatism as opposed to irate activism. I wanted to know why people responded in this manner, which was different from what I expected.

2: What factors influenced LHWA community members’ response to C8 contamination?

A consistent concept that arose from the literature I drew on for this study was that power and context significantly influence social action, be it action in Appalachia, response to contamination, or interpretation of biomonitoring results. In order to understand why community residents acted the way they did I need to understand the factors that influenced these actions.
both from a structural sense and from the views of participants. I expected the power of DuPont in a community which views itself as dependent on DuPont to be a key factor based on the work of Gaventa (1982), Phillimore and Bell (2005) and Shriver et al. (2014). Framing literature tells us that both stakeholders and outside groups will assert frames which can influence action. So too will DuPont assert frames that will be represented in others’ frames.

Chapter Descriptions

Chapter 2: Methods

This chapter discusses my recruitment, data collection and analysis methods. It begins by telling the story of how I became involved in the project as this influenced the methods employed. In short this project grows out of a grant studying biomonitoring reportback. I draw from the 16 semi-structured interviews I conducted for this project. I also draw on multiple interviews with four subjects I recruited separately from the biomonitoring study. Further I draw on various published material, including journalistic work and reports from organizations, along with scholarly work.

I transcribed these interviews and coded them using the qualitative software NVIVO. I employed a mix of codes, some developed for the biomonitoring study and some developed specifically for my own study. I also spent time re-listening to the interviews as I thought this gave me a better sense for the tone in which the words were said and where people felt very strongly about a subject. The mix of coding and listening allowed common themes to emerge, and this forms the heart of this dissertation.
Chapter 3: The Story of C8 Contamination in The Mid-Ohio Valley

Chapter Three introduces the central case study of the project, the experience of C8 contamination of the Little Hocking Water Association in Washington County, Ohio. This Appalachian community’s tale of contamination of tens of thousands of people by a chemical giant has been a story of creative destruction. Eighty percent of the affected population took part in responding to this contamination through scientific study and/or legal action, providing a novel approach to community contamination that could provide guidance for communities dealing with contamination in the future. This chapter begins with a vignette of driving along the Ohio River and seeing the enviro-social history written in the land and artifacts. The tale is about the roots of the Valley and the greater Appalachian region in resource extraction and how it is an area characterized by environmental exploitation and power imbalance. It then proceeds with the narrative of C8 exposure from its role in production, through its discovery in the water, and the resulting lawsuits and biomonitoring report back studies.

Chapter Four: Discovering Exposure

Chapter Four focuses on the process of identifying C8 contamination in the Mid-Ohio Valley. Pairing the recollections of residents, researchers, and other individuals associated with the process, with archival materials, including newspaper coverage and publically available legal documents I reconstruct the networking process in which community residents came to identify C8 contamination as a social problem. Residents of the valley seem to exist in a reality which tacitly accepts a certain level of externalities from the local chemical plants, such as strange smells and particulate deposition. This chapter asks two key questions: 1) what was it about C8
exposure information that tripped the tolerance levels for certain community residents? 2) What actions did these bellwethers take that created the norms and opportunities to influence others to cross the liminal barrier from ‘not my problem’ to ‘my problem’ and ‘our problem’?

Key in this discussion will be the roles of informational ‘barriers’ and ‘portals’. Chemical plants often exist in a “realm of imperceptibility” due to the levels of education needed to understand the chemical processes they undertake and the dome of intellectual property protection and corporate secrecy along with ineffective regulation (Murphy 2004). These factors create barriers between populations effected by the externalities of the plants productive process and access to the information and expertise they would need to identify their exposure. The main portal discussed is legal discovery; this formalized part of the legal system is discovery which can force a contaminating organization to divulge information to prove contamination. As we will see in the chapter on response, this is a way to force a polluter to give complainants the smoking gun, handing them the very tool they can use as leverage to defeat them.

The theoretical contribution of this chapter is the development of discovery as a distinct and necessary process of the exposure experience and to identify the concept of information barriers and portals which influence it. This information could be useful to future affected communities in identifying the barriers they must overcome and possible portals they could use as they try to disseminate exposure information and influence people that their exposure is a social problem.
Chapter 5: Understanding Chemical Exposure

Chapter 5 takes up the process of the construction of meaning which follows the identification of contamination as a problem. The subsequent understanding process is the journey by which people construct the meaning of that contamination. The development of understanding involves a series of questions such as where does it come from, what will it do, what can I do to learn more about it, and can I do anything about it? These questions will all be asked repeatedly as part of the process of gathering, sorting, and analyzing incoming exposure information. This process is faced with more informational barriers and portals, some which overlap with the identification process and some which are novel. Individual factors, such as education and background become especially important in this process as do formal and informal networks (Granovetter 1975). The actor in the understanding process is an information seeker, sorter, maker, and transmitter. Their tools include eyes, knowledge of chemistry, their health, local political economy, networks, and the interpretive schemas or ‘frames’ they have developed or embraced. At the simplest level, the identification process is the ascertainment of a possible threat and the understanding process at the simplest level is the meaning that develops about that possible threat.

In this chapter I will reconstruct the process by which community residents gathered information about C8 exposure and constructed personal and collective meanings of that exposure using interview and archival data. The key factor in this process will be the role of biomonitoring report back studies and the structural opportunities accessed which opened these informational portals to the effected community. The chapter will begin with a discussion of the
concept of discovery as a social process, identifying its constitutive role in the exposure experience. Then utilizing the voices of community residents and their advocates, I will identify how community residents developed early understanding of contamination and were able to identify the contaminating party before they were able to ascertain the health effects of their contamination. This chapter will end with a discussion of how community members utilized their given opportunity structure to gain access to biomonitoring.

Chapter Six: Responding to Chemical Exposure

Chapter Six focuses on the response to exposure. It begins by defining response and describing the feedback-loop between the understanding and response processes, in that while understanding informs response, the response patterns themselves have effects which inform understanding of contamination and future response. It then reports on the response patterns observed and employs quotes from the participants to contextualize these responses as suitable to the Mid-Ohio Valley context. This chapter then discusses the literature of Gaventa on quiescence in Appalachia and how it is not appropriate in this case. Instead, the work of Cable (1993) and Shriver, Adams, and Messer (2014) is drawn on to show how the response patterns seen in this case fit with resistance patterns in industry dominated environments.

The two major response patterns seen in the Mid-Ohio Valley exposure experience are participation in biomonitoring studies and legal action. By participating in one or both of these actions, community members were taking multiple steps to address their exposure experience. They increased the available information, added resources, publicly asserted norms of response action, developed leverage against the offending company, and contributed to new scientific
information. These steps have greatly moved forward the understanding of both exposure and health effect information for C8. Further it may prove a model for other communities dealing with contamination as to how to develop response patterns which can benefit not only the contaminated community but also the greater public.

Chapter Seven: Conclusion

Chapter Seven discusses the three major findings of this study. First it will address the importance of the exposure experience as a multi-stage, on-going process which can last long after the initial exposure. This study has shown that over ten years after exposure discovery, the people of the Mid-Ohio Valley are still actively constructing their exposure experience and doing so in a way which reaches far beyond their corner of the world into regulatory policy and the science of C8. Second, it will reinforce the importance of information portals and barriers to the exposure experience. This discussion will highlight how the widening of portals pertaining to C8 information has led to more opportunities for C8 related action. Third, it addresses the central importance of context in the construction of the exposure experience. It does so by discussing how after the conclusion of data collection for this project, a citizen group finally emerged in response to what they saw as the failures of the C8 Health Project. This shows that as context changed, so did response patterns.
Chapter 2: Methods

Introduction

This study employs in-depth, semi-structured interviews with residents of the Mid-Ohio Valley. The area affected by contamination centers around the DuPont Washington Works plant in Washington Works West Virginia. Due to its location on the banks of the Ohio river, contamination has spread to communities in Ohio including Belpre, Little Hocking, and Vincent where most of my interviews took place. In the following sections I discuss my methods for collecting and analyzing these interviews. I also utilize media and journalistic material, legal data, government documents, and information from public organizations.

How I Became Involved in the C8 Exposure Experience

In 2013 I became a research assistant for a project in progress that was reviewing participant experiences of biomonitoring in a variety of biomonitoring research studies. The project was funded by the National Institute of Environmental Health Sciences (NIEHS) and was entitled “Ethical and Legal Challenges in Communicating Individual Biomonitoring and Exposure Results to Study Participants” (hereafter referred to as the Biomonitoring Ethics Study). The project examined how researchers, Institutional Review Board (IRB) officials, and study participants approach, understand, and respond to issues which develop around biomonitoring report-back. Overall it sought to inform best practices for the expanding field of biomonitoring and household exposure report-back studies. The biomonitoring ethics study reviewed report-back practices and participant engagement in eight different biomonitoring report back studies.
My role in this project was to examine one of these studies, the University of Pennsylvania’s Center for Environmental Excellence and Training’s study (hereafter the CEET Study) of human exposure to perfluorooctanic acid (PFOA) in Washington County, Ohio. I organized, conducted, transcribed, and analyzed interviews with 16 CEET participants. During this research process I began to develop questions about why the C8 case unfolded.

I was surprised that my respondents had not organized using environmental health, antitoxics, or even anti-corporate frames and did not form into citizen groups or protest their contamination. Instead, their response to exposure seemed to be oriented around more institutional forms of response, namely legal action and participation in scientific research projects. Even more striking were the types of answers interviewees gave in response to questions regarding their concerns about biomonitoring participation. They did not display hysteria in the face of the uncertainty which comes from exposure to an emerging contaminant. Rather their concerns were about the possible harm that biomonitoring and the overall exposure episode could have on DuPont’s deciding to close the plant. Community members saw a direct tie between the community’s economic health and the continued operation of the DuPont Washington Works plant. This concern for economic security in the face of contamination propelled my interest in this study. I wanted to know why they responded to their exposure in the way they did and to understand the factors which influenced this process. My dissertation grew out of these questions and the methods became shaped by the parent study in the following ways.
The Case Study Approach

The first major influence from my experience in the biomonitoring ethics study was to proceed with a single case study. Having conducted and analyzed sixteen interviews with the biomonitoring participants I was struck by the level of concern with keeping the polluting party in business. While this was understandable due to the importance of DuPont to the local economy, these concerns were elicited as responses to question about their participation in a biomonitoring study. Their exposure experiences, even ten years after their exposure was discovered, seemed inordinately filtered through this lens of needing DuPont. I wanted to explore their words in light of the structural factors this community was faced with and how it influenced the exposure experience concept. Due to this desire a single case study made sense.

The case study approach has long been used in qualitative social science research to gather detail and insight about the social dynamics and structure of single communities, subcultures, or organizations. Criticisms that this approach cannot provide generalizable results (Miles 1979) have relegated it to mere hypothesis generation while proponents of this method argue that it can generate generalizable findings (Flyvbjerg 2006) and see its value as a way to develop theory (Eisenhardt 1989).

The generalizability of a single case study depends largely on readers understanding the case’s social characteristics and history. In the present case, the community I studied is characterized by white working class peoples and has a history of domination by polluting industries. The environmental problems faced by this community are tied to this corporate domination. They have features which make it at least somewhat generalizable to other kinds of
environmental problems in such areas. These features are extractive economies, government involvement in technological development, and contaminated communities.

Recruitment

Recruitment was influenced by the framework of the biomonitoring ethics study. The plan of the ethics study was to review four distinct biomonitoring report back studies and to interview participants, researchers, and IRB members involved in those studies; the project later added four more studies. The CEET study was one of those studies to be reviewed but it brought with it some difficulty in recruiting participants. Due to litigation resulting from the DuPont contamination, CEET researchers had obtained a certificate of confidentiality (COC) protecting their study participants from being contacted or subpoenaed based on their participation. This COC prevented our study group from contacting participants directly without their first giving consent to being contacted. This created the need to have CEET researchers conduct initial recruitment on our behalf which was done by a research assistant and then an undergraduate student. They provided us a list of people who were willing to be contacted. At this point I would take over and contact possible participants by phone to solicit in-person interviews.

The need for CEET to conduct recruitment was a problem; it had moved on from the then nine-year-old study creating some difficulties in communication. The recruiters were only tasked with our work part-time. This complicated their contacting study participants as the recruiters were unable or unwilling to delve deeply into the task. Their information came from the original study so participant who had changed their address would not be contacted. Due to the COC I could not gain access to contact information to do the recruitment myself and the final sample was limited to 18 people and a total of 16 interview participants.
The Study Sample

The population from which this study sample was drawn consisted of residents of the Mid-Ohio Valley, specifically in communities near the DuPont plant in Washington West Virginia. The total sample of 21 interviewees comes from two distinct groups in this area. Group one consists of participants in the CEET study, all of whom lived within the Little Hocking Water District. The Little Hocking Water District is a user-owned municipal water system which served as the primary force in getting DuPont to provide clean water to community residents. These interviews contain significant information about the exposure experience, making them wonderful data sources for this dissertation. I obtained permission from the principal investigator Julia Brody and co-principal investigator Phil Brown to analyze these interview transcripts for this dissertation.

Group Two was originally expected to be made up of interviewees solicited via newspaper advertisement. However, after taking out two separate ads in a local newspaper and getting no response, I abandoned this tactic. Instead, I reached out directly to a contact I had gotten from a colleague. This contact was involved in the 2004 litigation against DuPont. Through this person I obtained five more interviewees. Group two contains these interviewees: three plaintiffs in the 2004 case against DuPont, one plaintiff’s lawyer, and one researcher involved in the Brookmar C8 biomonitoring study. The respondents were predominately white, working class, and evenly split between men and women.
Data

Interviews

The interviews were designed to elicit thoughtful, often long responses to a list of roughly thirty questions. Interviews were recorded using two digital recorders with the permission of the interviewees, all of whom agreed. Interview recordings were kept in a password protected computer folder. Interviews were numbered; recordings and transcripts do not contain interviewee names and there is no master list which contains both interviewee names and transcript number. This is due to the fact that re-contact for CEET interviewees was prohibited by IRB. Non-CEET interviewees number only five and the interviews are quite distinct, allowing me to know who is who without a list. Interviewees names have been changed to protect anonymity.

No compensation was provided for Group 1 interviewees. Group 1 interviewees were interviewed using a script for the Biomonitoring Ethics project using a signed consent form. Copies of this signed consent form are maintained by me in a locked wooden trunk. During the interviews I would ask follow up questions as they occurred and I modified this script over the data gathering period to include more questions about the factors involved in their exposure experience. The first four interviews yielded strong responses about the importance of DuPont and surrounding chemical plants to the local economy. Due to this I began asking about how people viewed DuPont and how economics influenced the exposure experience.

Group 2 interviewees were interviewed using versions of the biomonitoring ethics project script, modified with questions to fit their positions of researcher, lawyer, litigant, and/or
biodtoring participant. The Northeastern University IRB decided that an unsigned consent form was appropriate for this round of interviews and copies were given to interviewees. Ten dollar gift certificates to a local coffee shop were provided as compensation for the interviews. Interviews with group two members tended to be longer due to their multiple roles and due to the on-going nature of the litigation and exposure response. I spent almost a full day with the plaintiff’s lawyer and conducted three interviews with him. I interviewed one plaintiff and biomonitoring participant twice and had multiple follow-up conversations with them. The interviews lasted approximately sixty to ninety minutes. A semistructured, open-ended interview was used as the primary data collection instrument (Dearnley 2005). This form of interview allowed respondents to recount their most vivid recollections of their exposure experience. Major questions or themes of the interview included the meaning tied to the biomonitoring process, DuPont’s economic importance, and how interviewees chose to respond to contamination. It was neither possible nor necessary to confirm the accuracy of these narrations of past experiences, since I aimed to establish how respondents recalled and understood what had happened to them. Strong rapport was established to foster self-disclosure and to elicit these accounts. Respondents, on the whole, seemed quite comfortable and at ease during the interviews, perhaps because the interviews were confidential and, for some respondents, somewhat cathartic, enabling them to treat the interview as an occasion to reflect on what their experiences had been and what they mean to them in the present.

I also gave free gardening advice to several members of both groups, having worked as a gardener for years.
Archival Data

Beyond information obtained from interviews, I learned much about the Mid-Ohio Valley contamination episode from publically available sources. I am in great debt to local journalist Callie Lyons for her 2007 book on this case, *Stain-Resistant, Nonstick, Waterproof, and Lethal: The Hidden Dangers of C8*. Using this work along with supporting documents from the Fluoride Action Network, the Environmental Working Group, Keep Your Promises DuPont, The C8 Health Study, and the Marietta Times, I was able to reconstruct the timeline of C8 contamination and early exposure experience process. These sources also helped me understand the contextual situation in which the exposure experience unfolded. The backbone of this story comes from Lyons’ work and I am comfortable with its accuracy. This is not just because she was covering the story at the time, but also because my chief interviewee John said that while she had “stolen”, the story he did not question its accuracy. I am further in debt to the group Keep Your Promises DuPont for their website and emails which keep me up-to-date with the current happenings related to the Mid-Ohio Valley contamination.

Analysis

Interview recordings were transcribed and entered into the qualitative data analysis software program NVIVO for coding by me. In the coding process I read through transcripts and re-listened to interview tapes looking for patterns that emerged organically from the response data. This inductive coding process allows insights to arise from the ground-up by continually conducting an open coding process. This defends against over-simplification of community
responses into scholarly concepts which, while of explanatory importance, may not be salient or translatable to the understanding of lay people.

Deductive coding, informed by existing scholarly work was also employed in conjunction with inductive coding. This included insights on the importance of large employers in economically dependent communities. This process highlighted the importance of issues like “job-blackmail” and trust in explaining community action or lack of action (Gaventa 1982). Through the coding process responses are winnowed through continued coding and refinement.

I found that a majority of interviewees reported their fears of damaging DuPont and how the resulting loss of jobs influenced their exposure experience. In this way we learn that, at least in this community, and probably in communities of a similar type, economic concerns may trump health concerns and lead to a lack of action to reduce community exposure. This could then inform future report back studies on the need to educate about the relationship between economic structures and understandings of risk.

**Limitations and Benefits**

This study is limited from making causal claims due to size of the sample. However, the purpose of this study is not to provide causal claims, rather it is to help build the exposure experience concept for use in future studies. The exposure experience is a necessary concept in our increasingly contaminated world, as it helps us understand how people experience and respond to chemical contamination. The in-depth interviews employed in this study allow for the experiences to be shared in ways that surveys or structured interviews would not. While an
embedded ethnographic study may be the preferred method to understand the context in which people live their daily lives; this study is able to draw much of this context from the interviews and from analysis of the local economy through secondary sources. It becomes quite clear for the researcher that the area is dominated by chemical companies and that local and state governments support corporate agendas for the promise of jobs and economic well-being.

The time aspect is both a limitation and a benefit of this study. I was not able to capture the immediate emotions that people experienced in the first years of the exposure episode. That said this study benefits from the passage of as people had the ability to examine what was truly meaningful in the process, absent of raw emotion. Ideally a study would capture both time periods, the immediate period during exposure discovery and response and the retrospective period where people can look back to evaluate the entire experience. For future studies I recommend a longitudinal approach with a stronger ethnographic component where the researcher is actually part of the community rather than a fly-in researcher. This would decrease resources needed for travel and allow the researcher greater legitimacy with research participants and decrease the likelihood that something important is missed.
Chapter 3: The Story of C8 Contamination in the Mid Ohio Valley

Figure 3.1: Regions of West Virginia

Source: West Virginia Chamber of Commerce

Introduction

This chapter examines the social and ecological history of C8 exposure in the Mid-Ohio Valley. It begins by explaining the importance of place, and defining the region and study area.

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Next, it examines the geological and political economic history which gave rise to chemical production in the area in general and DuPont’s history specifically. The next section focuses on the production of C8 contamination and DuPont’s efforts to conceal community exposure. This is followed by the narrative of the social discovery of community contamination by the community itself.

The Importance of Place

Place matters for community exposure in two important ways which influence the exposure experience. First, geologic and ecologic forces set the stage for social action. Often the activities which lead to community contamination are tied to specific places due to the presence of certain geologic or ecologic features which gave rise to specific types of production in that area. Investment in certain types of production creates 'treadmills of production' which influence continued production in these areas (Schnaiberg 1980). This mingling of geologic, ecologic, and social history can often explain why industries center in certain areas and make contamination more likely.

Altman et al. (2008) conceptualize place as a shared view of the “eco-social history” of an area. This shared collection of meanings tells the story of how regions are shaped through the interaction of human activity and its ecosystem. New generations are socialized with this history and the expectations that it brings. As we shall see in the coming chapters, the chemical industry and the omnipresence of pollution are seen as part of the way of life in the Mid-Ohio Valley. The exposed communities were made up of families with direct and indirect economic

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7 Eco-social history (Adams 2011; Altman 2008; Altman et al 2008) refers to the shared meanings which people in a community develop about their ecological and social surroundings.
ties to DuPont and the larger chemical industry. Overall the impression given by the people I interviewed, people contaminated by DuPont’s actions, was that the area needed DuPont. The community residents’ views of their region, their eco-social history, and the biographies they wish to create were built around the functioning of the chemical industry. The dangers they attached to their exposure experience included not only health risks, but centered around the fear of a loss of DuPont as an economic force in the valley. In this way, place cannot be separated from their exposure experience.

Figure 3.2: Major Ohio River Basin Chemical Plants & Terminals

(Source U.S. Army Corps of Engineers)
Political Economic History of the Region.

To understand the history of C8 contamination in the Mid-Ohio River Valley we must first discuss and bound the region. It is comprised of the Ohio River and the valley which it bisects. Looking at the map above entitled “Major Ohio River Basin Chemical Plants and Terminals” we see the Ohio River beginning in Pennsylvania, created by the meeting of the Monongahela and Allegheny rivers. It ends by joining the Mississippi River, creating an industrial corridor for the Midwest to the Gulf of Mexico. Along the way it forms hydrologic and political boundaries between the states of Ohio and West Virginia, along with Indiana, Illinois, and Kentucky. However, chemical contaminants do not respect political boundaries and C8 spread from the Washington Works Plant in Washington WV into the surrounding areas communities on both sides of the river. My focus is one section of this chemical corridor, a contaminated zone of Ohio and West Virginia roughly defined as the communities of Washington and Athens Counties in Ohio, and the part of Wood County, Ohio nearest the Ohio River. Throughout this project I will refer to these collectively contaminated communities as the Mid-Ohio Valley. This contaminated area is only part of a much larger chemical production nexus which spans from Pennsylvania to Mississippi using the Ohio and Mississippi rivers as their skeletal system. Production decisions in the Mid-Ohio Valley cannot be separated from the capital city of Charleston, WV nor can they be seen without reference to investment in infrastructure development by states along this chemical corridor. I tell the story of these connections beginning with a description of the eco-social history of our study area below, which ties the nascent chemical industry near Charleston to war production along the Ohio River
tributary the Kanawha River, and union defeat to the production of C8 in Washington WV. It was in these times that the relationships which led to chemical contamination were forged.

**How did C8 get there?**

C8 did not end up the in the Mid-Ohio Valley by chance; its history in the area is rooted at least one hundred, if not thousands of years in the past. The early American chemical industry grew up in the area due to the valley’s geological history. Long before people set foot there, the remnants of an ancient sea left the valley bisected by a wide, dependable river. This river provided and continues to provide cheap transportation for the goods produced in the area; allowing them to travel upriver to the commercial center of Charleston WV, and its nexus of interstate highways, or down river to ports and ocean shipping routes. Barge convoys of nine or twelve travel this liquid industrial corridor, carrying coal, chemicals, lumber, and other goods; tying this otherwise remote Appalachian region to centers of production around the world.

The river is not the only geologic gift to the chemical industry. Rich reserves of coal and other minerals were available just below the surface, as evidenced by the terraced hills overlooking the river. The early chemical, dye, and salt industries took advantage of generous salt-flats upriver near Charleston, providing natural roots for them to blossom. These flats yielded not only salt, but chlorine, a key substance necessary to the developing chemical and pigment producers.\(^8\) Nathan Cantrell of the West Virginia Historical Society, in his 2004 history

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\(^8\) Chemical production, coal and salt mining, and pigment or ‘dye’ manufacturing were intertwined in the 1800s. See Cantrell 2004. Also Travis 1993. *The Rainbow Makers: the origins of the synthetic dyestuffs industry in Western Europe*
of the chemical industry in the region, notes that the area provided all of the six key inputs needed by the chemical industry at this stage:

While salt was the true predecessor to chemical manufacturing, as John Hale had predicted, the industry would have never fully developed without the abundance of West Virginia's other natural resources. Chemists had plentiful raw material, or feedstock, in the area from natural gas, coal, oil, and other mineral deposits, such as high quality limestone. Carbon from coal, oxygen and nitrogen from the air, and chlorine from the salt brine, hydrogen from water, and easy importation of sulfur, provided the “big six” main elements that are the base of all products. (Cantrell 2004, pg. 2)

Due to this history, the geological groundwork for C8 production in the Mid-Ohio Valley had been laid far before it was ever invented. However social factors also underlay this production decision, constructing the social aspect of “eco-social history.” By building in the valley, DuPont was taking advantage of the industries which had built upon this ecological wealth. Doing so decreased shipping costs of inputs compared to building elsewhere. It also took advantage of the existing labor and community relationships which had developed around the nascent chemical industry and the dominance of Appalachian resource extraction industries, especially Big Coal. Building in Appalachia meant the ability for corporations to take advantage of a job market dominated by capital, keeping wages and expectations low (Cantrell 2004, Pg. 4).

DuPont’s formal entrance into the area of Appalachian Ohio and West Virginia can arguably be dated to 1917 and the U.S. entrance into WW1. At the time DuPont was the primary
manufacturer of gunpowder for the U.S. market. Estimates for war procurement of total gunpowder production were only half of what would be needed. DuPont worked with the government to scout areas where new plants could be built to meet demand and the Mid-Ohio Valley region was selected, specifically the area along the Kanawha River, south of Charlestown WV. For Cantrell “This choice marked a key point in Kanawha Valley development and foreshadowed the growth of the suburbs, revitalization of the salt industry, and the solid establishment of the chemical industry.” (Cantrell 2004, pg. 3)

After WWI, in 1924 DuPont began building its Belle Works Plant for the production of synthetic ammonia. Completed in 1926, Belle Works became a battle ground in the 1930’s between DuPont and burgeoning labor unrest (Cantrell 2004, pg. 4) DuPont defeated the unionizing campaign, keeping its company union and laying the groundwork for corporate dominated labor relations in the plants it would construct throughout the Ohio River Valley.

The Washington Works Plant

The Washington Works plant was constructed beginning in 1944 at the tail end of WWII for the main purpose of producing what would become DuPont’s trademark product, the nonstick coating Teflon. At the time Teflon was a needed part of military production, used for artillery shell fuses and as part of nuclear material production for the Manhattan Project (Lyons 2007 Pg. 20). After the war Teflon found hundreds of industrial uses from computer chip coatings, electrical cable insulation, food packaging, to cookware. Without Teflon, C8 would likely not have been as needed at the Washington Works.

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9 For a fascinating discussion of the use of Teflon and the dangers of fluorine in the Manhattan Project see The Fluoride Deception (2004) by Christopher Bryson.
C8 is needed in Teflon production as a surfactant, something that reduces surface friction and allows for an even distribution of product. In practice, when Teflon is to be spread over a surface, it clumps and does not spread evenly (Interview with C805). For an industrial coating this is problematic, since uniform spread and coating thickness are central to product quality. When C8 is added to the process, it decreases surface friction and allows for the desired uniform spread of Teflon. C8 is not an ingredient of Teflon, rather it is an additive which is necessary for production and later must be removed from the final product. It is not destroyed in the process but it is somewhat degraded in that it also works as a ‘soap’, removing impurities when from the final product. This meant that DuPont had a disposal issue with the used C8. At various times, sometimes due to management decisions, sometimes due to worker negligence, C8 was pumped directly into the river (Lyons 2007, page 39; Interview with C805). C8 was also dumped from its very inception in the Teflon process on plant property at the Riverbank Landfill. Starting in 1948 additional C8 was burned in the plant’s incinerator until 1965. In 1988 the Riverbank Landfill was excavated and its contents moved to the Dry Run Landfill purchased from the Tennant Family whose farm bordered DuPont’s Washington Works property (Lyons 2007, pp. 33-34) Here begins the social discovery of C8 which is depicted in Figure 3.3.
Figure 3.3: C8 Exposure Timeline

1950
- 1951: DuPont begins using C8 at Washington Works Plant in WV. (Hawthorne 2003)

1960
- 1961: DuPont learns C8 is toxic in lab animals and effects organ function. (Hawthorne 2003)

1970
- 1978: 3M informs DuPont that C8 accumulates in workers. (Hawthorne 2003)

1980
- 1988 DuPont buys Lubeck, WV well field and drills new field for Lubeck downriver (Lyons 2007)

1990
- 1991: DuPont creates community exposure guideline of 1ppb. (Lyons 2007)

2000
- 2000: 3M agrees to phase out C8 and related chemicals. (Hawthorne 2003)
- Sept.2004: DuPont settles class action suit. (Fluoride Alert)
- Aug.2005: CEET study releases results finding C8 exposure. (Lyons 2007)

2010
- 2010-2011: C8 Science Panel certifies six diseases as related to C8 exposure. (C8 Science Panel)
- 2015 Keep Your Promises DuPont launches campaign targeting DuPont in response to delay over medical monitoring and sale of Washington Works Plant. (Keep Your Promises DuPont)

Present
Why Was DuPont Worried about C8?

Before we get to the social discovery of C8 we should explore the issues behind by DuPont’s excavation of the Riverbank Landfill. DuPont decommissioned and excavated the Riverbank Landfill because in 1984, through internal testing, they found that the groundwater below the landfill had leached into the groundwater of the neighboring town of Lubeck WV (Lyons 2007, pp. 33-34). This caused DuPont to take approximately 7100 tons of contaminated sludge and dump it in the Dry Run Landfill beginning in 1988. Soon after the Tennant cattle began to die and by 1990 the herd was completely gone. Also in 1988 DuPont purchased Lubeck’s tainted well field, and also purchased land for and developed a new well-field for Lubeck without informing the municipality of the true reasons for this action.

This action prompts another question: why was DuPont testing for C8 to begin with? The answer to this question is complex and presents the opportunity to introduce C8 as an emerging contaminant. By emerging contaminant I mean that C8 is a toxic chemical for which there is incomplete information about its health and environmental effects. What makes it so concerning is that it has proven negative health effects on animals in laboratory tests (EPA 2010). Also it persists in the environment essentially forever as it does not break down through processes of environmental or biological degradation (Vierke et al. 2012). Furthermore, through the efforts of the C8 Health Project (discussed below) C8 has been linked to kidney cancer, testicular cancer, ulcerative colitis, thyroid disease, pregnancy-induced hypertension (including preeclampsia), and hypercholesterolemia by an independent board of experts (C8 Science Panel 2011, 2012a-d). Studies of C8 are ongoing but it is only in the last fifteen years that this

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10 1984 tests show 1.5 PPB C8 in Lubeck water. Lyons page 33.
information about C8’s human health effects became public. The information from these studies cannot explain DuPont’s actions pertaining to the Riverbank and Dry Run Landfill. The impetus for that action lies with 3M Corporation.

In 1978 DuPont was tipped off by C8’s manufacturer, 3M, about C8’s possible toxicity. 3M’s studies showed that PFOS\textsuperscript{11}, a chemically similar substance to C8, building up, or bio-accumulating, in the blood of 3M workers (Lyons 2007 pg. 112.) DuPont began its own internal monitoring of PFOA and developed a preliminary safe level for the chemical. In 1981 DuPont was once again tipped off by 3M about PFOA’s toxicity, this time based on a study of birth defects and cancer in PFOA exposed rats. That same year DuPont removed women from the Teflon production labs in response to two out of seven female Teflon workers having babies with birth defects and C8 in the newborns’ blood (Lyons Pg. 30, Interview with Plaintiffs 1,2).

Rather than inform workers and surrounding communities about the possible harm of C8, DuPont embarked on a 20-year cover-up which not only included the concealing of the Lubeck contamination discussed above, but a concerted effort to define C8 contamination as within safe levels. In 1987 DuPont toxicologist Gerald Kennedy concluded that 500 ppb (parts per billion) was a suitable safe level for C8 in the blood of workers and the company set the acceptable level for community drinking water at 5ppb. By 1991 DuPont reduced this drinking water guideline to 1ppb. This extension of the definition of local water as safe may have continued into the present

\textsuperscript{11} C8 or PFOA and PFOS are chemically identical fluorinated carbon chains (PFCs) except PFOS has a sulfonic acid group in place of C8’s octanic acid group.
day, but due to the concerted action of individuals working in concert and in conflict with regulators, experts, and lawyers, we now know C8 contamination as a social problem.\footnote{As of today, the EPA has not completed its risk assessment of the human health effects of C8 nor has it certified a ‘safe level’ of contamination. Instead, the EPA has moved to phase out C8 by the end of 2015. Further it has initiated a phase out of all long chain perfluorinated chemicals due to their environmental persistence and their possible health risks. See \url{http://www2.epa.gov/assessing-and-managing-chemicals-under-tsca/20102015-pfoa-stewardship-program}}

**Figure 3.4: Molecular Structure of C8 (Perfluorooctanoic Acid)**

![Molecular Structure of C8](http://www.eoearth.org/view/article/155177/)

Cattle as Canaries: The Tennant Family and the Social Discovery of C8 Contamination.

Social discovery is a process by which communities come to define a phenomenon as a social issue (Krimsky 2000). With over 70,000 chemicals in use in the modern world system, most people who do not deal with them on a professional basis do not concern themselves with such information (Edlestein 2004, Pg.3). It is only when something happens that raises a need or desire to examine a specific chemical that it becomes ‘socially discovered’ and a social problem. In the case of C8 in the Mid-Ohio Valley, social discovery began with one family.
Without the involvement of the Tennant Family, one can only speculate as to when C8 contamination would have been discovered in the Mid-Ohio Valley. By selling land to DuPont for the Dry Run Landfill in 1984, a landfill they were not told would become a chemical dumping ground, they unknowingly turned themselves and their cattle into the iconic ‘canary in the coalmine’ (Lyons 2003). Whereas canaries were historically brought into mines as living air monitors, alerting by their death dangerous gasses or a lack of oxygen, the die-off the Tennant cattle in the late 1980s sounded the alarm that something was wrong with the local environment.

Soon after the opening of the Dry Run Landfill the Tennant family’s cattle began to experience strange health issues and by 1990, 280 cattle were dead. The Tennants initially reached out to the West Virginia Department of Environmental Protection (WVDEP), beginning what would become a decade long struggle with state and eventually federal regulators. Lyons’ (2007) investigation of the WVDEP details a “conspiratorial bureaucracy” characterized by a revolving door of personnel, information, and funding between DuPont and the WVDEP which may explain why the Tennants never received satisfactory protection from the state agency. Particularly pernicious in this process was the 1996 action by Dr. Eli McCoy of the WVDEP. Dr. McCoy negotiated a $200,000 settlement with DuPont for cattle and deer deaths near its Dry Run Landfill near the Tennants former farm (Lyons 2007, pg. 57). This settlement barred further investigation or enforcement at the landfill the same year that the WVDEP had fined DuPont $250,000 for chemicals leaching from the site.

The Tennants’ experience with the federal Environmental Protection Agency was not any better. The EPA commissioned a study of the Tennant which culminated in a 1999 report “The Tennant Farm Health Herd Investigation” (Lyons 2007, pg 14). This study undertaken by six
veterinarians concluded that the Tennants’ cattle had died from faults in herd management, citing poor nutrition, deficient veterinary care, and inadequate pest insect fly control. Taken in the context that the investigators were not informed of the neighboring presence of a chemical landfill, the study is flawed. Even more puzzling is evidence in the report citing hazardous levels of fluorinated chemicals (PFCs) in the nearby Dry Run Creek (Lyons 2007, pg14), levels that were ignored in the conclusion. In retrospect, the study was flawed from the inception in that only veterinarians were assigned to the research team. As their expertise was focused on animal and herd health, and they were not informed of the eco-social context, it follows that their conclusion would be based not in toxicology but in the terms of veterinary science, as those were the variables they were expected to assess.

This conclusion did not fit the Tennants’ understanding of their predicament. Rather than accepting such an unfavorable regulatory response, the Tennant family hired a local environmental lawyer, Robert Billot 1998. The Tennants then brought legal action against DuPont for damages to their herd and property. In doing so they directly challenged DuPont in an area where DuPont is seen as essential to the local economy (Judge et al. In Press). In this way they took on not only the corporation but the ire of community members. Lyons notes that they even had to change churches twice in order to avoid stigmatizing looks and gossip. Lyons notes that “For thousands of Mid-Ohio Valley residents and area plant workers, DuPont is known purely as one of the economically depressed region’s largest employers. The Tennants are branded as a force that tried to diminish that systemic viability (Lyons 2007, pg. 17).”

The Tennants were shunned by the community and they were silenced by the courts, but the information uncovered through their actions may have saved the system they so threatened.
While their lawsuit ended in a sealed settlement which constrained the Tennants’ ability to speak out about the contamination; it also showed that DuPont knew much more about the problem than they revealed. During discovery for the Tennant lawsuit, a key legal process which will be discussed in the Discovery chapter, DuPont was forced to disclose corporate documents which proved DuPont’s knowledge of community C8 contamination surrounding their Washington Works plant. Based on this information Billott began organizing what became a class action lawsuit against DuPont on behalf of the contaminated communities surrounding DuPont. By once again bringing suit, the legal discovery process allowed access to DuPont’s documents detailing the contamination. These documents became the community’s leverage over DuPont. Not only did they prove DuPont’s knowledge of contamination, they also proved that DuPont had participated in a cover-up to hide this contamination from the community.

Billot did not keep the information he learned about C8 private. Not only did he launch the class action lawsuit, he alerted local, state, and federal regulators, and began the social discovery of community contamination through press coverage and later, community meetings. This finding was only an impetus for action. As people became faced with this new information, they too began to act, setting in motion processes which continue to influence the exposure experience today.
Water Boards: The Little Hocking Water Association Negotiations

When the local water boards learned of their contamination, they alerted their memberships, an experience to be discussed in the discovery chapter\textsuperscript{13}. The water boards, particularly the Little Hocking Water Association (LHWA), were central to both the structure and infrastructure of the water cleanup. The Little Hocking Water Association is a member-owned water service that provides water to parts of ten townships in Washington County and Athens County Ohio (Lyons 2007, Pg. 46). As a member-owned service the LHWA is accountable to two groups, the residents it serves and state and federal water regulators. Each year a seven-member advisory committee is chosen through a vote by the water service customers (owners) themselves. The LHWA is not an anomaly, as roughly 90% of Americans receive their water through public water services (Lyons 2007 Pg. 46) The role that the LHWA played in the C8 exposure response was extremely important.

The social discovery of C8 in the Little Hocking Water Association is a story of stalls and barriers. After 20 years of cover-up The Little Hocking Water Association learned in 2001 that the WVDEP had entered into an agreement with DuPont to test for C8 in area water supplies. The LHWA attempted to join this testing but the WVDEP stalled this attempt. This prompted Little Hocking to attempt to hire an outside laboratory to conduct the testing but again their attempts were thwarted. At this time only one laboratory in the country had the capacity to test for C8, Exygen Research (Lyons 2007, Pg. 48). The problem was that DuPont had this

\textsuperscript{13} This was an uneven process in that different water systems learned about their contamination at different times. While Lubeck and Little Hocking learned of their exposure between 2000 and 2001 where as citizens of Parkersburg West Virginia did not learn of contamination until 2006 because city officials feared causing hysteria (Lyons 2007 Pg. 65)
laboratory under exclusive contract, barring it from doing any testing for C8 that DuPont would
not authorize, once again concealing contamination. Fortunately, the WVDEP eventually
relented and in January of 2002 the LHWA had proof that its wells were indeed contaminated
with C8.

As a water service the LHWA has a formal obligation to provide clean water on demand. Under this charge the water board took two actions which were essential to the exposure experience. First, they began posting any information about C8 water contamination they had on their website. This allowed members of the water system to access up-to-date information from a trustworthy source, something they could not count on from state regulators. Second, and even more importantly, the LHWA began four years of negotiations with DuPont which culminated in construction of a water filtration system that would remove C8 from the water (Lyons 2007, 49). These negotiations were separate from the class action lawsuit and from the biomonitoring studies. It is likely that the evidence gathered by the CEET study, discussed below, was helpful in getting DuPont to finally sign off on the settlement.\textsuperscript{14} The LHWA has subsequently sued DuPont for maintenance and operational funds to continue to service and run the filtration system and this legal action is still ongoing. They directly addressed the water contamination in a way in which citizens did not need to become personally involved and in a manner which did not threaten the systemic viability of the local economy.

\textsuperscript{14} Based on the timing of the settlement with the dissemination of information of the CEET Study. Within days of the study information being released DuPont also began supplying bottled water to LHWA members.
Biomonitoring and Legal Action

The LHWA was not the only body that began to face the knowledge of C8 contamination head on. Citizen action formed into two distinct but somewhat related patterns. Community members launched a biomonitoring study of the LHWA and a class action lawsuit, which in turn, prompted another, much larger, biomonitoring study. Ultimately these citizen actions resulted in one of the largest data sets compiled for an emerging contaminant and over 40 scholarly articles based on this contamination information. Moreover, six diseases have been linked to C8 exposure from these studies and currently members of the population with these diseases are able to petition the court for medical monitoring funds. None of this would have been possible without the actions of members of the exposed population and their representatives.

The Class Action Lawsuit

Building on the information of DuPont’s extensive knowledge of C8 exposure, Billot and his legal team filed suit in August of 2001 against DuPont. The suit, Leach et al. v. E. I. DuPont deNemours and Co, was filed on behalf of 12 named plaintiffs and 50,000 residents of the 6 identified contaminated communities. As will be discussed in the response chapter, joining the lawsuit was a stigmatizing process especially for the named plaintiffs. Suit members were seen as threatening the economic health of the community by threatening DuPont. Residents feared DuPont would shut down, cut jobs, or move production overseas. Still, the suit went forward and DuPont survived. In 2004 DuPont agreed to settle the suit with a complex agreement in which the majority of funds ($70 million of a total of $103 million) would be used to conduct a
biomonitoring study of community residents.\textsuperscript{15} In negotiations with the court the settlement provided for an independent testing body, the C8 Health Project. Additionally, an independent health and science advisory board reviewed the gathered information and made assessments of the health outcomes of C8 exposure. This review board, now known as the C8 Science Panel, has certified six diseases linked to C8 exposure. The settlement provides that class members with one or more of these diseases are entitled to medical monitoring funds from DuPont, though the nature and amount of these funds is in the process of being litigated (Interview with Plaintiffs Lawyer 1).

\textbf{The CEET Study}

In 2003 Washington County physician, Dr. Hong Zhang, prompted by several of her patients’ expressions of concerns about C8 exposure, contacted her mentor Dr. Edward Emmett at the University of Pennsylvania. At this time, hearings continued in the class action suit against DuPont, was keeping C8 in the public eye. Dr. Emmett agreed to collaborate with Dr. Zhang and contacted the Little Hocking Water Association (LHWA), hoping they would partner in the study. LHWA wanted to remain neutral, keeping open their option to sue DuPont. Instead, they partnered with the Decatur Community Association (DCA), a group primarily focused on trusteeship of public buildings. The DCA stepped up as a community partner in what has been recognized as a strong example of community-based participatory research (Tillett 2007).

\textsuperscript{15}The settlement provided for another $235 million in additional class compensation (medical monitoring) if exposure was tied to negative health outcomes, which it was (Lyons 2007, Pg. 87; C8 Class Action Website http://www.hpebd.com/Personal-Injury/DuPont-C8/C8-Class-Action-Settlement.shtml)
The CEET study tested 370 community members, recruited by a stratified random sample, who received water from the Little Hocking Water Association, a community owned water service between 2004 and 2005. Study partners reported back individual exposure results to participants before the overall results were released to the community or published in peer-reviewed journals (Emmett et al. 2006a). Participants received a one and one half page letter that reported individual C8 levels and a comparison to their municipality’s average. Participants could then opt to join community meetings led by the DCA and researchers, and were encouraged to contact researchers directly if they had questions about the meaning of their results.

The CEET study found C8 levels 60-75 times higher than the national average, based on NHANES, a national study which uses a representative sample of the population to determine health and contamination. The team reviewed multiple C8 exposure pathways, ruling out atmospheric deposition, and identified drinking water as the primary exposure source, and noting other water uses and occupational exposure as contributing factors (Emmett et al. 2006a). C8 exposure was associated with higher cholesterol levels (Emmett et al. 2006b), lower birth weight and pre-term birth (Nolan et al. 2009), and pregnancy-induced hypertension (Nolan et al. 2010). On the day CEET study results were made public, DuPont announced delivery of free bottled water to LHWA municipalities, implicitly recognizing their role in the contamination and representing an important gain for the residents. Follow-up testing approximately two years later by CEET researchers proved that LHWA members’ C8 concentrations fell 26%, a change Dr. Emmett attributed to the report-back as 76% of those retested changed their water use behavior within three months of public dissemination of the results. (Emmett et al. 2009; Tillett 2007).
The C8 Health Project and C8 Science Panel

The C8 Health Project grew out of the 2004 class action settlement. The plaintiffs’ lawyers used settlement funds to undertake a large-scale biomonitoring study of the affected population. Between 2005 and 2007, the project tested over 69,000 people and reportedly turned away people who wanted to participate. Participants received $400 each in compensation, while CEET study participants were not compensated (Lyons 2007, p89). Both the CEET and C8 Health Project used similar collection and testing methods and procedures, setting up testing sites in close proximity to affected populations. The C8 Health Project paired a health survey and qualitative self-reports with extensive laboratory testing for both health markers and 10 different PFC (perfluorinated compounds) levels in participants’ blood to explore relationships between C8 exposure and health outcomes (e.g. blood sugar, cholesterol) (Frisbee et al. 2009; Steenland et al. 2009a-d).

The C8 Health Project provided free testing to a medically underserved area of Appalachian Ohio and injected roughly $70 million into the area through study compensation, jobs, and related economic activity (Lyons 2007, p 94). In cases where researchers were able to identify health risks such as high cholesterol or dangerously poor organ function, the C8 Health Project could be credited for saving lives (Lyons 2007, pp 93-96). One interviewee related that she learned of her high cholesterol through the C8 Health Project, something she would not have known otherwise, as she could not afford regular doctor visits. When she took her results to her doctor, he immediately put her on cholesterol medication. Hypercholesterolemia has subsequently been labeled as one of six C8 exposure-related diseases by the C8 Science Panel,
the group appointed by the Court, which is responsible for analysis of data obtained by the C8 Health Project (C8 Science Panel 2012d)

The C8 Health Project established a significant body of biomonitoring information that has been used by the C8 Science Panel as well as by outside researchers. That almost 70,000 people participated makes it one of the largest study populations for an emerging contaminant, with impact extending far beyond the Ohio River Valley. It has produced 38 articles on the relationship between C8 exposure and health outcomes including hyperactivity (Stein and Savitz 2011), liver function (Gallo et al. 2012), pregnancy outcomes (Savitz et al. 2012; Stein et al. 2009) and thyroid function (Lopez-Espinosa et al. 2012a). Furthermore, the C8 Science Panel has identified significant associations between C8 exposure and six diseases: kidney cancer, testicular cancer, ulcerative colitis, thyroid disease, pregnancy-induced hypertension (including preeclampsia), and hypercholesterolemia (C8 Science Panel 2011, 2012a-d). Based on these findings, the Court appointed a Medical Monitoring Panel to develop monitoring protocols for each of these diseases. Class members who have these “probable link” diseases are able to petition the court for compensation. Currently 2700 lawsuits have been filed and a plaintiffs’ lawyer reported that he expects more than 3000. (Plaintiffs’ Lawyer 1, July 2014). Plaintiffs wait for the outcome of these lawsuits, which may take years.

The Continuing Exposure Experience

The exposure experience is a concept which draws its meaning from social, molecular, and environmental factors. Each exposure episode will have its own events, its own effects, and its own exposure experiences. Sometimes people are exposed to well-known chemicals for
which there are established procedures and known effective responses and treatments, as with lead. However, due to our understudied chemicalized environment there will be cases where people are exposed to emerging contaminants. In these cases, where the information about the effects of the chemicals, including long term and generational effects, have not yet been fully studied, the exposure experience should be expected as an ongoing process which may never conclude.

Exposure experience is an ongoing process beyond the issue of incomplete science. Other social factors contribute to the continuance of the process such as regulatory action, legal proceedings, and community response. Depending on the specific case, dealing with the results of the exposure may never fully be completed to the satisfaction of those exposed and the larger community. Even when response activities cease, when lawsuits are settled, and chemicals banned, we can still expect the exposed to wonder how their day to day life is being affected by their exposure. It is up to them to decide when their exposure experience is over, and even then it becomes part of our chemicalized history.

In the case of the C8 exposure episode, the exposure experience is ongoing. The C8 Science Panel and other researchers are continuing to mine the data of the biomonitoring projects; pushing forward and refining our understanding of the health effects of C8 exposure. Lawsuits for medical monitoring continue to be filed and litigation may continue for years without a settlement. The LHWA is still in litigation with DuPont for funding to operate the water filtration system in perpetuity. The people I spoke with are still dealing with their exposure, as will be reported in the following chapters. Some have illnesses which have been linked to C8 and these are daily reminders that their experience is not over. Others want to know
just how much C8 is in them. The next three chapters will examine the stages of exposure experience that they went through and provide insight as to the reason for their actions.
Chapter 4: Exposure Discovery

Introduction

It started with a letter

On October 31st 2000 my wife went out to get the mail and she brought it in the bill from our Lubeck Public Service, our water department here... there was a letter attached with it, the billing, and it stated the fact that in compliance with the Safe Drinking Water Act and the state of West Virginia... in order to ensure tap water, safe drinking, US Environmental Protection ‘duh da, duh da’,... all that was fine. (But) Then it says that ‘an unregulated chemical for which Lubeck Public Service has monitoring data is Ammonium – whatever, you know (APFO – C8 salt form) also known as PFOA or APFO-c143 and C8, which is used at DuPont Washington Works. Attention has recently been focused on PFOA because it is one of several products phased out by the manufacturer, 3M Company’. You know, this is just a lot of jargon, so I just kind of skimmed over it. The next sentence (said): ‘PFOA is a persistent chemical that is slow to be eliminated from the bloodstream of people who have been exposed to it. DuPont reports that it had toxicological and epidemiological data to support comments that exposure guidelines established by DuPont are protective of human health...’ Red Flag pops up... You know, and also it goes on down here... ‘PFOA is unregulated for drinking water purposes, that it had no limit established by regulatory agencies... ‘These levels are below the DuPont guideline and DuPont has advised the district they’re confident that these levels are safe.’ Ok, that’s the letter I got. It was addressed to us. I took it in and laid it on the desk and throughout the next couple months I heard of children having trouble with their teeth turning dark. Also, within a stone’s
throw, three young men having testicular cancer... I got to thinking about it and it got to bothering me and I talked it over with my wife and I said 'you know, you gave me a letter out there one day, when you went out to get the bills there was a letter from Lubeck Public Service about a chemical in the water, C8. It said according to DuPont standards it was safe. And she said 'well what does DuPont have to do with our drinking water? I said good point. So I started getting curious. (Interview with John, Class Action Plaintiff)

June and John’s exposure experience began with this letter, which provided the impetus for them to consider that they had been exposed. John describes how reading about purported “safe levels” of this substance he had never heard of caused “red flags to pop up”, however, that information in and of itself did not prompt June and John to consciously do anything at that point. Instead, the letter “laid on the desk”, as much as the concept of possible exposure it alerted them to sat in the back of their minds. This unconsciously added to a kaleidoscope of lenses with which they sorted through the constantly incoming sensory information of life. This frame or lens was not “put away”, instead it began marking certain information they came across as data that could be related to their exposure, such as the strange local prevalence of testicular cancer. It was the slow stewing of this new ‘frame’ of possible contamination. that prompted June and Jon to take more formal action and begin to identify whether or not they had been exposed to C8.

This chapter describes the discovery process, the first stage of the exposure experience. Discovery is a process which begins with the introduction of the possibility of exposure. Without this identification of the possibility of exposure, what I call the “exposure impetus,” there can be no exposure experience. If people pay attention to this impetus, it beings
their journey of understanding and response that is the exposure experience. Discovery is part of the overall process of understanding exposure; I intentionally separate it as a first stage to highlight how discovery is centered on the question of “Have I been exposed?” The rest of the understanding process centers on determining the meaning of, and response to this exposure. The chapter will proceed with a discussion of the concept of discovery and the barriers and portals which influence this process. I will then describe the stakeholders involved in the identification process and the roles they played. This will demonstrate the interrelation of action by community members, DuPont, regulators, lawyers, and researchers in the collective discovery and overall exposure experience process.

Defining the Exposure Discovery Process

The exposure experience begins when an individual becomes faced with information on their possible chemical exposure, the exposure impetus. This information can come in many forms: e.g as a news report about a chemical release or of new research on the human body burden\(^\text{16}\) of a legacy chemical workers may be exposed to during a manufacturing accident or may develop suspicions prompted by office scuttlebutt; community residents may develop knowledge about a local disease cluster or be concerned with a strange industrial odor and begin asking questions about possible causes. For some, suspicions may lay dormant until prompted by a new impetus, as with this woman whose husband retired from DuPont:

\(^{16}\) Body Burden refers to the total bioaccumulation of toxic chemicals in a biological organism at a given time. (Coming Clean: What is Body Burden. http://www.chemicalbodyburden.org/whatisbb.htm) Naturally occurring and anthropogenic substances a body is exposed to can build up within the tissues of that organism. Depending on the type and amount of the exposure these substances can contribute to negative health outc
Well a lot of times people know ahead of time that something is a danger but they try to keep it covered so as not to create a problem for whatever outfit or company is putting it out there. They try to keep it quiet for a while and all of a sudden it comes out.

**Figure 4.1: The Exposure Experience**

![Diagram](image)

This exposure impetus, whatever its source, must cross the ‘liminal barrier’, the point at which a person consciously entertains a piece of data as opposed to the preconscious sorting of information in which we are constantly involved. This preconscious sorting is what allows people to function in a world which is constantly throwing extensive information at them, which they then must choose where to put their attention. It is the moment when a piece of information passes through this sorting process into the conscious mind that one can to being to consider chemical exposure, with the ultimate goal of proving or disproving such exposure. Once exposure is identified, the *understanding process* move forward and the guiding question becomes “What is the meaning of exposure?”
The discovery process for each exposure episode will have a different specific history, as they arise out of different shared eco-social contexts (Altman et al. 2008; Judge et al. 2015) which influence meaning construction and interpretation in each case. Furthermore, the process will vary slightly by individual, due to each person’s unique situation, skills and experiences. It is through the interaction of stakeholders that the specificities combine to form collective accomplishments of social discovery of exposure. While each person’s actions in such collective processes are valuable, in attempting to draw more generalizable understandings of these processes it can be useful to sort discovery actions in two general categories which I call ‘portals’ and ‘barriers’. Portals are structures, opportunities, resources, and network connections, which help provide access to exposure information. They gather exposure data and interpret existing or new exposure information. Barriers, are the opposite of portals, they make exposure identification more difficult because of physical, informational, legal or other means. Barriers and portals can exist independently of exposure cases. They may also be intentionally created or brought to bear by different stakeholders. In studying the collective exposure experience to understand why it unfolded in the way it did it is necessary to understand how portals and barriers were used.

**Portals and Barriers**

The letter from the Lubeck Public (Water) Service provided June and John a portal through which they were able to view the possibility of their exposure. This portal is an institutional construction, opened through the linked actions of private citizens and institutional actors. It ties together a series of events including: the die-off of the Tennant herd, legal action which brought from behind the corporate wall DuPont’s knowledge of chemical contamination,
and the function of state regulators and local water services to provide safe, clean water. In effect, the letter was a next step in a series of portals through which contamination information became available to the contaminated community, including word of mouth, courthouse gossip, media coverage, and the formal process of legal discovery.

In exposure episodes, information which can prove or disprove exposure exists, whether it is hidden behind a chemical plant wall, given off as smoke through a smokestack, existing incognito as part of a consumer product, or concealed and concentrating in one’s fat cells. The operative questions are: ‘do people have portals to access this information?’; and if so, ‘does the information prompt them to question their chemical exposure’? Theoretically, if a person had the expertise and resources, they could continually test their exposure to chemicals in the air they breathe, water they drink, and in any other vector it occurred to them to test. In doing so however, they would still face informational limits, such as detection limits inherent to the methods and technology used and knowledge gaps between known contaminants which have established testing methods and unknown contaminants which may show up in data as ‘noise’ or may not show up at all. The inability to see these contaminants does not disprove their existence; rather it represents barriers to their discovery. These issues of knowledge gaps and methodological/technological detection limits are to be expected in what is a cutting edge, burgeoning field of scientific inquiry. They also represent an informational barrier to exposure discovery, even when in the hands of the most knowledgeable experts. In many cases of public or community contamination the person seeking to identify exposure is not the foremost authority on exposure, but is rather a non-expert, compounding the knowledge gap needed to prove exposure (Brown 1997; 2013). It is likely that these ‘lay practitioners’ will have to seek
expert help as a portal to access and to be able to interpret such information. Doing so (accessing experts) represents an additional barrier. Further, these non-experts face resource barriers, such as not having access to the technological or financial means for exposure testing.

Still, with all those barriers, lay discovery and citizen science have been central to the discovery of chemical exposure (Brown 1997; Brown and Mikklesen 1997; McCormick et al. 2004). Through their everyday lives people develop interpretive schemas or “taskscapes” which help them organize, sort through, and give meaning to incoming information (Ingold 2000). Through these taskscapes17 people are well equipped to identify abnormal or novel stimuli, such as a child’s strange sickness, a noxious smell or taste, or a loud explosion at a nearby chemical plant. Abnormal information that falls outside of normal taskscapes can prompt people to explore the source and meaning of this abnormality. Sometimes this knowledge of exposure is normalized, but often enough this abnormal information can prompt people to explore further. Eco-social contexts influence personal taskscapes such that people living around DuPont had become habituated to strange smells and particle deposition. Further, preliminary evidence shows that the community was resigned to accepting a tradeoff of environmental externalities for jobs and the community’s economy. Depending on their personal experience, resources, and frames of reference, people can choose to explore or ignore such stimulus; a decision which itself represents a self-created barrier to further identification activity if one chooses to ignore the stimulus.

17 While these possible markers of exposure can become normalized over time, as the concept of taskscapes implies, this process takes time and out of the ordinary information can prompt people to explore further. Eco-social contexts influence personal taskscapes such that people around DuPont had become habituated to strange smells and particle deposition, and further, preliminary evidence shows that the community was resigned to accepting a tradeoff of environmental externalities for jobs and the community’s economy.
Importance of Framing

While taskscapes derive from day to day life (microsociology) as influenced by personal experience and shared eco-social history, one must also look at the power of macro-and meso-level interpretive schemas or frames which are propagated by both various parties to organize collective interpretations (Benford and Snow 2000). Frames differ from ‘dominant ideology’ arguments, which hold more of a top down control model over the freedom of thought; e.g., an argument that the ‘dominant ideology’ of capitalism precludes the majority of people from conceptualizing alternatives and resistance. Framing allows for the existence of alternative models, or competing frames, and turns people from subjects of ideological hegemony into thinking beings. For example, the growth of the anti-toxics movement as part of the larger environmental movement in the United States in the late 1970s and 1980s was marked by the construction of frames which tie industrial production and pollution with environmental and human contamination (Shabecoff 2003). Through the work of these movements, concepts such as concerns over toxic exposure have been framed as actionable public concerns that need to be addressed. Framing works much like a ‘window frame’ which can not only make these issues visible, but it can help to mark useful portals and interpret the information obtained through those portals.

The Two Portals

The two key informational portals utilized by Mid-Ohio Valley residents to identify chemical exposure were legal action, specifically the legal discovery process, and bio-monitoring
studies. These methods are not individualized but, rather, are collectivized attempts by individuals, each with their own ‘story’ of inquiry. All participants would have experienced some sort of initial impetus. The impetus raises the question of ‘Am I exposed’. From interviews conducted with biomonitoring participants and with three plaintiffs in the legal action, the inciting information came from a mélange of conversation, newspaper coverage, letters from local water services, and by direct outreach from researchers and the legal team. The biomonitoring studies and the lawsuit collectivized these questions and provided a finding that exposure was factual and widespread which was supported by multiple experts, the court, and through its acquiescence to the settlement, DuPont. This leads us to ask what was it about these factors which enabled them to be used as portals to exposure discovery in this case.

**Legal Action as Portal to Exposure**

In a legal action once the party bringing suit, the plaintiff, convinces the court of the initial validity of their claim a case is allowed to proceed. It is at this point that the court opens *discovery*, a process which can drastically level the informational imbalance between a possibly exposed community and a polluting entity. While the court may issue limits, such as what information is deemed pertinent for discovery, the process, in essence forces a polluting entity to share any records it has which could relate to possible chemical exposure. While polluters may have incentives to not comply, especially by hiding documents, doing so opens them up to civil and criminal penalties in addition to public relations issues. DuPont, for example, faced fines from the EPA as a result of not disclosing information in 1981 about the threat to female workers from C8. They settled, paying $10.25 million in fines and another $6.25 million to fund
supplemental environmental projects: a $5 million fluorotelemer degradation study and $1.5 million in educational support to Wood County WV. Public schools. (Lyons 2007, pg. 84-85)

Legal action is not without its problems as a tactic for identifying and understanding exposure as it comes with specific structures and expectations which represent barriers. The first barriers are resource questions. Before they engage with the legal process individuals and groups must determine if they are willing to expend the time and resources which it would take to launch a legal fight. Legal actions can take years and be very expensive. By bringing suit, plaintiffs can open themselves up to “strategic lawsuits against public participation” or SLAPP suits. These countersuits can further the time and expense which must be undertaken. Prospective plaintiffs must also consider the stigma of unpopular legal action, which may mark them as trouble makers and cause them social stress or even acts of reprisal.

Beyond the resource and social barriers are legal barriers which govern access to the legal system. Plaintiffs must establish “legal standing”, meaning proving to a court that one’s case falls under the authority of the court. Plaintiffs must convince both their legal team and the court that the dispute in question contains a legal issue, such as the breaking of law or a contract. Once suit is brought then the plaintiff’s face the challenge of proving their case and achieving a positive ruling or using their position as leverage to negotiate a positive settlement. In doing so, they are challenged at every turn by the defendants’ legal team, whom in most cases will have more resources to bring to bear to their defense than will the plaintiffs. For example in the C8 class action, DuPont had the resources to support both in-house and outside counsel, making them able to harness more legal expertise than the affected community. Such imbalances in access to ‘legal labor’ can allow corporations to bury less resourced plaintiffs in
legal motions and even countersuits (Abrams 1989). The discovery process is similarly affected by these issues of skill and scale, as motions for discovery can be met with an avalanche of documents, often irrelevant, which must be reviewed. Further, the legal system can create legal decisions which are disadvantageous to exposure discovery and understanding. The Tennant lawsuit for example, which preceded the C8 class action, ended in a sealed settlement (Lyons 2007, pg.19). This prevented exposure information from being disseminated to the public; it took a second lawsuit three years later to bring this information fully to light.

In the face of all of these barriers, legal action was made extremely useful to the C8 exposure experience, affecting each of the discovery, understanding, and response processes. The initial legal discovery process in the Tennant case gave Robert Billot’s legal team the information they needed to bring the second suit, which exposed DuPont’s knowledge of extensive C8 contamination in the groundwater of communities surrounding the Washington Works plant. This information provided leverage which was used to negotiate a settlement with DuPont. This settlement funded the C8 Health Project and along with the CEET study, gave scientific proof of this contamination. The publicity from the lawsuit and the recruitment of participants for the C8 Health Project worked to inform people about their possible exposure, strengthening already existing exposure questions and sometimes prompting them for the first time (Lyons 2007, P88)

The legal discovery period seems particularly useful to individuals and communities faced with informal disparities between themselves and polluting entities. Legal discovery can force a polluting entity to open its books to exposed parties, making available internal memos, reports, and other documents which contain exposure information the community to would
otherwise not have access. Such documents can be useful as leverage in negotiating settlements and arguing for legal decisions as they can prove ‘who knew what when’ type questions. This information of ‘who knew what when’ can speak directly to issues of illicit activity, cover-ups, regulatory noncompliance, and information about health risks of exposure. Through the legal discovery process in the C8 exposure episode, plaintiffs not only learned that DuPont had knowledge of extensive C8 contamination, they also learned that DuPont had concerns about the effect of C8 on developing fetuses due to two cases of birth defects in female Teflon workers (Lyons 2007, pg.30, Interview with John). This caused them to remove women from Teflon production years before the community learned of its exposure and became concerned about health risks. In short, legal discovery, even with the access and resource barriers of the legal system, is one of the most powerful portals to access exposure information in situations of informational imbalance between community and industry. Without legal discovery the C8 exposure episode would look quite different.

**Biomonitoring as Portal to View Exposure**

Biomonitoring report-back studies were the other main collective form of exposure discovery undertaken in the Mid-Ohio Valley. Like the legal system, biomonitoring comes with its own limits and issues. It is a rather expensive process that not every individual or community would be able to afford. Arguably it would not have been available at a group or community level without the availability of outside funding. The CEET study was funded through an $800,000 grant from the National Institute of Environmental Health Sciences, obtained through the efforts of Dr. Ted Emmett and his research team (Lyons 2007, pp 99-100). It is unlikely this would have happened were it not for a personal connection between local physician Dr. Zhang
with her mentor, Dr. Emmett. Had the community attempted to apply on their own for this grant, it is unlikely they would have been successful in obtaining it and, further, may not have even known of such a possibility without their expert partners. Similarly, the C8 Health Project was funded through the 2004 class action settlement and would have been impossible to undertake at such a scale without this funding.

Aside from the ‘opportunity cost’ to access biomonitoring, there are also significant informational barriers. These barriers fall into two distinct categories. First, affected individuals and communities are unlikely to have wide expertise in the biological, epidemiological, and medical fields. This represents a barrier in being able to meaningfully interpret the information received in biomonitoring report back without expert guidance. Secondly, even with expert guidance, there is a gulf of difference between what chemicals can be tested for and how much is known about the effects of those chemicals. This inability to interpret the meaning of chemicals found in ones’ body poses more of a problem for the understanding process than it does for the discovery process. Knowledge of the presence of chemicals is of primary importance for discovery and biomonitoring report-back provides this information with the highest degree of certainty.

Biomonitoring that does not include report-back is another growing portal for the discovery of chemical exposure. The National Health and Nutrition Examination Study (NHANES), for example, combines biomonitoring for chemicals with epidemiology, medical, and nutritional science, examining 5000 U.S. citizens a year to give a representative picture of health and exposure in the United States (CDC 2009). The CDC, using data collected from NHANES, has released four National Reports on Human Exposure to Environmental Chemicals
and, as of March 2013 has released data on 246 chemicals found in the serum of the sample population. While NHANES does not directly report results to tested individuals, it provides a useful portal into the ubiquity of chemical exposure in the U.S. Population. In the Mid-Ohio Valley case, the two locally focused studies featured participant report back, giving finite levels of exposure to participants, proving their exposure in the most certain way available. The information developed in these studies, as we will see in the next chapter, goes far beyond identifying exposure and has been an important factor in the development of the meaning of this exposure. The following sections will discuss how different stakeholders utilized portals and barriers to effect the C8 exposure experience.

**Exposure Discovery: Where the Action Is**

Exposure discovery exists in a range of behavior between expert lead institutional discovery and lay epidemiology, like that practiced by June and Jon.

**Figure 4.2 Spectrum of Exposure Discovery**
In this section we will highlight the interaction between stakeholders in exposure discovery and the barriers and portals they utilized. Figure (4.2) depicts such stakeholders on a continuum of information control from the perspectives of exposed exposed community. By this I mean that the exposed community has differing amounts of control or access to each stakeholders’ information. The more centrally controlled institutional forms towards the left hand side of the graph represent the least amount of access to information and say over how that information is used. As one moves from left to right on the continuum the access and control the exposed community has increases with the more de-centrally controlled informational forms on the right. Information about exposure is the central factor in the entire exposure experience. As exposure information is gathered, the nature of the entity gathering and interpreting that information guides where that information will go and how it will be used. Exposure does not take place in a vacuum, rather it takes place in complex social system with many different interests and liabilities (Edelstein 2004)

Institutional discovery, such as the discovery of C8 exposure by DuPont, is an expert led process which takes place in corporations, government agencies, and research universities. Corporations and government agencies are top-down, goal-oriented structures, both tasked with identifying hazards. However, they do so for differing reasons. Corporations, especially those which manufacture chemicals, have a financial incentive to internally identify hazards their actions create because these represent financial and public relations liabilities. As such, corporate discovery of exposure may or may not prompt dissemination of this information to government regulators or the public. The material incentive to not to disclose information is a
barrier to such action, especially since legal grey area exists about what corporations must disclose (Markowitz and Rosner 2003).

In the case of chemical contamination in the Mid-Ohio Valley, DuPont learned of community contamination well before regulators and affected residents. The central control of information by DuPont, whose chief responsibility is to return a profit to investors rather than to the public good, acted as a barrier to this information reaching the public. This is not a unique case, it represents a systemic problem by which the creators of many toxins have a material interest in obscuring exposure discovery. As a community member I interviewed put it:

I think it's good that the C8 started – not started. It didn't start. It's been going on, but it's an ongoing problem that plants, chemicals might have on the system, whether it's for the fertilizer, whatever it is, but it's good that it makes the chemical plants be aware, keep them aware, keep the – I'm not saying that they keep everybody aware, but I'm sure they're doing studies other than at DuPont, but they're doing studies at Shell, FMC. Everybody's doing studies and research, not necessarily – I'm not gonna – they're not gonna spout it out to the paper and say, "Here's what we're doing and here's what we're finding. We're finding high levels of this and high levels of that, but we don't have any reason to believe it's hurting you, but here's what it is." They're not gonna publish that. I'm sure they're doing it.

Another married couple who were exposed by DuPont highlighted how even when people outside of the plant learn of a problem through unofficial channels, problems are not reported through official channels. It is as if they never happened:
P3: I just think that getting out the information when they have a… Like when they had that chemical spill that happened over here. It’s happened at different times, and it might be weeks before you’d ever hear anything about it. And they had one where they didn’t know how much leaked out into the air or anything about it… I think any time something like that happens the public should know.

P2: One of the members of our church works up here at Krayton and when there’s a fire or anything he goes in. And one Sunday he got called away from church about a month ago or two months ago and his wife said that he called her and told her, “Chrissy get the children and get out of here. Go to your mom and dad’s, don’t stay here.” And she told him she wasn’t going to do it and he said “Yes you are.” He said ‘Get the kids and get away from this area.” But see nobody else knew anything about it. It was never in the paper. Nothing.

Interviewer: Are there warning alarms or anything around?

P2: Yes, we have them but nothing went off.

P3: When they had some kind of explosion over there at that time then there was a chemical spill or leak and everywhere’s got one of these, they got one down the road here they got in Belpre, them big ol’ sirens everywhere and none of them went off. Anything that happens they try to keep it quiet and that’s not fair to the communities when they don’t let you know what’s going on. That’s what makes a lot of the people angry is because we just don’t get the information we need to know.
Corporate ownership of information, through physical property and intellectual property rights is strengthened by resource and expertise imbalances in relation to surrounding communities and the general public. The result are structures and practices which inhibit parties outside of the corporate entity, including regulators in some cases, from being able to view the objective reality of corporate activities and the “chemicalized regime of living” they create (Murphy 2004). These regimes develop out of the interaction of local history with larger political economic, scientific, and cultural forces which differ by community context. They function at the systemic level to facilitate continued capital accumulation of polluting industries while limiting the ability to resist this type of production and its inevitable externalities. At the meso-level these regimes work through “techniques of unknowing,” cultural practices of science, such as the discounting of low dose effects of chemical exposure or devaluation of animal exposure studies, which can work to spread doubt and bias over exposure and other types of information.

In the case of C8, DuPont learned of worker exposure to C8 from 3M, their C8 supplier in 1980 (Lyons 2007, pg. 29). It learned of the presence of C8 in groundwater in communities surrounding the plant in 1984 through DuPont studies (Lyons 2007, pg. 30). This information was not widely disseminated until after the two lawsuits against DuPont. It came to light through legal discovery. This information however was not ‘owned’ by the workers and the communities, but was the intellectual property of DuPont and 3M, who chose to keep it ‘imperceptible’ to the public. This practice of controlling exposure and health effect information behind the corporate veil, is not a special case, rather it is representative of the ubiquitous practice of ‘siloing’, or creating barriers to access information, by corporations whose chief
responsibility is not to the public welfare but instead to create profits for shareholders. Increased public access to exposure and health effect information represents a constant threat to polluting companies, as this information can be used to challenge corporate activities in regulatory, legal, and public relations arenas.

Exposure information control is however, not the only corporate tool. Corporations also engage in impression management activities which attempt to control how information is interpreted. Most commonly this activity falls into categories of marketing, which are used to sell products and public relations, which are designed to promote and protect the corporate image (Stauber and Rampton 1995). For more specific impression management of environmental issues, corporations have been found to sponsor political and community activism to counteract activism and framing of concerned communities through front groups and ‘astroturf’ organizations (Helvarg 1994; Mix and Waldo 2015). In the C8 exposure episode a different strategy of impression management was employed, in which DuPont promoted to regulators and later to the public, the frame that the community exposure to C8 was within “safe levels”:

C8 is found in the groundwater below the Dordrecht (DuPont Plant, Netherlands) and Washington Works sites and at low levels in the Parkersburg Lubeck water system and in the water supplying the sanitary water to the Washington Works site. C8 levels in these waters are all below the Community Exposure Guideline of 1 part per billion except that the Washington Works site has 2/3 parts per billion” (DuPont Strategic Plan for C8 Zipfel et al. 2004. C8 Ammonium Perfluorooctanoate Fluorosurfactant Strategies and Plans), quoted in Lyons 2007 pp. 38-39)
Safe levels are a risk-based toxicological concept which assert that there are concentrations of known toxicants to which people can be exposed which will not cause them discernable harm. This is the belief behind the aphorism the *dose makes the poison*. For example, some substances at low levels may be helpful to human health, such as iron or sodium. Above certain levels these same substances can become harmful or even deadly. Other substances, such as lead and mercury, have been found to have no safe levels. Furthermore, ongoing study of endocrine disrupting chemicals, meaning chemicals which can interfere with or mimic hormones, shatters the idea of safe levels (Colborn et al. 1996; Vandenburg et al. 2012). These chemicals, of which C8 is suspected to be, may not act in the classic dose-response model, meaning that the amount of the dose may not directly relate to the amount of effect. Instead effects may have to do with genetic interactions or exposure during critical periods.

In practice what the public may understand as a safe level may mean something different to a toxicologist. For example, a toxicologist may be referring to ‘acceptable daily intake’ (ADI) which is the safe level of a substance that can be ingested daily for a lifetime without increased health risks. Or they may be referring to the ‘no observable adverse effects’ (NOAEL) which means the highest dose of a substance at which no negative health effects are found. These levels are expected to be based on peer reviewed toxicological studies and form the basis of toxicological risk assessment. However, the concept of safe levels when used as impression management in exposure episodes may not always rise to this scientific challenge.

The frames of safe community exposure levels was asserted early in the experience by both DuPont and regulators, and appear to be based more on impression management than on rigorous science. Lyons reports that in the late 1980’s DuPont set about to establish ‘safe levels’
for C8 exposure in their workers, culminating in an exposure study by DuPont toxicologist Gerald Kennedy based on new workers exposed to steady airborne concentrations for eight hours each day (Lyons pg. 38). Based on this study Kennedy concluded that the safe C8 blood level for employee’s was 500 parts per billion (ppb) and by extension that “an acceptable level for community drinking water would be five parts per billion” (Kennedy’s Internal Memo, quoted in Lyons 2007, pg. 38). This study was not peer reviewed, nor was the community involved in commenting. The purported safe levels filtered through the water districts, culminating in the letters announcing the presence of C8 in drinking water. Instead of assuaging concerns that C8 was within safe levels, prompting people not to explore further, the exposed community still began to question whether they had been exposed and what the meaning of the exposure was.

**Socio-Economic Power**

Corporations can also exert normative and economic power over their neighboring communities, especially in economically disadvantaged areas like the Mid-Ohio River Valley and the larger Appalachian region (Shriver et al. 2014; Gaventa 1982; Phillimore and Bell 2005). Gaventa’s classic work on corporate power in Appalachia, centered on the almost hegemonic power of the coal industry, argues that in areas such as Appalachia, where corporate entities control economic production, infrastructure, and exert great political power, this level of control produces quiescence on the part of workers and communities. This means that people are quite unlikely to even question corporate activities. Beyond simple mechanisms of controlling job access, large corporations in areas like Appalachia can exert ideological control over the community and can influence community shaming or even violence towards troublemakers who threaten the status quo of corporate dominance. Phillimore and Bell (2005) argue a slightly
different, less ideological approach to corporate power in economically disadvantaged areas, holding that corporate power can be based on community trust in the corporation which develops overtime out of the history of interaction between the company and the community. They employ the symbolic interactionist work of Ingold (2000), who argues that people develop “taskscapes” in which “We habitually naturalize and normalize the settings we inhabit through our activities, assuming virtues and benefits at least as much as we may be provoked into doubt, disaffection or resistance.” (Phillimore and Bell 2005, pp. 312-313). In this way, individuals and communities with high levels of trust in local corporate entities, develop interpretations of everyday activities and information which assume the virtues and benefits of corporate activity while individuals and communities with lower levels of trust are more likely to develop doubt, dissatisfaction, or resistance to corporate actions. Indeed, we will see that both resistance toward and boosterism of DuPont were enacted by different groups in the contaminated area. However, due to limited sample size one cannot make causal inferences between levels of trust or dislike of DuPont and response pattern.

As we see in Table (4.1) more than half of participants had a family member that worked for DuPont.
Table 4.1: Interviewee Characteristics

<table>
<thead>
<tr>
<th>Interviewee Characteristics</th>
<th>n. 19&lt;sup&gt;18&lt;/sup&gt;</th>
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</thead>
<tbody>
<tr>
<td>Worked for DuPont&lt;sup&gt;19&lt;/sup&gt;</td>
<td>6</td>
</tr>
<tr>
<td>DuPont Family&lt;sup&gt;20&lt;/sup&gt;</td>
<td>11</td>
</tr>
<tr>
<td>Participated in CEET Study</td>
<td>16</td>
</tr>
<tr>
<td>Participated in C8 Health Project</td>
<td>19</td>
</tr>
<tr>
<td>Participated in Class Action Suit</td>
<td>3</td>
</tr>
<tr>
<td>Demonstrate Trust in DuPont&lt;sup&gt;21&lt;/sup&gt;</td>
<td>2*</td>
</tr>
<tr>
<td>Chemical Industry Boosterism&lt;sup&gt;22&lt;/sup&gt;</td>
<td>7</td>
</tr>
</tbody>
</table>

Were the sample size higher I could make statistical inferences between DuPont family status and response patterns. At this point I can only point out that all of the people who either worked for DuPont or had a family member that worked for DuPont participated in biomonitoring. This makes me think that participation in biomonitoring was seen a less threatening action towards DuPont than legal action, in which only three interviewee’s

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<sup>18</sup> Mid-Ohio Valley residents who participated in biomonitoring studies and/or legal action against DuPont

<sup>19</sup> Worked either as direct employee or contractor Washington Works Plant.

<sup>20</sup> DuPont Family: member of one’s family or oneself work for DuPont.

<sup>21</sup> Interviewee’s were not directly asked about their feelings of trust for DuPont. Here I am reporting the number of people whose discussion of DuPont mentioned having a level of trust or show, by my judgment, trust in DuPont. Helpful in making this assessment was viewing the ways in which people expressed their views of safety at DuPont this this reflects a judgment which is related to the way they view DuPont. Further, vocal boosterism of DuPont, reported in the same table can also be seen as somewhat related to trust in DuPont.

<sup>22</sup> Boosterism: positive views and vocal support for the chemical industry and downplaying of negative issues related to chemical production. This differs from a belief in the economic need for the chemical industry, which can and was seen by some respondents as a tradeoff of economic benefit for environmental and health hazards. See Brown and Mikkelsen 1997.
participated. Also telling was the fact that not all of the members of DuPont families automatically volunteered\textsuperscript{23} trust in DuPont or boosterism of the chemical industry.

A few respondents did express aspects of trust in DuPont. For example one woman highlighted her trust in DuPont \textit{before} C8 contamination:

If I personally ever had anything that would happen to my body, I would never ever think it came from DuPont. It was just time for me to have this in my body. But we just never look at it as being anything harmful, because we breathe it, you drink it, you eat food that's got all this (contamination).

This is not surprising, since DuPont’s culpability in exposing people to C8, and their extensive knowledge of this contamination which they hid from the public, has been proven beyond a shadow of doubt. More commonly, when people talked of their feelings about DuPont, they expressed the economic need for DuPont in the area: a frame which pervades the entire exposure experience. Whether or not people trust DuPont, their taskscapes and their lifescapes (overall outlook on life) directly or indirectly, are constructed with the belief of the need for DuPont. When they encountered the possibility of exposure, they did so in the context of this belief.

DuPont is an economic force in the Mid-Ohio Valley, and this force influenced people’s perception on their exposure. DuPont is one of West Virginia’s largest employers, ranking seventh in the state in 2003, employing 2400 full time employees at the Washington Works plant

\textsuperscript{23} Participants were asked about their trust in researchers, as the original study was focused on research practices. They were not directly asked about their level of trust in DuPont or the chemical industry.
at an annual payroll of $200 million (Lyons 2007 pp.22-23). These jobs are considered some of the best available in the region due to the pay, benefits, and prestige. DuPont workers and their families proudly call themselves “DuPonters” and Lyons reports that “even as news of the C8 lawsuit was making daily headlines, DuPont’s Dawn Jackson estimated the number of applications on hand for entry level work at twenty thousand” (Lyons 2007 pg. 23). DuPont also donates to local charities, sports programs, and schools as a “partner in education”.

What is more telling however is how people talk about the need for DuPont’s economic benefits. For example, a retiree from a different chemical company in the area said:

You can’t get rid of DuPont. Hell, they’ve got thousands of people working over there. They bring millions of dollars into this valley so you can’t get rid of them.

His wife echoed this sentiment saying “well, there wouldn’t be anybody in this valley if it wasn’t [for] DuPont.” A grandmother whose husband retired from DuPont shows that it was part of the local discourse:

In the paper almost at least once a week when they’re writing something about C8 they say that DuPont is our highest employer in this area and if the plant were gone where would these people work?

In terms of the discovery process, the effect of the frame of DuPont showed up in how a minority of interviewees viewed the goals of the biomonitoring studies, which were the main portals of access to individual and community exposure information. This played out as the fear that the studies would harm DuPont. For example, a successful business owner stated:
Well to me, the study is looking to see if there is a culpability on a part of the industry causing problems and if they don’t determine there is a problem I hope they will not further harass our employers.

When asked if they thought their community would benefit from participation in the CEET Biomonitoring Study, an elderly retire with no family ties to DuPont replied:

No … I felt that perhaps it would be a negative result and … because… we cannot afford to lose DuPont or whatever … payroll so I did not. I didn’t think it would be any benefit to the community. DuPont came here because no place else in the United States would accept them. Because their Teflon plants, they built three of them: one in Scotland, one in Germany, and one in West Virginia. And the ones in Scotland and Germany both blew up and … West Virginia was the only state in the union that would accept them. The stuff is violent and … the plant that is down here… the buildings, the Teflon building were built three sides brick facing inland so to speak; the fourth side facing the river is plywood so that if it blows up it would blow out towards the river… they’ve had one or two… I think one explosion. It occurred up high enough in the tower it blew one piece of metal up two miles or something.

He later said:

This [The DuPont Washington Works] is very definitely a hazardous plant and … so I was afraid that the study might cause them to pack off and leave so I did not look for local benefit to the study… It would be a disaster for this area because this area is built on our industrial plants. We had a large plant in Shell that’s of course now Krayton, and
they had a reactor blow up and … a big fire; they had every fire department within a big radius … they evacuated half of the city of Belpre and whatever, the fear was that they were going to pack off and leave…this area is dependent on their large employers…

It is striking that in two quotes this man expressed knowledge of severe safety hazards and accidents by DuPont and the local chemical industry yet at the same time argued that the community needs these plants. He was afraid that DuPont and other companies would leave as a response to a question about biomonitoring studies in which he participated. While he later expressed issues with chemical regulations which may or may not relate to his political philosophy, it is quite clear that he accepted and enacted the frame of ‘the need for DuPont’ which influenced his view of the CEET Study.

This man was not alone in his fears that the CEET Study would harm DuPont. A former chemical worker and member of a “DuPont family” said:

I thought that they were doing a study to penalize or to do something against the chemical companies… And I wasn't necessarily in favor of that, that the chemical companies are a way that provides thousands of people income, and they were trying prove that there was something wrong with them. I guess I thought maybe they were trying to get rid of the chemical plants in this valley, DuPont. You can't get rid of DuPont. Hell, they've got thousands of people working over there. They bring millions of dollars into this valley, so you can't get rid of them.”

Overall, five of the sixteen CEET Study Participants I interviewed expressed this concern that the biomonitoring study would be harmful to DuPont. That said, all of those respondents
participated in the study and the later Brookmar Study. Thus while they actively considered the frame of the ‘need for DuPont’ and the related frame of DuPont’s vulnerability, they ultimately took an action which stands in opposition to these frames. Still, the frame of economic need will pervade the rest of the exposure experience, influencing meaning and response patterns, which will be discussed in the following chapters.

**Government Agencies and Regulators**

Discovery activity may also involve government regulatory agencies and independent research institutions. Exposed communities can theoretically access exposure information through these entities in their publications, by reaching out to their employees, and in certain cases of intransigence through Freedom of Information Act requests. In practice however, exposed communities may find that government agencies represent institutional barriers to information. Famously, Love Canal mother turned activist Lois Gibbs ‘kidnapped’ two EPA officials in order to prompt them to answer the community’s questions and take action. In the C8 exposure episode, the Tennant family for years dealt unsuccessfully with state regulators before filing suit against DuPont.

Environmental regulators are directed by law and mandate to study and manage the environmental and human health consequences of industrial production; doing so on the basis of scientific study in interaction with government, corporate, and academic experts. This directive would seem to keep regulators separate from outside influence, but in reality, it puts them at the behest of political will, and leads them to balance environmental and health protections with economic concerns (Shogren et al. 1999; Zywicki 1998). While they have legal authority,
resources, and expertise, regulatory agencies are also constrained by several other factors. Regulatory agencies face the problem of decision making in the face of scientific uncertainty, as information on possible contaminants develops through an iterative process of epidemiology, animal studies, chemical analysis, and an inability to conduct experiments on human subjects. Further they face an ever-growing problem of scope, as new chemicals and processes are created every year. For example, a 1999 EPA study of 3000 high production volume chemicals utilized in the U.S. found that only 7% have complete toxicity profiles (EPA 2009a). What this means is that the majority of the most regularly produced chemicals are incompletely understood when it comes to their effects on the environment and human health. The growing scope of chemical contamination is not reflected in rising budgets for chemical regulators. It is not a scientific decision based on lessened risk; rather it is driven by politics. Environmental justice scholars show how direct and indirect penetration of government regulatory agencies has manipulated relatively strong environmental protections into more polluter friendly regimes (Bullard 2000; Faber 2008). These compromised standards, at best, attempt to balance economic growth concerns with human and environmental health and at worst privilege corporate power and profits over human and environmental health.

Beyond the national level, state regulatory agencies can play a role in exposure discovery, however, like their national counterparts, they too are subject to similar political and budgetary constraints. As we see above, the budget for the West Virginia Department of Environmental Protection is seeing a similar decline as all federal environmental regulatory budgets. Overall, the trends in the amount of money we as a society spend on environmental regulation shows that environmental regulation is not a strong commitment.
In the case of the Mid Ohio Valley C8 exposure, one cannot separate state political economic decisions from regulation. The State of West Virginia has formally tied part of its economic well-being to an economically successful chemical industry through investment in two special economic zones, the Chemical Alliance Zone and the Polymer Alliance Zone. These two partnerships between the state and the chemical industry are marketed by West Virginia as “The West Virginia Edge,” boasting “Industrial raw materials in vast supply and close proximity.” as well as being within “500 miles of 66% of the U.S. population” and cheaper production costs compared to the US average (Polymer Alliance Zone Promotional Video: www.pazwv.com). According to the Chamber of Commerce, West Virginia is home to 150 chemical and polymer companies, employing over 12,800 workers and contributing to 25% of the state’s overall international exports, or roughly $1.2 billion. The West Virginia Chamber of Commerce itself publishes an online publicity magazine called the West Virginia Edge, which promotes this idea of the “edge” that WV provides the industry (West Virginia Edge 2012). The first issue of the edge is particularly symbolic; its front page exclaims, “West Virginia Invented the Chemical Industry. Now We’re Reinventing it!”

The frame of the West Virginia edge has been formulated into a structural mechanism, the state-industry partnership in which the state provides direct subsidies, tax breaks, and infrastructure to retain and attract specific, desired industries. In return, these industries provide jobs, tax revenue, and increase the regional knowledge and capacity in the targeted productive sectors. This ideally creates further incentive for related producers and spin-off industries to do business in the area. States increasingly have moved towards ‘clustering’ approaches which identify existing regional concentrations in competitive industries which are seen as having a
high potential for economic expansion and spin-off industries and then providing targeted investments to promote industry expansion. This clustering approach takes advantage of existing structures, which reduces costs compared to having to produce a whole new infrastructure. It also points to issues of decision making in state/industry partnerships, especially what role surrounding communities play in these siting decisions (Gatrell and Callzonetti 2003). Such clustering approaches may not be appropriate for all industries and can be particularly difficult in “peripheral areas” whose “extractive economies” that have long served as the base of peripheral economies are not ‘naturally’ associated with the dense networks of trained professionals and the positive business climate found in learning regions.” (Gatrell and Callzonetti 2003, pg. 296) They further argue that it is precisely the absence of these structures that characterize the Appalachian economy, though universities have helped in the face of this lack of “innovation infrastructure.”

Funding for state/industry partnerships often comes in the form of federal earmarks in which federal funds are directed to specific state projects. (Gatrell and Callzonetti 2003) In West Virginia, there is a rich history of federal earmarks especially for the big three of coal, oil, and gas. Beyond the funds received in federal highway spending, which arguably benefitted most industries by reducing transportation costs, in the 1950’s West Virginia began received subsidies to support gas, oil, and coal industries in the region. In 1954, the US Department of Interior helped form the Appalachian Experiment Station (AES), which supported research on oil and gas exploration, coal mine health and safety, and coal gasification (Gatrell and Callzonetti 2003, pg. 297). In 1975 the AES was taken over by the US Department of Energy, and after multiple name changes, today it is the Morgantown office of the National Energy Technology Laboratory. In the 1980s Senator Robert Byrd (D-WV) was particularly effective at gaining federal earmarks
for the creation of the National Research Center for Coal and Energy at West Virginia University (WVU), the Concurrent Engineering Research Center at WVU, and the Robert C. Byrd Center for Advanced Flexible Manufacturing at Marshall University.

Prior to the 1990s, the earmark process was not directed by the state in any planned way, but was ad-hoc. The ideas for projects were often being brought into the state by industry representatives, or even federal agency officials, unofficially seeking West Virginia's assistance in obtaining continued or new program support (Gattrell and Callzonetii 2003, pg. 299). This change in state activity, from passive to active, may have been related to changes in another federal program in which WV participated. This program, the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR) coordinates federal agencies to invest in academic research and human resource development in states with lagging economies. In 1994 NSF required states to direct investments towards state defined goals in science and technology enhancement, raising WV’s decision making responsibility in how the federal money it received was spent. It was two years later, in 1996 that West Virginia Governor Gaston Casperton launched the Polymer Alliance Zone. Three years after that, in 1999, then WV Gov. Cecil H. Underwood issued an executive order creating the Chemical Alliance Zone, directly south of the Polymer Alliance Zone.

Overall there is there is a clear partnership between the state and the chemical industry in which the state has become heavily invested in the flourishing of that industry. Similarly, at the local level, people feel like the economic health of the surrounding communities are directly tied to the chemical industry, as seen in table 4.2. In the case of Little Hocking, DuPont has become
the face of this perceived need. This frame of the need for DuPont, both at the local and state level made the discovery process more difficult.

**Table 4.2: Economic Framing of Exposure**

<table>
<thead>
<tr>
<th>Participant Response</th>
<th>Participants (n=19)</th>
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<tbody>
<tr>
<td>Chemical Industry Boosterism&lt;sup&gt;24&lt;/sup&gt;</td>
<td>7</td>
</tr>
<tr>
<td>Need for Chemical Industry Jobs</td>
<td>12</td>
</tr>
<tr>
<td>Related Economic Concerns to C8 Exposure</td>
<td>13</td>
</tr>
</tbody>
</table>

<sup>24</sup> Boosterism means positive views and vocal support for the chemical industry and downplaying of negative issues related to chemical production. This differs from a belief in the economic need for the chemical industry, which was seen by some respondents as a tradeoff of economic benefit for environmental and health hazards. See Brown and Mikkelsen 1997.
Regulatory involvement in the Mid-Ohio River Valley exposure situation highlights how regulatory practices often evolve as “rear guard” actions in response to crisis or concerns that develop from the externalization of what come to be identified as harmful by-products or waste from the productive process. According to Lyons (2007) DuPont was required by law to report its products and waste to state and federal regulators. However, for the majority of time DuPont used C8 it had not been identified as a possible contaminant. Further, DuPont reported C8 waste externalization through a number of different chemical names and formulas, effectively hiding
the nature of and extent of its polluting activities (Lyons 2007, pg. 58). When the Tennant family began attempting to work with state and federal regulators to identify what was killing their cattle they were largely unsuccessful and this led to them pursue legal action against DuPont (Lyons 2007 pg. 10).

Regulators became more involved with C8 as an emerging contaminant when in 2000 C8 manufacturer 3M Corporation announced that it would discontinue its production of the chemical (Lyons 2007, pg. 109). At the same time 3M broke through the hidden nature of chemical contamination, by filing with the EPA a ‘Substantial Risk Notice’, a corporate disclosure which identifies a substance for which the corporation has significant health or environmental concerns. It is at this moment that one could argue that C8 became identified as a possible threat at the regulatory level and these concurrent actions prompted several responses by regulators. First, this filing initiated an extensive review of C8 and close isomers by the EPA, which culminated in two substantial regulatory actions: 1) a voluntary phase-out agreement of C8 between C8 users and manufacturers slated to take effect in 2015 (USEPA 2006); and 2) an ongoing EPA investigation into the entire class of “long chain”25 perfluorinated chemicals (USEPA ‘No Date’; 2014).26 Finally, this raised awareness of C8 as a threat. This awareness was combined with the dissemination of knowledge of community C8 exposure that was found in the Tennant case. At the same time Billot and his legal team began laying the groundwork for their class action suit and began recruiting plaintiffs. Further, local water services sent letters to their members

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25 Long chain refers to carbon chains of 7 or more linked carbons.
26 At the state level, the West Virginia Department of Environmental Protection adjusted the ‘safe level’ for C8 exposure to 150ppb, which was 150 times higher than the 1ppb ‘safe level’ used by DuPont at the Washington Works facility (Emmett et al 2009).
informing them of the possible exposure. As we will discuss in a later section, these letters and the lawsuit process, began wide public dissemination of C8 exposure, prompting community level discovery processes which culminated in the eventual filing of the class action, the C8 Health Project and the CEET Study, which in turn proved to a scientific certainty the reality of C8 exposure.

It is clear that structurally West Virginia has an economic interest in the economic health of the chemical industry, which creates an opportunity for political economic concerns to influence regulatory decisions. In her book on the C8 exposure episode, Lyons highlights multiple specific instances were DuPont directly benefited from questionable regulatory activities. First, she highlights a classic revolving door mechanism (Faber 2008) between the chemical industry and regulators in which not only were personnel traded but DuPont paid for state studies (Lyons 2007, pg 60). For example, in 1996 Dr. Eli McCoy of WVDEP negotiated the settlement between DuPont and the WVDEP for contamination of The Dry Run Landfill. This effectively shut down investigation of the landfill for community contamination. Dr. McCoy then went to work for Potesta and Associates, the consultant hired to help DuPont comply with this settlement. Similarly, the law firm of Spilman, Thomas, and Battle which was the primary negotiator for C8 issues for DuPont had three lawyers hired by WVDEP to head C8 related departments. These officials participated in negotiations of ‘safe levels’ between DuPont and WVDEP (Lyons 2007 pp 56-57).

Lyons also found other forms of questionable industry-regulator activity. In 2002 WVDEP public relations secretary Andy Gallagher was prevented by DuPont from warning Wood County residents about C8 air emissions (Lyons 2007, pg. 58) his came to light only
when Mr. Gallagher was deposed in the 2004 lawsuit against DuPont. In 2001 when WV. Governor Bob Wise appointed a ten-member panel to establish safe levels of C8 DuPont paid for the panel’s study. Subsequently, as questions come out about the validity of the panel’s findings, DuPont officials Dr. Dee Ann Stats and Dr. Gerald R. Kennedy admitted to a policy of destroying documents related to C8 exposure (Lyons 2007, pg 61).

Overall, the picture that Lyons paints is that DuPont seemed to have undue power to influence regulatory decisions by the WVDEP. The extent of harmful collusion between DuPont and state regulators is hard to ascertain, but enough is known to show that the balancing of regulatory mandates with political economic constraints is uneven discovery of chemical exposure. Exposure to chemicals we know more about are easily identified as compared to lesser known chemicals. For these emerging contaminants, the meaning of exposures is often understudied until impetus comes from outside sources, such as academia or citizen involvement.

**Academic and Independent Researchers**

Academic and independent researchers are the third institutional player in exposure discovery and understanding development. The key functions they perform are information gathering, information translation, and expert legitimacy. Information gathering often takes the form of scientific study which may be conducted in partnership with affected communities. Such studies greatly increase the information available to the community. The affected communities can then use this information to oppose industry and regulatory studies. Such expert information and affiliation increases the legitimacy of lay positions because they often take lay held beliefs and confirm and translate them into the proper form for legal and
governmental action. Expert researchers can also serve as information translators, an integral function to the exposure experience where lay people do not easily understand much of the information. This is why biomonitoring report-back can be such a powerful tool, because it combines study with result translation, adding clarity to opaque numbers on a sheet.

The power and legitimacy of these academic based or independent researchers comes from their years of expertise and their position outside the fight between community and polluter. Academic researchers are tied to academic institutions which ideally provide them with the resources they need to stay independent from specific interests. Independent researchers are often based in research institutions or corporations. They can provide similar legitimacy as academic researchers, depending on their prestige. Both academic and independent researchers can still become captured by special interests so it is important for them to be vetted by the affected community before trusting their data.

In the case of C8, there were two biomonitoring report back studies which greatly increased the power of affected communities against DuPont and intransigent governmental regulators. As described in Chapter 1, the CEET study was conducted as a community-academic partnership with the Center for Environmental Excellence and Training at the University of Pennsylvania, Led by Professor Ted Emmett. While this study only focused on the Little Hocking Water System, its effect was felt throughout the valley. Through this study residents of Ohio were able to prove beyond scientific doubt their high levels of exposure to a C8 and connect this exposure to DuPont’s activities. Effectively this study can be seen as a bridge from the exposure impetus to the understanding process because it proved exposure and attributed it to a clear culprit.
The C8 Health Project was much larger than the roughly 400 person CEET study, testing almost 70,000 people. This study was conducted by court appointed, independent experts led by Dr. Paul Brooks. Dr. Brooks was a well respected hospital administrator in the area and seen as unbiased in the C8 matter (Interview with plaintiffs’ attorney). The C8 Health Project not only proved widespread contamination, it greatly contributed to the scientific understanding of C8. Further, due to its legal roots, it became the basis for justifying the medical monitoring program set up to disburse funds to affected parties, who developed C8 related diseases.

They key to these studies for the exposure experience is that they allowed communities to have independent access to information that otherwise would only be available through governmental or corporate sources. As we saw in the previous section, these traditional sources were biased in DuPont’s favor. On the spectrum of informational control that exposed peoples have, academic researchers are further towards the middle than government regulators and corporate entities. In practice, each university or research center will have different controls and freedoms over research direction. Indeed, researchers at the same institution may be subject to different freedoms and controls, depending on their position, department, and perhaps most importantly, funding. In the modern research process, funding is the lifeblood that buys out teaching obligations. It channels research questions into specific projects with specific projects it which are fundable and it influences the tenor of conclusions, causing tempering of language and even the hiding of results that are damaging to certain entities.
Organizations

Beyond the institutional entities involved in exposure discoveries, moving towards more the democratic forms of information development in figure 4.2, there are a variety of public, community based, issue driven, and movement organizations with differing types of involvement. National and international broad spectrum environmental groups, such as Greenpeace and Environmental Working Group, affect exposure experiences by raising public consciousness of chemical contamination and particularly problematic toxins through their campaigns. Other organizations, like the Toxics Action Center and The Center for Health, Environment and Justice (Formerly Citizens Clearinghouse for Toxic Waste) are more hands on, working with affected communities to provide guidance, information, and links to expert knowledge. Research organizations such as Commonweal Biomonitoring Resource Center and Coming Clean undertake actual biomonitoring and report back in affected communities. Affected citizens may also form their own exposure related organizations or adapt existing organizations to deal with the exposure experience.

Social movement organizations are important to study in relation to the exposure experience because social movement scholars have demonstrated how the presence of strong movement organizations which construct mobilizing frames are key to emergence of environmental mobilizations. Social movement organizations (SMOs) are the building blocks of social movement mobilizations, providing divisions of labor, resources, contacts, member populations, and more when they join a cause (McCarthy and Zald 1977; Morris 1984). In the C8 exposure experience, there was evidence of national level publicity on C8 by the Environmental Working Group and biomonitoring advocacy by the Decatur Community
Association (DCA), both of which may have played a role in the discovery process of C8 exposure. I will first discuss the role of the tangible community biomonitoring work undertaken by the DCA and then the more ephemeral publicity work of the EWG.

**Activist Biomonitoring**

Environmental health organizations such as Commonweal Biomonitoring Resource Center and Coming Clean represent a new thrust to expand biomonitoring report back to the individual and community. By testing people and, with consent, publicizing their contamination results, groups can utilize results politically to attempt to make change. This is called ‘activist biomonitoring’ by Morello-Frosch et al. (2009). For example, The Body Burden Work Group and Commonweal conducted “Is It In Us”, a study which tested 35 Americans in 7 states for 20 different contaminants (Body Burden Work Group, No Date). This study gained consent to publically identify participants, providing a human face to the exposure data. These organizations and similar groups often work in academic partnerships and can run into funding issues and other forms of institutional control, however they have been quite effective at showing how the democratization of biomonitoring and exposure information is viable and useful at local and community levels. Greater access to biomonitoring report back at the local level is a direct aid to individuals and communities, as it can level informational imbalances with corporate and government agencies, giving people access to information they would not otherwise have had. Finally, at the meta-level, advocacy biomonitoring raises awareness of the hidden, but extensive, contamination of our everyday world and the body burdens we all carry.
Both the CEET and the C8 Health Project informed exposure discovery, as they provided scientific proof of exposure to participants to the number of parts per billion. The C8 Health project was launched between the plaintiff’s lawyer and a local health corporation, Brookmar. The CEET was created out of an expert led partnership between University of Pennsylvania and the Decatur Community Association, a community based organization historically involved in the preservation and maintenance of public buildings. By partnering with the University of Pennsylvania through their relationship with local physician, Dr. Zhang, the DCA was able to bring access to biomonitoring report back to the community. This enabled them to see if they were and to what they were exposed with the best of scientific certainty. Both the DCA/UPENN CEET study and the C8 Health Project could be seen as closing the door on the question of ‘am I exposed’ and opening the door to the question of ‘what does exposure mean’? Both also went on to use the exposure information they accumulated to further develop understanding of the health impacts of C8 exposure.

Just as social movement scholars have pointed to the need for strong social movement organizations which can act in response to socio-environmental stresses, social movement framing scholars have highlighted the need for these organizations to craft strong messages. These messages raise public awareness and frame issues in ways that prompt interest and action. These messages, as we discussed above, can serve as exposure impetus, or the initial prompt a person needs to begin to ask about their own exposure. I found no evidence that my interviewees gained their exposure impetus through the work of any national environmental organization. Instead, learning came through the media, water service letters, and the CEET Study and C8 Health Projects. During the time when C8 exposure became known to the
community, a national level environmental organization, the Environmental Working Group (EWG), was conducting consciousness raising efforts at the national level which may have helped to influence the awareness of people that were not interviewed.

The EWG has been very involved at the national level in the targeting and framing of several types of PFCs, including C8, for regulation due to their environmental persistence. They were instrumental in bringing national attention to the C8 exposure in the Ohio River Valley as well as in lobbying industry to agree with the EPA to a voluntary phase out of C8. EWG’s focus on PFCs has mainly been on raising awareness in consumers and lobbying for changes in regulation. For example in 2008 they lobbied California to ban PFOA and PFOS in food wrappings (EWG 2008). Their frame for this has been through focusing on Teflon, the well-known consumer product which PFOA is utilized to make. The EWG did not have a perceptible local presence in the Ohio River Valley, in fact no evidence of local environmental groups being involved has come to light. Lyons (2007) notes that several local women attempted to organize resistance to DuPont but they were unsuccessful in gaining support. The people that I spoke with not only never identified the EWG directly as an information source and further, I found no evidence of a local presence of an environmentalist organization in the area. One interviewee, John mentioned utilizing the Fluoride Action Network as a primary information source. I sent several emails to the EWG and to people whose name I found connected to their C8 work but I received no responses. Still, I cannot be sure of the indirect effect of their work, as they, through their publicizing of the health risks of C8 on a national level may have contributed framing information to individuals connected to the C8 case whom I did not interview.
The Power of Individuals in Discovery of Exposure

At the extreme end of the identification and understanding spectrum stands the inquisitive individual; a person who may or may not become a member of one of the types of organizations addressed above, but a person who holds a question about their chemical exposure. Depending on their actions, their resources, their knowledge, their gumption, and chance, these individuals may fade to history or they may become heroes. In the famous case of the contamination at Love Canal, NY discovery of contamination began with Lois Gibbs, a mother and housewife who became concerned when her children became sick. Attempting to understand the etiology of their illnesses, this worried mother began to identify other unusual community health issues. This led her to organize an initially unsuccessful but, over time, a very successful campaign against regulatory agencies. This culminated in the discovery of extensive chemical contamination from toxins buried on former industrial land where her children’s school stood.

The individual is centrally important to exposure discovery because ideas and information about exposure are created and interpreted by a series of individuals, regardless of their status or organizational position. Concern for exposure begins when a person or people spread information through their social networks. In the case of C8 contamination in the Mid-Ohio Valley the story of discovery begins with the work of several key individuals in interaction with organizations and institutions. We have seen the efforts of June and John, who became part of the class action lawsuit, and we will continue to read of their work in the coming chapters. However, as we learned in Chapter 3, the first key individuals in the C8 exposure experience are the Tennant Family, whose 1998 lawsuit against DuPont launched a legal discovery process which learned of DuPont’s knowledge of extensive C8 groundwater
contamination. It was this knowledge that prompted the class action lawsuit, which once again opened the discovery process and allowed information of contamination to be widely disseminated.

The discovery process for the Tennants began well before the lawsuit. It developed through their daily experience on their farm, witnessing the effects of chemical runoff on their cattle. The Tennants had sold part of their farm to DuPont who had used at as chemical dump. The proof of this was watching their once thriving herd of cattle waste and die off. The death of their cattle was the exposure impetus. The Tennants then began unsuccessful interactions with local and national regulators, including the EPA, attempting to prove chemical contamination by DuPont. Had this process gone more successfully the lawsuit may never have been necessary, the legal discovery process never broached, and a different story of exposure experience may have played out.

The Tennant case stimulated the discovery process. Even though DuPont had the ability to hire more lawyers and bury opponents in paperwork and motions, even though the settlement was sealed, the legal system gave the Tennants, and later the surrounding communities a more level playing field than they had with government regulators. Just because the settlement was sealed it did not mean that exposure was not found, just that the Tennants could not talk about it. Their lawyer Rob Billot launched another lawsuit, once again forcing the discovery process and bringing evidence of the contamination into the open for good. The information found in the discovery process was used as leverage against DuPont in negotiating a new, unsealed, settlement of the large class action case filed on the behalf of Mid-Ohio residents. This settlement led to the C8 Health Project.
Conclusion

This chapter has focused on the concept of exposure discovery, the initial part of the larger process of developing understanding of exposure in the exposure experience. The exposure experience begins with an initial exposure impetus which prompts one to question, whether they have been exposed and to search for proof of their exposure. Exposure discovery is a factor of informational access which is influenced by informational control structures such as intellectual property, resource imbalances, and lack of expert information. Exposure discovery and obscuring of discovery are undertaken by a range of stakeholders with differing models of informational control and different goals. Stakeholders use ‘portals’ to access information and encounter ‘barriers’ to informational access. In the C8 exposure experience this process of discovery took place in the face of widespread concern about how C8 exposure would affect DuPont and by extension, the community’s economic well-being. This concern was not powerful enough to stop the discovery process. The main portals of biomonitoring report-back and legal discovery were successful in overcoming regulatory weakness, and informational and resource disparities so that the affected community could discover the truth of their exposure.

Specifically, the actions of the Tennants opened the door to the process of community discovery. They were the whistle blowers who allowed others to encounter, in various ways, a C8 exposure impetus. This exposure impetus was verified by the portals of legal discovery and biomonitoring studies. Due to the intransigence of government regulators and the corporate walls of private and intellectual property, this information would otherwise not have come out. It took the joining of legal and scientific experts with the affected communities to force this information into public view. The same scientific experts and their teams were then able to
translate this information to the affected communities, helping them bridge the gap in the discovery process from exposure impetus through proof of exposure to exposure understanding. In the next chapter we will discuss this understanding process.
Chapter 5: Constructing Understanding of Chemical Exposure

Introduction

In this chapter, I establish the meaning of the understanding process in the exposure experience as an information-gathering and meaning-making endeavor undertaken by individuals who, in concert, promote collective understandings through their actions. The understanding process is a learning experience with two interconnected goals: 1) to reduce or remove the uncertainties that are created by becoming exposed to a chemical such that a person can develop meaning for that exposure, and 2) to inform measured responses to that exposure. To attain these goals individuals and the groups they form will access ‘information portals’ and will interact with ‘informational barriers’. Following the main portals of biomonitoring report-back and legal discovery, they will add other important portals, such as interaction with other affected community members, direct outreach to experts and physicians, and research based on biomonitoring data. Through these portals, individuals continuously enact understandings of their exposure, continually refining them based on new information. Through interaction, they posit shared understandings of their exposure, which in turn, affect the response patterns we will discuss in Chapter Five.

This chapter will first describe the understanding development process at the individual and collective level and the paramount meaning of context in this process. Next, it will identify and discuss the key informational portals, barriers through which exposed community members, and related stakeholders gather, interpret, and frame information about their exposure. It will then discuss the major themes of meaning that emerged from the Mid-Ohio exposure experience
through the eyes and words of participants in this process. Community members used the portal of biomonitoring report-back research heavily in this process to develop exposure data. Researchers then mobilized this data, some directly related to the community through the CEET Study and those designated by the legal team as part of the C8 Health Project, into rigorous scientifically meaningful health information. This information is useful to the community to better understand the health risks to which they were exposed. Further, it has been employed as part of the response process as leverage in a developing mass-tort case against DuPont for medical care costs.

The development of these exposure understandings at the individual and community health level are also part of larger themes of meaning that emerged through the interview process about the understanding of life in the Mid-Ohio Valley. Interviewees spoke of economic pressure in the community which framed the exposure as part of the need for the chemical industry and the jobs it provided. Many interviewees saw this need as a tradeoff between their health and the community’s economic well-being to which, while they were not happy about it, they seemed fairly resigned. This was not a completely hegemonic theme since a small number of the affected population did challenge DuPont through legal action and promoted the frame that DuPont could survive the lawsuit. In addition, tens of thousands participated in biomonitoring studies to gather information and better understand the meaning of their exposure which represents another, less threatening challenge to DuPont.
Definition of Exposure Understanding

Understanding in the exposure experience is an information gathering and interpretation process. It begins with the exposure impetus and operates continuously. The first part of this understanding process is the discovery process discussed in Chapter Four, which focuses on the question of whether or not one has been exposed. Once proof of exposure is established, the understanding process focuses on questions of meaning of exposure. As people interpret new information, their understandings will refine, prompting new questions and forming a continuing cycle (as we see in figure 5.1).

Once a person discovers that they have been exposed to a chemical contaminant they are faced with a multiplicity of questions pertaining to the meaning of their exposure. The meaning of chemical exposure is a dynamic concept, in that the meanings a person constructs about their
exposure will be expected to change over time in the face of new information. This includes information obtained through the response process of the exposure experience. The information collected is likely to emerge unevenly, incompletely, and sometimes be contradictory, as people attempt to construct meaning out of the various types of information including: the nature of the chemical exposure; the particular chemical, at what concentration, externalized over a certain period of time, through a particular form of pollution, in interaction with environmental geographic, geologic, and meteorological factors. Indeed, individuals and communities will not have perfect access to information about every factor, nor would we expect them to be able to create a perfect understanding of the interaction of these various factors for themselves. Instead, people create “good enough” understandings, which draw together information from as many factors that are available that they see as important. They interpret this information and make reasoned decisions for action based on what they know at the time.

A member of the Community Advisory Board put it this way:

There seemed to be as the time went on and the results were being obtained and some preliminary findings were coming … an ease of the fears that people had when the news first broke, and it was really no understanding at all amongst the community… [as to] what was going on and as time passed and we began to inform the population more about things and all, I could see that people were becoming more comfortable with what was taking place. I mean they still were not pleased with things but they were more comfortable because they understood better.
Collective Understanding and the Exposure Experience

The creation of understanding takes place both individually and as a collective. As we see in figure 5.2, collective action and social networks, promote shared understandings of exposure experience.

Figure 5.2: Collective Understanding Construction in the Exposure Experience

A persons’ individual understanding of their situation is influenced by factors internal to them, such as their education, job, and personal exposure. At the same time, their understanding is influenced by the community context, including the economic situation of the community, levels of trust in the polluting company, and state of the scientific evidence. By sharing with other community members, the individual can modify their personal understanding and contribute to collective understanding, which leads to collective responses.
These collective understandings are a form of impression management, which can provide meanings to existing information and for the interpretation of new information. These frames are themselves specific collections of information which can steer understanding in certain directions. They become collective expressions through the action individuals and groups take to share and promote them. As we see in the C8 exposure experience depicted in figure 5.2, multiple, sometimes contradictory frames develop. The result of this interaction for Mid-Ohio Valley residents was twofold. First, biomonitoring became the primary portal through which information about the health based meanings of exposure were accessed. While it was seen as threatening to DuPont by some interviewees, this frame did not stop them from participating. Instead, framing influenced whether or not one would join the lawsuit, as this question split the community into differing action patterns.

**Figure 5.3: The Construction of Two Collective Understandings of C8**

<table>
<thead>
<tr>
<th>Knowledge of chemical</th>
<th>Individual A’s Understanding</th>
<th>DuPont must be held directly accountable and can survive retribution: Justice Focus.</th>
<th>Collective response: Lawsuit and biomonitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social position</td>
<td>Individual B’s Understanding</td>
<td>DuPont is vulnerable and necessary to local economy: Focus on balancing community’s economic and environmental health</td>
<td>Collective response: Water cleanup and biomonitoring</td>
</tr>
<tr>
<td>Health</td>
<td>Individual C’s Understanding</td>
<td></td>
<td></td>
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<tr>
<td>Resources</td>
<td></td>
<td></td>
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<tr>
<td>Anti-toxics framing</td>
<td></td>
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<tr>
<td>Boosterism</td>
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</tbody>
</table>
This model of information gathering and interpretation marries the systems approach to disaster response developed by Edelstein (2004) with the symbolic interactionist accomplishment of meaning of Garfinkel (2002, 2010) and Ingold (2000). Garfinkel looks at social interaction as a constant accomplishment and the building block of our entire society. Two individuals cannot exchange meanings perfectly, but instead use created symbols whose meanings must be interpreted for people to arrive at shared agreements of meaning. In a world where meaning must be constantly accomplished the role of the individual is to gather and interpret information through patterns of their everyday life, what Ingold calls “taskscapes.” Through this sorting of constantly incoming information people can create patterns of culture and action, or taskscapes which have shared meaning. Exposure represents a possible disruption to these normal taskscapes. Through the exposure experience people gather information, create meaning, and respond to exposure creating new patterns of everyday life. As depicted in figure 5.4 the individual is exposed to the exposure impetus which they then must interpret and respond to in a way that is meaningful to them within their given eco–social context.
The questions then become: what patterns of meaning emerge and in what ways do people accomplish this meaning making? The next section identifies the importance of the historical contexts which drastically influence information gathering and meaning. Following that, I will identify the information portals through which people gained information about their exposure. Next, I will discuss the different forms of impression management and framing that were employed to help interpret this exposure information. Finally, this chapter will discuss the forms of collective understanding that were developed as part of the C8 exposure episode.

The Importance of the Exposure Context

Context is extremely important to the exposure experience, sometimes as important as the specific chemical to which one is exposed. Beyond the effect of the chemical, be it short or long lived, contextual factors such as the nature of the exposure and how much is known about the chemical will influence the exposure experience. One contextual factor that must be examined is
the nature of the exposure - how did a person or community come to be exposed to the chemical. We should expect differences in exposure experiences at both the individual and community levels depending on exposure routes, e.g. through personal application of a contaminant-laden cosmetic, part of a long term point source exposure from an industrial facility, or everyday exposure through legacy contamination from worldwide nuclear fallout from nuclear weapons testing (Beck and Bennett 2002). Individuals and communities have differing agency in each of these situations both in terms of control of information and opportunities to respond. The nature of the exposure source, meaning both its physical properties and the social relations that control it will directly influence how people discover, develop understanding, and respond to exposure. While point source industrial pollution and legacy contamination often require long term collective campaigns targeting industry, regulators, and affected populations. Consumer product-driven exposure experiences can often be dealt with in a more individualized manner. An individual may develop concerns based on personal experience with a product or they may draw information from news outlets, government agencies, or from environmental advocacy groups which target consumer products, e.g. The Environmental Working Group’s Coming Clean Database, the Campaign for Safe Cosmetics.

In many cases the individual consumer can reduce their exposure by choosing products made without chemicals, when such products are available. Szasz (2007) notes that this type of consumer action, which he calls “shopping our way to safety,” is an inverted and unequal form of chemical regulation. In terms of the exposure experience it individualizes such exposures which could instead be mobilized against in more collective forms for more substantial political
economic changes. This effect is but another example of how the nature of exposure can influence the exposure experience of individuals, which in turn influences collective experiences.

The consumer approach hits on a larger contextual point which is very influential in the exposure experience - the current lay and scientific understandings of the chemical in question. Chemicals which are well known both publicly and scientifically will prompt different exposure responses than chemicals for which little is known. In the case of C8, comparatively little was known about it outside of the chemical industry until the lawsuit and subsequent C8 health project. Had more been known publicly and by regulators about the long term health effects of C8 it likely would have been regulated differently and DuPont may have made different productive decisions in the face of regulatory costs.

Overall, the nature of the exposure relationship is itself part of the shared eco-social history in which exposure unfolds. This eco-social history includes research and discovery of chemical substances, economic investments made to manufacture these substances, commodity chain development in which the chemical substances make up productive links, consumer behavior, and governmental regulation. This relationship will greatly influence the exposure experience because it structures not only the ways in which people can access exposure information and the avenues of response, but through the shared eco-social history which gives rise to the exposure relationship. It affects the frames that influence people’s pre-exposure understandings. Exposure relationships influence people’s understanding of the possibility of exposure itself, reinforcing beliefs about risks and safety. As has been shown, expectations about chemical exposure in general, and C8 exposure specifically, were created overtime through the relationship of the Washington Works Plant and other chemical plants within their surrounding
communities. Workers developed beliefs about chemical safety and risk through their daily taskscapes. Through interaction with these workers and through living near the plants, dealing with their externalities, and through appreciating the economic impacts of the chemical industry, many of my respondents talked of exposure emerging in a context which framed exposure as threatening to DuPont, not just to the exposed.

Further, each individual’s meanings of their exposure will differ based on their personal experience and their interpretation of external and internal information. External information includes any information that is accessed pertaining to the known health effects of the specific chemical, regulatory information, or frames. Internal information refers to an individual’s personal knowledge and expertise, health, and beliefs. If for example, over time, a person develops symptoms which they, through information gathering, link to their exposure, their exposure takes on new meanings. These new meanings can prompt new responses, such as seeking out special medical attention and remuneration from DuPont for medical bills. These new efforts will cause the individual to encounter new information, such as the slow trudge of the legal system, adding meanings of impatience, more uncertainty, and depending on the outcomes of the health effects and legal action, even more information for interpretation.

Informational Portals

There are three major portals which influenced the understanding process. They are the historical understandings of C8 related through the experiences of DuPont employees, C8 lawsuits, and biomonitoring report-back projects.
Historical Understandings

The first portal I draw attention to is the experience that DuPont workers gathered through their work with C8 at the Washington Works Plant. Due to the amount of jobs DuPont provides, it would be hard not to know a person who worked at DuPont; indeed 12 of 19 participants in the biomonitoring studies had members of their immediate family who had worked for DuPont. These workers had developed an understanding of C8 through their work taskscape. They felt it was safe, inert, even referred to it as “soap” (Interview with Plaintiff 2; Lyons 2007 pg. 39). Dave, a DuPont retiree who has now become very interested in the meaning of his exposure, spoke about C8 as something he worked with regularly:

Anyway, I worked for DuPont. I retired from there. And I worked with C8 and I’ve gotten C8 on my hands at a billion parts per billion [sic]… So, it was my fault. Especially, because we were supposed to wear rubber gloves… I retired in 2000, December 31st 2000 … a few years before that, exactly when I don’t know but ah… (laughter) you know, I kind of laugh… the funny thing to me is… we used C8 to make Teflon but C8 is the safest thing we make Teflon out of… other than demineralized water. Everything else is worse than C8 (laughter). Take my word for it. So, am I concerned about C8? Not really that much. I mean, here I am 70 years old, I’ll be 71 next August. I don’t know what’s coming down the road but nobody else does. I’ve always been disgustingly healthy to some extent. I’ve been slightly overweight for most of my life but… I can tell you one thing. If I do die because of some chemical that I’ve

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27 Immediate family refers to oneself, one’s spouse, one’s siblings, one’s parents, or one’s children having worked for DuPont.
been exposed to at DuPont, I’ll bet you a dollar to a donut that it’s not gonna be C8.

(laughter)

Lenny, a DuPont retiree who had worked 37 years at the plant and 17 years in the Research Lab testing chemicals including C8 downplayed fear of working with C8:

No. I really wasn't afraid of any of the chemicals we used. Of course, there’s not many chemicals that you can use with Teflon that affects Teflon at all. So, I never was concerned about any of it. And safety was a top priority down there so... a lot of things, so if you’re going to do this with sulfuric acid or something else you had to get this on that or so on. So I wasn't concerned about any of the chemicals.

He added:

Yeah, I worked down there where they had the stuff and I, all the time… We analyzed all the materials that went in. I don't ever remember having to test anything on C8. We'd get a batch of some chemical that went in to the stuff, since they had a screw-up or two down there where somebody'd pumped it into the wrong tank. We had to verify everything before we unloaded it… They didn't want to put it in the wrong place… They had one Teflon [by-product] they called Teflon Dispersion; this looked like milk. And I think some of that might have been shipped out, but it came into the lab in liquid form and we would test that… But some of that liquid Teflon went out; that’s what went on the frying pans and that type of stuff at that time. So we tested those... but I don't know... the rest of the stuff is pretty much inert. You are not going to get anything off of it even if you ate it.
These quotes above show that through their daily taskscapes, which put them in interaction with C8 and other chemicals, they had developed an understanding of C8 as safe. They worked with it and in doing so developed expectations about what C8 would do based on these interactions and the standards set in place by the company to govern these interactions. The workers brought this belief in the safety of C8, and even some of the chemical home with them. This influenced the community understanding of C8 as safe through their social networks. However, over time, DuPont took actions which may have influenced workers to view C8 as something which required precautions.

Dave, the DuPont retiree who told me he had C8 on his hands “at a billion parts per billion,” said:

Before I retired they told us, they said 3M’s gonna quit making C8, they’re going to quit shipping it to us so we’re gonna have to come up with or probably just have to make it ourselves if we keep doing it, but we’re trying to get rid of it and get out of the[business]… because they knew what was coming, you know.

Another interesting action DuPont took which could have alerted workers to the danger of C8 was how they came to deal with cigarettes and the concept of “getting a Teflon high.” As Lenny, who worked 37 years for DuPont said:

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28 Plaintiff 2 notes that their deceased spouse who worked for DuPont and died of ‘strange diseases’ brought containers of C8 home to use as a ‘soap’ when their would wash their cars. They remember these containers being in their garage for years.

29 I say ‘may’ because the workers I talked with did not relate a change in their attitudes towards C8 based on these company actions.
Right, what they did... The smokers, they finally decided to do better; make them put their cigarettes in a little case. Then they finally outlawed smoking while I was still there, in the buildings. I never smoked so I never had to worry about that stuff… Any dust which you might... some of the Teflon was a real fine powder, and, if you weren't careful I suppose it could drift into your pocket and get into your cigarettes.

Interviewer: Did they talk about a “Teflon High”?

Lenny: Yes... Well, the guys told me it was kind of like having the flu or something, but it didn't last very long I guess... I never got that because I never smoked and I was careful what I did. When the stuff's hot you had to have it in a fume hood or just stay away from it.

Dave also mentioned this hazard:

When you got a job in Teflon why, the first thing they give you is a plastic case for your cigarettes. Because, you can eat Teflon but do not burn it! Because you’ll get (a) Teflon high that you won’t like. It will give you a high that... I’ve never got one because I never... I have smoked in some years past but I haven’t smoked for a long time. But ah, yeah that’s what… your pot’s got Teflon on it and a little piece comes off you eat it, no big deal. You can eat Teflon.

That these safety actions did not cause workers to begin to fear C8 is understandable; DuPont was targeting Teflon, rather than C8, which workers thought was an inert component in the Teflon manufacturing process. However, another DuPont action which could have warned
workers of the risk of C8 did directly target C8. In 1981 DuPont removed women from working directly with C8 due to concerns that it would cause birth defects (Plaintiff 1 Interview; Lyons 2007 pg. 29). Interestingly none of the DuPont workers I spoke with, all of whom were male, even mentioned this. While I cannot be sure if it affected their understandings the risk of C8 exposure, or even if they learned of this, the fact that they did not mention it leads me to believe it did not factor heavily in their understanding. Overall, the DuPont retirees gave the impression that they thought that C8 was safe due to their experience with it. This did not however preclude them from participating in both exposure studies, as all of the DuPont retirees I talked with had done. The exposure impetuses that faced them were enough to overcome their initial understanding developed through their taskscapes.

Lawsuits and the Understanding Process

While the workers I talked to had developed understandings through their work, most of the people I spoke with had not had a direct relationship with the chemical and were faced with developing an understanding about their exposure without this context. To do so they made use of different informational portals. In exploring these portals one must first note that while the legal process was key to the overall exposure experience; its primary effect was on the discovery and response portions of the process. It was key in providing exposure impetus in the discovery period and to the response portion, as meaningful response strategy which garnered resources and held DuPont accountable. Its effect on the understanding of the meaning of exposure is indirect: first it provided resources for the C8 Health Project, which along with the CEET study

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30 Plaintiffs 1 and 2 mentioned this event, which probably has to do with it being a point of leverage against DuPont in the Class Action Lawsuit. DuPont was fined in 2001 by the EPA for failing to disclose this information.
are the primary portals for the understanding process: secondly it plays into the economic framing to be discussed later. In this way, it helps define the two major collectivities of this exposure experience, - those who sued and those who did not. This in turn affects people’s understanding of the response process. Therefore the lawsuit it is inextricably linked to the understanding process but not neatly and not directly. In comparison, the biomonitoring report-back studies had direct effects on the understanding process.

The Effect of Biomonitoring Studies on Exposure Experience Understanding

The biomonitoring report–back studies and the subsequent research were the primary lenses through which information about the health risks of C8 were made widely available. This section will explore the reasons and mechanisms by which they were effective. Not only are biomonitoring studies able to prove exposure, which is key to the discovery process, but they can also can provide information about the health risks of exposure. In the exposure experience the health-related meanings of exposure, as discussed above, are central factors in the overall understanding of that experience. When asked about the reasons for participation in the CEET Study the primary reason given for participation were health-related; either interest in personal, family or community health concerns. Biomonitoring report-back provided a mechanism through which participants could both gain better access to known health risks of their exposure and contribute to the production of new knowledge regarding health risks.
Table 5.1: Reasons for Participation in CEET Study

<table>
<thead>
<tr>
<th>Participant Response</th>
<th>Participants (n =16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal or Family Health Interest</td>
<td>12</td>
</tr>
<tr>
<td>Personal Interest in Science</td>
<td>3</td>
</tr>
<tr>
<td>Community Health Benefit</td>
<td>4</td>
</tr>
<tr>
<td>Research Altruism</td>
<td>3</td>
</tr>
</tbody>
</table>

Both the CEET Study and the C8 Health Project were able to recruit more people than they originally anticipated (CEET Study Researcher Interview; Interview with Harry Dietzler; Lyons pp. 89,102), showing that people wanted the information that the studies could provide. That said, the information each study provided was different. As discussed in Chapter Three the CEET study was much smaller; four hundred people compared to the almost 70,000 in the C8 Health Project. The CEET study was limited to the Little Hocking Water System, testing only for C8 and its’ metabolites, while the C8 Health study was open to an estimated 80,000 exposed individuals (Lyons 2007 pg. 88), and tested for a dozen perfluorinated compounds and numerous other health indicators including a “comprehensive metabolic panel, cancer, and pre-cancer markers, organ functions, vitamins, minerals, folic acid, insulin, and hormone levels/ more than fifty tests in all” (Lyons 2007 pg. 90).

31 This number only refers to the 16 people who participated in the CEET study. It does not include the three plaintiffs I spoke with, or their counsel.
32 It should be noted again that participants in the C8 Health Project were paid $400 per person, creating a strong economic incentive to participate and thus tempering the idea that information was the main reason for their participation. This however is not the case for the CEET study, which was unpaid, and thus participation was more likely to be information-seeking behavior.
Both sets of report-backs were of immediate use in proving exposure, and in certain cases, finding immediate health risks in participants, as in the case of one of my interviewees who found out through the biomonitoring studies that her cholesterol was at dangerous levels. However, what made the studies extremely useful to the understanding process was the health and exposure research which was conducted on the data sets created by the biomonitoring studies. The CEET Study led to an article in the *Journal of Occupational Health and Medicine* which demonstrated water and not air pollution as the major C8 exposure vector (Emmett et al. 2006b). The study team also published two articles in the *Journal of Reproductive Toxicology* on the relationships between C8 exposure and birth defects and outcomes (Nolan et al. 2009; 2010). Further, the study prompted DuPont to begin to provide free bottled water to members of the Little Hocking Water District. In a follow-up study conducted a year later Emmett and his team found that due to people’s changes in water use, including the provided bottled water, that C8 blood concentrations had decreased 26 percent (Emmett et al. 2009\(^{33}\)).

In terms of scope and output, the C8 health study has been even more effective at developing health information related to C8 exposure. It has created one of the largest data-sets ever for an emerging contaminant (Interview with Dr. Paul Brooks). It provided funding for extensive analysis of this data set for C8 related health risks. Based on this analysis, exposed parties with health risks found to be significantly associated with C8 can be compensated for medical care. Eleven different epidemiological studies have been conducted on this data set, resulting in the publication of thirty-eight articles and seventeen reports on the exposure and

\(^{33}\) Emmett’s team also published multiple articles on the design and success of the community partnered research model however these articles do not ‘speak’ to the meaning of exposure but to the methods of engaging in exposure research and they are geared to an academic/research audience and not the exposed.
related health effects of C8. This has resulted in the C8 Science Panel, the body set up through the settlement to analyze the weight of the ongoing research, to formally identify six diseases associated with C8 exposure: kidney cancer, testicular cancer, ulcerative colitis, thyroid disease, pregnancy-induced hypertension (including preeclampsia), and hypercholesterolemia (C8 Science Panel 2011, 2012a-d). Exposed parties with these diseases are entitled to medical monitoring funds (payments for C8 related disease care) from the $235 million set aside for this purpose in the class action settlement (Lyons 2007 pg. 87).

The impact of the C8 Health Project on the C8 exposure experience and the overall scientific understanding of health effects of C8 cannot be understated because its effects are still being realized. Research on the data set and the identified C8 linked diseases is ongoing. Further, lawsuits to gain access to the medical monitoring funds are underway, with 2700 already filed (Interview with Plaintiff’s Attorney). The C8 Health Project leveraged the exposure data through secondary data analysis to identify statistically significant associations with diseases which otherwise would not have been viewable except perhaps through lay epidemiological methods which would have taken longer and would be less likely to be received as legitimate by the scientific community and the court.

**Why Biomonitoring Studies Were Useful: Legitimacy and Reach**

One question that must be asked is why the information provided by the biomonitoring studies and the related scientific research was seen as important and useful to exposed

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34 The settlement defines those who may sure to access medical monitoring funds as community residents who lived in one of the six counties involved in the contamination and had received contaminated water at least one year before the settlement of the lawsuit (Lyons 2007, pg90).
people. Even though interviewees’ demonstrated their desire for the health information the study could provide through their reasons for participation, some of the same interviewees expressed distrust in the studies, believing that they were designed to harm DuPont. In practice, however, interviewees wanted not only their exposure information, but also wanted more study, including follow-up biomonitoring. This desire for more biomonitoring information stems from two factors, one conceptual and one methodological.

Conceptually, biomonitoring meets the definition of information gathering behavior; providing information that would otherwise be inaccessible or nonexistent. The second factor is meaning-based, in that community members found the data to be legitimate. The reason for this is methodological. Biomonitoring researchers have found evidence supporting that how report-back studies are conducted influences interpretation of study data and experience (Morello-Frosch et al. 2013). In both ethical and practical concerns, the reporting back of exposure information to participants can be empowering, can increase environmental health understanding, and influence exposure reduction activity (Brody et al. 2014) However, the nature of the report-back process can greatly influence research translation and the experience and understanding that participants develop. This has caused practitioners to develop study designs and report-back processes which draw on community based research models to improve outcomes. Indeed my initial research with CEET study participants was part of an NIEHS project to develop better report-back methods.
Legitimacy of CEET Study

The CEET study featured three key elements which have developed out of this ongoing legacy of improving biomonitoring report-back research: the project’s community/researcher partnership, its ‘community first’ report-back method, and the multiple routes of informational access for the participants it employed. The study formed a community advisory board, comprised of DCA members and local physicians in addition to research partners. This community control over the study provided legitimacy, as it made the project an extension of the community, rather than a project external to it. In a community, which feared the collective economic damage that the exposure could cause, the impetus for the study needed to come from the community itself less it could be discredited as something undertaken to harm the community by outside forces.

It was through this group that the study design and report-back model was constructed. This worked to give information directly to the effected community first. It could be used to lessen informational disparities between the community and DuPont, the polluting party. This report-back began with a letter mailed to each participant informing them of their C8 level and comparative information on the national and community average of C8 exposure. The study team then held community meetings where participants and interested parties could discuss their results, ask questions of researchers, and get exposure reduction information.

Legitimacy of the C8 Health Project

The C8 Health Project, as discussed in Chapter 3, has a different history than the CEET Study, being rooted in and funded by the class action lawsuit as opposed to being community-
based and grant-funded. Because the study grew out of the class action settlement and was certified by the court it is seen as independent from control by either DuPont or the plaintiffs. In designing the study, which began as the idea of the plaintiff’s, both plaintiff’s attorney Harry Deitzler and journalist Callie Lyons report that great care was taken in choosing people above reproach to lead the study. Ultimately two well-known professionals in the local health care field, retired physician Paul Brooks and Art Mayer, the former president of St. Joseph’s Hospital in Parkersburg WV, were chosen. Dr. Brooks reported that he initially did not want to be part of the study as he feared it would be designed to favor the plaintiff. However, he joined when he became convinced that the study would function independently of either stakeholder in the case.35

Table 5.2: Emotional Responses to Learning Results

<table>
<thead>
<tr>
<th>Reported Response</th>
<th>Participants (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Emotional Response</td>
<td>10</td>
</tr>
<tr>
<td>Surprise</td>
<td>5</td>
</tr>
<tr>
<td>Anger</td>
<td>2</td>
</tr>
<tr>
<td>Fear</td>
<td>1</td>
</tr>
<tr>
<td>Concern (any type)</td>
<td>6</td>
</tr>
</tbody>
</table>

35 I question this narrative of Paul Brooks’ about the study being completely without bias towards the plaintiffs. From my interviews with Harry Deitzler, and a short interview with Dr. Brooks, it was clear that both men were known to each other before the study, and while they claimed no personal relationship, now Dr. Brooks and Mr. Dietzler live side by side on a hill above one of the local communities, in what I assess to be multi-million dollar homes. Most telling is how uncomfortable they were in disclosing this fact and took care to inform me that it was not ‘as it looked.’
Through my interviews with CEET Study participants, ten years after the study, I found that participants were pleased to have participated in both biomonitoring studies.\textsuperscript{36} Every interviewee chose to receive his or her results. They did so years ago when much less was known about the health risks of C8 exposure. Yet no one reported any negative psychological effects caused by learning results. Speaking to the usefulness of the studies interviewees cited both personal and community study, including the studies influence on the water clean-up. As we see in table 5.3, 14 out of 19 interviewees expressed the studies to be useful to the community while 13 out of 19 said they were personally useful.

### Table 5.3: Usefulness of Personal Report-Back Studies

<table>
<thead>
<tr>
<th>Participant Response</th>
<th>Participants ($n=19$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personally Useful</td>
<td>13</td>
</tr>
<tr>
<td>Useful to Community</td>
<td>14</td>
</tr>
<tr>
<td>Educated About Health Risk</td>
<td>4</td>
</tr>
<tr>
<td>Relieved Concerns</td>
<td>7</td>
</tr>
<tr>
<td>Changed Personal Behavior</td>
<td>2</td>
</tr>
</tbody>
</table>

For example, a father and testicular cancer survivor spoke of the personal usefulness of the study in this way:

\textsuperscript{36} As I discuss in Chapter 2
Well yes, [it was helpful] in terms of maybe helping me understand that there might be a link to testicular cancer and might help me understand a little bit better [the] way I came across it. More so, at least its given heightened awareness for us to keep an eye out on the boys and so in that regard it was very useful because at this day and age if testicular cancer is caught early and you can really do a pretty good job of taking care of it. So anything that brings awareness to an issue that could lead to quick catching of something is useful. But at the same time without becoming obsessed about. I think we’ve been able to balance that because we don’t sit around and still about it. As a result of the study we know there’s a possibility so you just make yourself keep an eye on things and do the self-exams and make sure the doctors check you every year, that’s what you can do about it. You can’t sit around and let it dominate your life by any means. But you can certainly keep it on the radar.

For this father, the study provided information which he and his wife incorporated into their parental taskscapes; adding another possible threat to “keep on the radar” but not letting it “dominate” their life.

A successful local business owner whom had concerns that the biomonitoring studies could harm DuPont expressed her view of the study more bluntly when asked about the usefulness of learning her results: “Uhh, it put my mind at ease. Other than that? No. I mean if it had been something alarming, yeah, it would have been useful. But it wasn’t.”

The vast majority of interviewees expressed their feelings that the studies had positive effects at the community level. A father who had worked in the chemical industry spoke of the
direct health benefits to the community from biomonitoring: “It was real good because people had been to the doctor and had tests that had never been tested before, and had no reason. They felt good all their life so why go to the doctor.” His wife cited both personal and community health outcomes: “Yeah, they actually found our son, which was, gee, when they did this testing, in his early 40s, he was a diabetic and didn't even know it, so actually, quite a few people who were in this area, benefited from the testing.”

Another mother of two, from a DuPont family, directly attributed the water clean up to the biomonitoring studies:

Yes it cleaned up the water. Absolutely. And we took a second look at the garden (water residue on vegetables was a secondary exposure vector), which right now we need to get going we need the garden stuff. Yes definitely. And it is a relief to know that we have an excellent water treatment plant.”

Her husband echoed this statement linking the studies to the water cleanup:³⁷

Well they cleaned up our water, that’s one thing. We’ve been on this water ever since little Hocking water started and before that we had a well and so I think that was a real plus to get the water cleaned up.

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³⁷ What is truly interesting is that it was the class action lawsuit settlement which provided the funds to build water treatment plants in six C8 contaminated water systems, not the CEET study or later C8 Health Project. The CEET study could certainly have been part of the leverage over DuPont, which did begin providing bottled water to members of the Little Hocking Water District on the day that the CEET Study results were made public. This belief that the water clean was due to the biomonitoring studies (the interviewees often conflated both studies so it is near impossible to be sure which if not both they are referring to) could be due to the antagonistic feelings towards the lawsuit and fears that it would harm DuPont. None of the CEET study participants I talked to participated in the lawsuit.
Data Translation

Overall, both biomonitoring studies were well received and will continue to have impacts on the understanding of the C8 exposure experience through the continuing scientific research. How this information gets to exposed community members has changed over time. Initially both the CEET and C8 Health Project directly reported exposure results to study participants via mailed report-back letters. To help people understand the meaning of this information community meetings were held in which researchers met with the public in order to present information and answer questions. However, ten years later, this form of direct outreach is no longer underway, having ceased soon after report-back. Further, the majority of the exposed are not likely to read the academic articles which continue to be published. Updated information is however available online as the C8 Health Project maintains an up-to-date website. Moreover, seventy-five percent of CEET study participants cited the continued coverage of the study and the lawsuits in the media as an information source. As they are watching for new news of C8, they will also be bombarded by legal advertisements keeping them abreast of their options to sue if they have the identified diseases. As Dave, the DuPont retiree put it: “my point is now… we have… we got all these lawyers chomping at the bit and you see all the ads on TV every night here.”

Impression Management and Interpretation

The understanding process is not just an endeavor of information gathering, it is also a meaning making process which involves the interpretation of the data collected. Exposed parties will call on different informational portals and interpretive schemas to give meaning to this
data. As we see in Table 5.4 participants exhibited three strong patterns of action to help interpret their results; speaking to other community members, contacting their doctors, and attending community meetings.

Table 5.4: Meaning Seeking Actions upon Receiving Report-back

<table>
<thead>
<tr>
<th>Reported Response</th>
<th>Participants (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended Community Meetings</td>
<td>14</td>
</tr>
<tr>
<td>Contacted Researchers</td>
<td>3</td>
</tr>
<tr>
<td>Spoke to Doctor</td>
<td>11</td>
</tr>
<tr>
<td>Spoke to Neighbors, Friends, and other Participants</td>
<td>13</td>
</tr>
</tbody>
</table>

Respondents felt that the community meetings were mainly focused on the dissemination of results and the quelling of fears by giving participants opportunities to ask questions of researchers. When queried on whether the meetings were useful the results were mixed. When interviewees said they were useful, they did not cite specific reasons why, except for three people who mentioned that the meetings put people in contact with other participants, allowing them to exchange information and make comparisons. Through making comparisons, people were able to assign some prospective meanings to the numbers they had received in their report-back. For example, one woman spoke of making comparisons at community meetings:

We met as a big group out at the high school or high school auditorium to address concerns and issues, and I know when we compared ours and his cousin and
his wife were there, and they both grew up in the area too, and my levels were higher than his and [I was] trying to figure that out. And he said well you drink more water, and I said I haven’t lived here half the time that you have that I would have consumed that much more…

Interviewer: Was the meeting useful to you?

Yeah, I mean we were able to talk to some others and see where they were too.

Several participants mentioned that the meetings were less useful because of people’s emotions. A member of the CAB related this:

We had a large public meeting at the high school and I moderated, if you will, kind of carried the microphone around and let people ask questions and they were DuPont representatives there and Dr. Emmett was giving the results of the data collection and the blood results in whatever conclusions we drawn up to that point and that got fairly heated. I mean there were obviously some folks in the audience that were very upset, particularly ones that had some health issues, and of course in that type of situation I think it’s human nature to sort of look for causes. And DuPont was there. Ironically DuPont had made the announcement that very day that they were going to provide bottled water to everybody in our county. But I remember that meeting, being definitely worn out by the end of it. It was a chore. I tried to get around to everybody to get them an opportunity to ask questions and managed it pretty well, but you get a small number in the crowd that are wanting to dominate more so than question; to make statements. So that was a little stressful to handle that.
Another biomonitoring participant spoke of the community meetings as too big: “In a situation like that there’s too many people there and they can get mad and yell and that don’t solve anything.” She further added that people were asking questions that researchers could not answer, prompting the crowd to get angry:

Probably they did not know the answer but most of them wanted to know what caused [C8 exposure] and what it was doing to them and they probably could not answer. But then it would make them mad and it would ruin the whole meeting. You couldn’t get any information.

**Going to the Doctor**

Another portal related to biomonitoring report-back through which community members accessed information and interpretative schemas was through reaching out to their personal physicians. Twelve out of nineteen interviewees related discussing their exposure with or directly bringing their report-back packets to their doctors in order to help them understand the meaning of their exposure. This experience was not at helpful as participants expected, as only two interviewees reported that their doctors had any interest in the information and, even then, could not address their patient’s queries as to the meaning of their exposure. One remembered her doctor saying that it was “bullshit that DuPont would dump that without paying for health care upfront.” Another doctor explicitly instructed his patient “not to drink the water.”

Interviewees expected or at least hoped their physicians would be able to shed light on the meaning of their exposure. Sadly, their physicians were unable to do so for three reasons. First, there is inadequate science about the health effects of industrial
chemicals. Second, the medical establishment is married to a “dominant epidemiological paradigm” which favors personal behavior and genetics over environmental causation as the etiology of disease (Brown 2007). Third, physicians are generally under-educated about environmental health issues (Gehle et al. 2011), though affected individuals often seek their guidance (Altman et al. 2008; Brown and Kelley 1996). This structural failure is compounded by the eco-social history of the Mid-Ohio River Valley which has left it a medically underserved area with high risks for chemical exposure. This structural inequality is perhaps best exemplified by an account by one of my interviewees which predated the biomonitoring studies. This mother and grandmother talked of the difficulty local doctors had when attempting to diagnose symptoms her daughter, a chemical worker, was experiencing:

The doctors back then…started called it High Valley crud. That’s what they called it. The High Valley crud. (lots of laughter)

Interviewer: What is High Valley Crud?

Anything that’s wrong with you, that’s what they call it. She was in the hospital up at Marietta for a couple weeks and they tested her, and tested her, and tested her, and the specialists up there said you’ve got to be shipped outta here because I don’t know what this is. I can’t decide. The only thing I can decide is High Valley crud. That was the specialist! (laughter) and they shipped her up to Columbus, to Ohio State where they do lots of testing. Put her up on the ninth floor where there’s only people that have… like HIV patients are there, people they don’t know what’s wrong with them. She was in isolation. And it turns out it was Hodgkins.
The above example ties together the eco-social history of the Mid-Ohio Valley with the local history of the medical system. Her daughter had to be transferred out of the area to receive a diagnosis other than High Valley crud. Yet this labeling of ‘High Valley crud’ is a tacit recognition that there is an unidentified something or ‘somethings’ in the valley, a valley referred to by locals as Chemical Valley, that is creating strange and negative health outcomes. The C8 Health Project, especially through the extensive studies undertaken on the collected data, has brought the most cutting edge of medical knowledge and epidemiological studies to this medically underserved area. This creates the ability to look beyond the ‘High Valley crud’ and create meanings that are useful to individuals and to the community, to the scientific and medical establishments, to regulators, and to the general public. In effect, it overcame local and structural barriers, creating a new information portal to which community members had much more access, which provided otherwise unavailable data and extensive information about the health risks of C8 exposure.

**The Dominant Frame: DuPont is Necessary**

As people accessed biomonitoring report-back and other portals they were continually attempting to assign meaning to what they were finding. As we discussed above, the portals themselves helped with this meaning making process. However, through my interviews a dominant contextual frame emerged which greatly influenced people’s interpretations. This frame was of the community’s need for DuPont. It became expressed in several ways: in direct discussion of economic need, in fears about the goals of the biomonitoring report-back studies, in antagonism towards the lawsuit, and in discussions of the tradeoffs of living in a contaminated area.
As one interviewee said in reference to the lawsuit:

Sure. They could close that plant down real fast if it keeps up. I don’t know how many millions of dollars any more it's costing, but most companies can't really afford all of that. And it would put a lotta people out of work.

Her husband responded: “My heavens, yeah. It would be harmful if it destroyed the plants, I think. 'Cause you're destroying the livelihood of a hell of a lotta people.”

Still, this was not the only way in which pro-DuPont framing influenced the exposure experience. Affected residents also seemed to have embodied the idea that exposure is to be expected and tolerated, framing life in the valley as a balancing between economic benefits and environmental and health protection. Early on in the interview process, I met a husband and wife who participated in the CEET study because of concerns they had about the chemical exposure to C8 in their children and foster children. They had cared for many foster children and still continued to do so at an advanced age. They were quite religious, which is common in the area, and they were so welcoming to a nervous graduate student who was out of his element. One thing the husband said clued me into something: sometimes people make choices to accept exposure because they really don’t have another option:

That’s [DuPont] about the biggest employer I would imagine in the area. And there’s a lot of concern about this [the CEET Study] and what effect it might have on DuPont. A lot of these plants are closing down and there’s a lot of concern about it. You know I guess it's just like coal miners. They go in the coal mines every day knowing that there is
a danger there. It’s just about the same way with this; maybe there’s a problem there, maybe there’s a danger, but we got a make a living. So they still go through it.

This was my second interview and it made me aware that I was in Appalachia and that here the political economy of the area meant something. There was a shared ecosocial history that I as a northerner has read about but did not consider. This is an area with a legacy of black lung disease, of the dominance of King Coal and despoilation of the environment in the name of unsustainable resource extraction jobs. Being faced with a limited choice of employment options, some of which can be harmful to one’s health is different when one’s father had to make the same unfair choice. This was an idea that I would repeatedly hear in future interviews - that people make tradeoffs between economic benefits and health risks.

The successful business owner put it this way:

Well, you know, it [the chemical industry] does supply a lot of people with good paying jobs. You know, nobody wants to work minimum wage fast-food restaurant jobs all the time. And yet, you know, Washington County is considered one of the worst air-polluted counties there is, so we pay a price for that.

Interviewer: So you see it as a trade-off?

Interviewee: An unfortunate trade-off.

A DuPont retiree commented on the trade-off between good jobs and health risks:
Yes, I think there is. I think there is a tradeoff. But, if you don't have that then what have you got? Maybe you got a steel mill belching out black smoke. You've got to have something. You are either going to starve to death or die of something else. (chuckle)

This idea that locally there is a tradeoff between economic success and community health is not however, hegemonic. A local mother felt quite differently:

No, I don’t see my community doing that at all. As far as DuPont goes, I think maybe they are getting a little more slammed because of it, but yet, I know at least where we live, the vast majority of retired people are retired from DuPont and they are living very nicely. DuPont has provided, you know, a good retirement for them after their service to the company, and yet it’s kind of sad that some of those people will be the first ones who would accept money in a lawsuit against the company, so it’s kind of sad I think.

Overall, 12 of 19 interviewees expressed the area’s economic need for DuPont and the chemical industry. What is striking about this is that I was not looking for this when I began the study. The intent behind my interviews was to learn about the effects of biomonitoring report-back on the exposure experience and to learn specifically about the studies in which they had participated. Yet what I kept finding was that these people’s exposure experience could not be separated from the economic concerns they had in relation to DuPont. This reinforces the findings of Altman et al. (2008), who argue that the exposure experience is shaped through the eco-social contexts from which it emerges. In practice, this means that to truly understand a people’s exposure experience researchers must explore the contextual effects that impact each specific case.
Conclusion

This chapter began by defining the understanding development process of the exposure experience as an information gathering and meaning making process. Individuals and communities use information portals to access, create, and help interpret exposure and health information to give meaning to their exposure and inform their responses. Understanding development is a continuous process through which meaning is refined through interaction with new information. These meanings are greatly influenced by the eco-social context from which they emerge. The individual physical and emotional meanings of exposure cannot be separated from the webs of political economic decisions which give rise to them. Further, as we will see in the next chapter, the responses based on these contextually based meanings are also inseparable from this context.

What this means in practice is that while there will be conceptual similarities between exposure episodes, the exposure experience of these episodes will not be reducible into each other. Two communities can be exposed to the same chemical but their experiences will be different based on contextual differences. While the specific hazards (health meanings) of an exposure episode are partially due to the specific chemical, they are also due to the relational factors governing the exposure source. Moreover, the interpretation of these hazards is again only partially attributable to the specific chemical. Contextual factors will form how people access this information, what information they see as legitimate, what options they have to respond, and how they believe their response will be received within their given context.
In terms of the C8 exposure experience, the meanings developed are constitutive of both physical and contextual factors. The exposure would not exist without DuPont, but it is likely the community would not exist as it does without DuPont’s presence. The physio-chemical properties of C8, its solubility and persistence, along with its practical use as a surfactant, the political economic decision to produce Teflon at the Washington Works Plant, decisions by DuPont to externalize C8, and lax regulation of C8 externalization: all of these were factors in the production of C8 contamination, and without them, the experience would be different. These political economic decisions that provided for the contamination of the area with C8 are also constitutive of the pervasive belief in the need for DuPont. In the manner of Schnaiberg’s (1980) “treadmill of production”, the continued investment in the Washington Works Plant allow for life as residents know it. Due to the size of these investments and the number of people employed, DuPont is both structurally and in people’s minds, part of what makes the area in its current form. The C8 exposure experience cannot be understood without the context of the belief in the need for DuPont.
Chapter 6: Responding to Exposure

Introduction

The Mid-Ohio Valley’s exposure experience is ongoing. Residents have mounted several actions to respond to C8 exposure, which have brought with them new information that spurred further response. Interacting with corporate, regulatory, and legal actors, community residents are now able to better understand the risks they face from C8 exposure. Members of the class-action lawsuit are now able to pursue new claims against DuPont based on the six C8-related diseases identified by the C8 Science Panel (C8 Science Panel 2011, 2012a-d). Further, research into the effects of C8 is ongoing, a field of scientific inquiry bolstered by the very actions of those who participated in the biomonitoring studies. This form of response action - the creation of an invaluable data set and the dedication of expert researchers who utilize it - has extended the effects of these actions far beyond the mid-Ohio Valley.

To understand how response played out in the form it did however, one must return to the eco-social context of the Valley. Belief in the need for DuPont’s presence and trust in expert representatives channeled response actions towards institutional participation and away from more controversial extra-institutional action like protest or boycott. This chapter explores the meaning of exposure experience response through the eyes of the participants. It begins by defining this process and examining the cycle between understanding and response. It then describes the response actions taken by different stakeholders in the C8 exposure episode and how these actions were influenced by local context into institutional paths. The chapter ends
with a discussion of how place-based context and framing continues to influence patterns of response.

**Exposure Response**

Exposure response is a process of measured actions taken to address chemical exposure. Participation in biomonitoring report-back studies are, for example, both information gathering activities and assertions of proper norms of response within the given context. These response actions prompt new information which can lead to new understandings and prompt future responses. In this dissertation the discovery, understanding, and response processes are artificially separated in order to better explicate their conceptual characteristics. In practice, response has no meaning without exposure discovery and understanding. Without knowing one is exposed, and without a meaning for that exposure, no meaningful response can take place. A reflex action is not equivalent to a measured response. Reaction, such as trying to dodge dripping liquid from a leaky chemical tank is unthinking reflex. If a drop or two reaches and absorbs into the skin without the person’s knowledge or suspicion, there will be no exposure response because they did not comprehend the exposure. If a person develops acute symptoms this new exposure impetus could make them reassess the situation and respond, but without it there is no response, just primitive reflex. In this way, response is both a choice and a contextually influenced process. It is constructed through the actions of individuals and the groups and institutions they form based on their development of exposure understanding.
The Cycle of Understanding and Response

This ongoing process of understanding and response form a continuing cycle as seen in figure 6.1.

Figure 6.1: The Cycle of Understanding and Response

Each information gathering action can influence a new response, while each new response brings with it new understanding. When a barrier to information gathering or response is encountered, people must overcome it, find a way to work around it, or decide to not do anything. Each of these options bring new understanding. When people gain successes in the exposure experience, such as winning funding from DuPont to build water filtration systems, these do not end the exposure experience, they bring with them new understanding and begin the cycle anew. Such is the ongoing exposure experience, a cycle of information gathering,
understanding and response. For example, when funding was received to build the new water
treatment plants, plant managers realized that they would then need ongoing funding for the
operation and maintenance of the filtration system. This understanding prompted the need for
further legal action to procure maintenance funding. So far, this response action has not
succeeded and it is still in the courts. This means that the cycle is ongoing, though perhaps
stalled in a current understanding of waiting for action from the courts.

The exposed residents of the Mid-Ohio Valley are experiencing this cycle of
understanding and response. In practice, this cycle mirrors natural information interpretation and
response processes, becoming part of daily taskscapes. At times individuals and communities
may experience it as a terrible stress, but at other times, it fades into the background. The
exposure experience is not over; rather people assign it less importance based on their current
understanding. The experience ends only when the exposed believe that it is over. In addition,
when it is over for some, it may not be over for others.

To explore this concept let us meet Dave, a DuPont retiree who worked in the Teflon
plant. In my interview with him, he stated he’d had “C8 on my hands at a billion parts per
billion.” Dave related this story as part of explaining how he became aware of C8 through his
experience at DuPont. At the time, this episode did not strike Dave as ‘a chemical exposure.’
This is because C8 was part of his normal work taskscape, and through this context, getting C8
on his hands did not occur to him to be problematic or special. It was certainly not something
deserving of any special response other than washing his hands. At this time, Dave had no
concept that C8 could be harmful, which forms the context in which this exposure was not
marked as exposure. In the present, now that Dave has new information about the risks of C8, he
can look back and relate this story as a case of exposure. There is a further personal context through which Dave interprets the exposure; he blames himself saying, “It was my fault. Especially because we were supposed to wear rubber gloves.”

Looking at this story of retrospective exposure, we can see the effect of the work-based social context in defining the situation as something unproblematic. As Dave gathered more information about C8 his view of the situation changed, however, his action of failing to wear gloves still marks his interpretation. If the situation were slightly different, for example if workers were not instructed to wear gloves, then perhaps Dave would not have taken responsibility for his own exposure. Still, what matters to Dave seems to be his interpretation that C8 is not as harmful as other chemicals with which he worked. His work-based taskscapes still influence his understanding of C8 exposure: “I can tell you one thing. If I do die because of some chemical that I’ve been exposed to at DuPont, I’ll bet you a dollar to a donut that it’s not gonna be C8. (laughter)”

When C8 exposure became a public issue in the Mid-Ohio River Valley Dave and his wife Mary began their exposure experience, by participating in similar discovery and understanding activities as did other community residents. They watched the news, talked with their neighbors, attended a community meeting held by Dr. Emmett and the DCA and they eventually participated in both the CEET Study and the C8 Health Study. Their actions were part of a series of interactions between community residents, health researchers, the legal system, state regulators, and DuPont. Through their actions, in concert with other community members, Dave and Mary helped form one of the major response strategy patterns employed by community residents in the C8 exposure episode.
Before we can discuss the resident response patterns however we must widen the set of stakeholders to the process. As noted above, community residents’ actions were only part of the story of exposure response. Institutional stakeholders we also deeply involved in the process; the community water system, government regulators, and DuPont. Together with community members, these stakeholders constructed several response patterns: an institutionally driven strategy led by the Little Hocking Water Association to address water quality; resident participation in expert lead biomonitoring report back research; and resident participation in expert lead legal action. In the following sections I will highlight the interaction of these stakeholders in each of the response processes.

**The Accomplishment of Clean Water**

“Yes, it (referring to outcome of biomonitoring studies) cleaned up the water. Absolutely...Yes definitely. And it is a relief to know that we have an excellent water treatment plant.” Community Resident

Context informs the definition of the situation for exposure episodes as does the physiochemical characteristics of the chemical in question. This means that the nature of the response will have both static physical characteristics and context-driven characteristics. In the C8 episode, the physical characteristic of the water systems as exposure vector is central. It combined the biological need for clean water and the concern for health risks of C8. This created the need for response to address water quality. In addition, the eco-social history of the area and of the developed world in general has created the social expectation that clean water is made available on demand for each household through municipal and or private water
distribution systems. This requirement for clean water on demand forms the baseline expectation of community residents prior to the discovery of exposure. When this quotidian is disrupted, there are expectations that actions must be taken to restore it.

The restoration of clean water formed a primary concern for the response process for community residents and the municipal water systems once they learned of exposure. No one I spoke with brought up the concept of not addressing the water contamination, even if they were unconcerned about the effects of C8. However, it is also questionable what direct role most community residents had, if any, in the action affecting this response. Due to the involvement of the EPA and the community water systems and the mandate they have to provide clean water, it is possible that these organizations alone could have affected a clean-up. Below we look at the interaction of community members in relation to the water clean-up.

The Tennant Family and the Little Hocking Water District

The impact that the Tennant family had on the C8 exposure experience is clear. It was their fight against DuPont that first alerted the EPA to chemical contamination from the DuPont plant. Through their lawsuit, knowledge of the community exposure emerged, allowing the municipal water systems to learn of their contamination. Once it learned from the WVDEP that DuPont and the regulators had entered into a consent agreement to test local water supplies for C8, the Little Hocking Water Association (LHWA) requested that their system be included in the test (Lyons 2007, pp. 47-48). Due to initial resistance from regulators the LHWA also began searching for a lab which could test for C8 if the WVDEP did not agree to test. Ultimately
LHWA was included in the WVDEP study and, along with their users, was formally informed of their system’s contamination on January 23rd, 2002.

At this point, according to Lyons, the LHWA became “an information clearing house for consumers with questions about C8” (Lyons 2007 pg.49). Further, she argues that “lacking a mayor, city council, or other local community representation, save a small body of township trustees charged with oversight of roads and bridges, the responsibility of leading the neighborhood through the water controversy fell to the water association (Lyons, pg. 50).” The LHWA is an entity which exists between individual residents and other stakeholders. Legally it is a user-owned water service mandated to provide water. In performing this duty, the LHWA was a de facto representative of community member concerns regarding clean water. This meant that individuals did not face a situation where they themselves had to directly assert this interest. Instead, the LHWA, based on its mandate to supply clean water, was the public’s advocate.

The LHWA began working with the WVDEP in its expansion of water testing within its system and in surrounding water systems once it learned about the contamination. LHWA representatives also attended every EPA regulatory meeting on C8. Its website hosted relevant information for all to access. Most importantly, the LHWA began private negotiations with DuPont to construct a filtration system to remove C8 from LHWA water. DuPont agreed to build the system but the negotiation process took four and a half years. During this process, LHWA entered into legal agreements with DuPont called “tolling agreements.” Tolling agreements are mechanisms used to extend the statute of limitations on a transgression, effectively preserving the LHWA’s right to sue DuPont for the contamination. In 2006, the
LHWA did sue when DuPont failed to agree to further extend the tolling agreements and the litigation is ongoing (March 2015 phone call to LHWA).

Currently the filtration system removes C8 from the well water to a point at which C8 is ‘undetectable’ (LHWA 2010). This ‘clean up’ or more accurately, the continued filtration of the water system was addressed mainly through the actions of the LHWA itself. While we cannot remove the importance of biomonitoring participation and the pressure of the class action lawsuit against DuPont, the provision of clean water for community residents of Little Hocking was obtained without much direct action by most of the community. Instead the LHWA took on this role because of its structural position and socio-cultural mandate. Citizens did not need to form a new organization or launch a mobilization to achieve this end. They gained clean water without the need for more direct forms of action such as a protest. In effect, they received the outcome they wanted without much personal effort; it was a path of action with little resistance.

**Biomonitoring as Response**

Participation in biomonitoring report back studies is a more nuanced form of response than allowing the LHWA to represent ones’ interests. Community biomonitoring, as discussed in Chapter 1, is a growing field which represents a challenge to more customary medical and epidemiological practices. Through their participation, community members are asserting a ‘new’ norm of the value of community based participatory research as well as the right to know what one is exposed to. The scientific exposure information is institutionally valuable, as it fits the scientific expectations and methods of regulators and researchers. It also challenges existing information control structures which work to hold exposure information in the hands of experts.
At the same time biomonitoring report back reinforces the role of experts and institutional research as the data from community biomonitoring studies is primarily still analyzed at the institutional level. This is due to the level of expertise needed to interpret such specialized information and the lack of understanding of the health effects of chemicals. This uncertainty will likely never be completely overcome. As such, I refer to this form of response as quasi-institutional behavior. Biomonitoring did represent the forging of new relationships between previously unengaged groups. However much of the effort and control over data exists outside of the community, even though the community did participate in the study through the work of DCA representatives.

Needless to say, expert power relationships were not the chief concern of exposed individuals as they made response decisions. They wanted their water cleaned up, they wanted to know what the effect of their exposure was, and they wanted to get on with their lives. For most of the respondents, getting on with their lives meant that DuPont would continue to operate the Washington Works plant. To achieve these ends they put their faith in their community water systems and biomonitoring researchers to do the bulk of the work. In doing so, they were able to achieve their aims. The water system got cleaned up, much knowledge was gained about the effects of exposure, and the Washington Works plant continues to operate.

Like the work of the LHWA, biomonitoring was also a process where a great deal of work was done not by the community but by the researchers. This does not mean that community members were not involved, especially in the CEET study which was directed by a community advisory board. Nor does it mean that community residents were ‘lazy’. Instead, it highlights how community members took measured actions in their response process, weighing
the costs (stigma, time, resources) of their actions and making decisions based on their exposure understanding. They utilized existing entities like the LHWA as they were intended, and when necessary appropriated other entities like the DCA for new purposes. In this way, they took advantage of what was available to them in order to most expediently address their needs. Community members overall were not looking for systemic or institutional changes, but instead they were putting their trust in existing institutions to correct a dysfunction in an aspect of the system those institutions are tasked to protect.

One effect of engaging in expert partnerships with biomonitoring researchers, especially since data analysis would be conducted by experts and not in concert with communities, is that the pace, scale, trajectory, dissemination, and nature of the research analysis is not always influenced by the community. This was less the case for the CEET study than the C8 Health Project, as the CEET study was conducted in partnership with the DCA. At this stage however both CEET and C8 Health study participants are left waiting for distant experts to continue to interpret the data collected. No further data collection for either study is planned even though many of my interviewees expressed a desire for a follow up study. Most commonly, they wanted a study to compare how much their C8 levels had fallen since their last test. None of my interviewees expressed any agency in making this happen, but left it up to the experts. As a response action, further biomonitoring seems unlikely though it is desired by the effected community and could be helpful in extending information about C8 from other sources. Those who pursued this tactic must simply wait for more analysis, a process that they do not seem able to prompt. My suspicion is that the nature of these research projects influences this lack of control. While the CEET study was seen as a research partnership, the community members
were not full partners. This is not a fault of the researchers as much as a lack of expertise and resources at the community level to be full partners and push for the study themselves. To conduct a new study would mean bringing in new funding and either rekindling or creating new relationships with outside experts. Currently there is no public effort to do this, perhaps because there is more focus on accessing medical monitoring funds through legal action.

The Lawsuit as Response

Legal action is the third major pattern of community response to C8 exposure in the Mid-Ohio Valley. It is also the most contentious and controversial activity, placing plaintiffs in direct opposition to DuPont and the popular frame of DuPont’s economic importance. So far, in this dissertation I have discussed the functional values of legal action, specifically its role in discovery and information gathering for exposed peoples. In this section, I will discuss the symbolic roles of legal action - how it was viewed by community members as a tool, a threat, and a grab for money.

To explore this symbolism let us attempt to put ourselves in the place of Mid-Ohio Valley residents in the period between 2001 and 2003. At this time, residents were likely to have learned of their possible exposure to C8 through letters from their water systems, media reports, and legal recruitment. Most of these people would have had little knowledge of C8 as a toxicant, and any knowledge they did have is likely to have come indirectly from DuPont through its employees who worked with C8.38 At this time, interested39 community residents are involved

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38 While Lyons (2007) highlights the work of the Environmental Working Group raising awareness of C8 as an emerging contaminant at the national level, I found no evidence of this or any other environmental group through my interviews except for one instance. A member of the class action lawsuit against DuPont mentioned gaining
in the information gathering and interpretation process of the exposure experience. To this end, they are facing information barriers and to access portals to get exposure information they need to mount initial response actions to garner this information. Their choices, however, are limited by the eco-social context.

Firstly, as discussed in the Discovery chapter, exposure is a situation where exposed communities are at an information disadvantage even before they even learn of their contamination. While pollution often escapes the walls of chemical plants, corporate information is much less mobile. While LWHA members could participate in the CEET study to determine the presence and amount of C8 in their bodies, members of other water systems did not have this opportunity without the lawsuit. Further, the only way to access information about how the chemical entered the environment, essential to determining exposure reduction strategies, is to break through the veil of corporate secrecy. Theoretically, this could be done in three ways. The first is to somehow convince the company to voluntarily disclose the information out of a sense of corporate responsibility. In cases where companies would face liability there is significant incentive for companies to proffer this information. Secondly, one could attempt to gain the information through a dedicated pressure campaign like those practiced by the anti-sweatshop movement (Ambruster-Sandoval 2005; Siedman 2007; Vallas, Judge, and Cummins 2015). These very public consumer action campaigns require controlled and continued messaging effort and actions to draw attention to corporate malfeasance. Such action would seemingly be out of character in the eco-social context of the Mid-Ohio Valley and would go information about the historical timeline of C8 from the Fluoride Action Network website. Overall I was surprised by the lack of environmental organizing

39 I think an understudied aspect of toxic exposure is the quiescent segment of the population who does not participate.
against the popular belief in the need for DuPont. Even less likely a tactic to force corporate
disclosure would be to push for a congressional hearing, since Congress has subpoena power
over corporate executives and documents. Instead, non-LHWA community members took the
most common path to get corporations to open their records; legal action to prompt the legal
disclosure as was discussed in Chapter 4.

Members of the Little Hocking Water System, on the other hand, had the opportunity to
join the CEET Study. This was a partnership of community and expert action which grew out of
the community itself. Through this portal, LHWA members were able to learn of their exposure
information independently from DuPont, government agencies, or legal action. For my
interviewees biomonitoring became their preferred action. They not only participated in the
CEET Study, they also all participated in the class action settlement funded C8 Study. None
however, participated in the lawsuit itself. To them, the lawsuit was, at best, a risky strategy that
was unlikely to be successful.\footnote{Note that all of the views of the lawsuit were given in 2013 or 2014. After the lawsuit had settled, the C8 Health project launched, and six diseases had been linked to C8 exposure through the C8 Health Project. People were still reticent to view the positive aspects of the lawsuit ten years later!} Below we see the range of CEET Study views on the lawsuit.

One biomonitoring participant expressed a lack of faith in lawsuits:

So I just never really can think that anybody could actually benefit from a lawsuit. You
can't really prove that that came from DuPont water. With water everywhere else having
it, why would it be DuPont? So I would feel that way if it was called something else, but
I just can see lawsuits doing anybody any – I think there's a limit to what the government
oughta have on some of these lawsuits.
Litigants and their attorneys were sometimes smeared by the claim that they were only in it for the money as mentioned by a grandmother and participant in both the CEET and C8 Health project:

Well, I feel that most people that join these suits, there not out for anything but the money, is my personal opinion. And even though, I mean I do hope that the C8 problem will be taken care of, I do not have any ill feelings towards DuPont because…without them we would be hurting for jobs.

In this case, she is making a direct connection between fears about the loss of DuPont with the selfishness of lawsuit participants. Another interviewee, a successful business owner, echoed the selfishness statement:

Ahh, well, they were just… that they were going to have the study and they wanted people to participate and there were attorneys there that wanted to represent you if you wanted to be represented and so forth. And some people thought ‘gee, free money?’ And I didn’t see that. I mean you’ve got to have a case. If you want to have a class action suit, and I guess there are some from all the community areas, and I don’t believe we signed up for that.

A contractor who worked at local chemical plants expressed a view opposite of those above; entertaining the possibility of mounting a lawsuit should he get sick.

I don’t know, I guess if I get a disease... at my age testicular cancer or what kidney cancer or something like that I don't know if I would sign up for the lawsuit or not. I might try
to find out more information about it… To see how likely it was that it would cause it but then go from there. I guess I’d have to decide after that… I mean I don’t see me against the big company.

Unlike the aspersions of ‘money grubbing’ litigants cast by other interviewees, this contractor seems to be making a more measured assessment of legal action. He would try to assess the likelihood of C8 causing his specific situation before joining the suit. He does not bring up compensation; rather he talks of taking on “the big company.”

One former employee of a non-DuPont chemical company in the area displayed contradictory views of legal action. He was the CEET study participant who was perhaps most interested in the legal aspects of the case and this interest came through when he answered seemingly unrelated questions. For example, when he and his wife were asked making comparisons between his blood levels of C8 with other CEET study participants, he replied: “I never did compare.” He continued, “I just think the lawyers wanted to take and cash in on something great.”

Later on in the interview, when the questions turned directly to the lawsuit, he commented:

It's the way the lawyers can make money as far as I'm concerned. That's the big thing. It's a way for the lawyers to make money. Yeah, you complain about it, but you still need the lawsuits to make sure that they can make some changes. But it still benefits the lawyers more than it does anybody else.
This former chemical industry employee is expressing much in this statement. First, he shows distaste for lawyers, a fairly common sentiment among CEET Study participants. However, he is also addressing the need for the legal system as a tool “to make sure that they can make some changes.” Second, he is expressing a need for change to the legal system. Essentially, he has articulated a nuanced tort reform argument. His view of lawsuits is that they can be beneficial to communities, but that they are more beneficial to lawyers. His wife, daughter of a former DuPont employee, agreed but had a slightly different sentiment. She first denied the need for the class action lawsuit: “It's unnecessary. I really just truthfully feel that it was.” She then expressed a deep-seated family loyalty to DuPont and the chemical industry:

Our daughter lives in that area, really close to DuPont, and she had cancer at 38, but it was a cervical type and it was behind the cervix, but she still wouldn't ever do anything about it. A lot of 'em signed papers when that class action suit [started], and she said, "No," even if she thought that it caused it, and we were the same way. I agree with my parent being an employee of DuPont, Bill. Made good money from DuPont… I'm alive from DuPont keeping me with good health, or health insurance. So I just never really can think that anybody could actually benefit from a lawsuit you can't really prove that that came from DuPont water. With water everywhere else having it, why would it be DuPont? So I would feel that way if it was called something else, but I just can see lawsuits doing anybody any – I think there's a limit to what the government oughta have on some of these lawsuits.

When asked if she thought that lawsuits could harm the area she said:
Sure. They could close that plant down real fast if it keeps up. I don’t know how many millions of dollars any more it's costing, but most companies can't really afford all of that. And it would put a lotta people out of work.

Her husband echoed this sentiment:

My heavens, yeah. It would be harmful if it destroyed the plants, I think. ’Cause you're destroying the livelihood of a hell of a lotta people. Not just DuPont, I mean there’s other ones in there, too.

Yet when I asked as a question about any benefits from lawsuits to the community, she relented a bit, expressing a belief that water treatment funding was obtained via lawsuit\textsuperscript{41}:

No, the cleanup part, I'm not sure a Little Hocking – well, they couldn't afford to put that much money into it. I don't think any of ’em could, not around here that could afford to put filters in and a separate building for all of it. That way, they’d benefited from that in the community.

Overall, the participants from the CEET study expressed negative views of the lawsuit. In drawing this analysis however I wonder how their views would be different if legal action had been their only recourse. Had the community residents of Little Hocking not had the opportunity to join the CEET study, and further, had they not had the LHWA negotiating with

\textsuperscript{41} Specifically, Little Hocking’s water filtration system was obtained via negotiations between DuPont and LHWA. However, the ongoing legal suit between these parties’ deals with the payment of continued maintenance costs of the system. The interviewee could be confused between the class action settlement, which provided for the construction of treatment plants in other effected communities and the current lawsuit. Regardless, in her view, some community benefit did come from legal action.
DuPont to clean up the water, legal action against DuPont would have been their next most likely response opportunity. In one sense, they are able to deride the lawsuit because they didn’t need it. When we look beyond their antagonism of the lawsuit proper, we further realize that they had no problem participating in the C8 Health Project, and accepting the $400 payment for participating that was funded through the class action settlement. Finally, none of the CEET study participants voiced any problem with the LHWA suing DuPont for funds to maintain the water treatment plant. As such, I think the stigma attached to the class action lawsuit may have less to do with fears it could damage DuPont, or personal opinions about tort reform, than the availability of response opportunities.

**Institutional Action, Extra-Institutional Action, and Free Riding**

Examining the three main response patterns above invited unexpected insights. From a social movement perspective, two interrelated patterns emerged; patterns which made me uncomfortable as a researcher. One is the tendency towards response actions that are largely institutional in nature. The second is that each response has aspects of the “free rider problem.” Fireman and Gamson (1979) explain the free-rider phenomenon as “the idea that it makes little sense for an actor to join in collective action when he (sic) can ‘ride free’ on the efforts of others (pg. 12)”. Effectively, the majority of the work to remediate C8 exposure was done by a minority of community members working through institutional paths. My discomfort comes not from the actions themselves but through my experience as a student of social movements. I mean by this that I came into this project with unknown biases that I only realized through the experience of doing this research. I expected a classic social movement campaign in the form of the anti-toxics movement or the environmental justice movement. The campaigns are epitomized by a
contentious stance taken by the community towards the polluting company and public forms of extra-institutional action such as protest or boycott. I had been expecting social movement activity and instead I found institutional and quasi-institutional action. Where I had been reading Bullard, Erikson, and Edelstein, I suddenly realized I needed a different literature. It struck me as action closer to the ideas of Gaventa and his views of Appalachian quiescence produced by corporate dominance. For Gaventa, citizens of Appalachia have little agency to resist corporate will. As Gaventa concluded in his landmark study of the power of Big Coal in Appalachia:

The pattern is one in which challenges by the people of the Valley to the massive inequalities they face have been precluded or repelled, time and time again, by the power which surrounds and protects the beneficiaries of the inequalities. (1982, pg. 252)

This made me uncomfortable for multiple reasons. First, it made me feel like I was unintentionally stigmatizing community members in my mind because they had not acted like I have believed exposed communities ‘should.’ Secondly, Gaventa’s explanation removes most of the agency from community members, explaining outcomes through mechanisms of corporate hegemony. This explanation does not fit all the facts, especially because there had been successes in the response process: the water clean-up, the two studies, the settlement, and the massive effect the biomonitoring studies had on the state of knowledge of C8.

Thankfully, the literature on community/corporate relationships in Appalachia does not end with Gaventa, and I was drawn to research by an interrelated group of scholars, namely the work of Sherry Cable and Thomas Shriver. Their work looks at the Appalachian community/corporate relationship in a form which is much less stigmatizing to individuals and
communities. Instead of seeing Appalachians as people without agency who are forced into quiescence or rebellion due to hegemony and deprivation, these more recent scholars highlight how in such a context the definition of response and resistance must be widened. Cable (1993) argues that in Appalachia, individual forms of resistance are common but that they may not always form collective resistance because actors interpret their situation as too constrained to have the desired effect. Cable’s study of chemical contamination of Yellow Creek, Kentucky found that people made complaints and attempted to work through institutional channels for years before structural changes by the environmental movement made collective action seem more viable. Making complaints and trying to gather information and make changes through institutional means was a type of resistance in this corporate dominated environment. Quiescence would have been the case if citizens did not ask questions or utilize existing structures.

Reading this type of literature both informed me of my bias and helped me to overcome it. My discomfort in my analysis was assuaged, but only for a moment. I had a new problem; a free rider problem. In the C8 exposure experience, the majority of community residents engaged in institutional and quasi-institutional behavior and did so in patterns where most of the effort, save giving blood samples, was undertaken by a few community members and their scientific and legal representatives. There is nothing wrong with this, pragmatism and efficiency are valuable to society in general. Yet in bringing up this phenomenon I was once again made uncomfortable by the fact that I was stigmatizing community residents through my analysis. The crux of the issue is this: The free rider problem is a problem for social movements because the power of social movement organizations is often measured by the numbers of people who
support their efforts and are willing to take action. As a person trained in social movements, I brought this perspective to bear on the C8 exposure episode because I had expected it to play out as a social movement response to toxic exposure. However the interviewees I talked with were not trying to build a social movement, they were trying to respond to chemical exposure in what they felt would be the most expedient way.

By looking through a social movement lens, I was seeing a ‘free rider problem’ when what I was actually seeing was much closer to pragmatic use of existing social institutions and creation of research partnerships which gave the communities access to expert information they would not have had. I was not looking at social movement activity, where participation, investment, and numbers are key factors. Instead, I was looking at more institutional types of action, where efficiency and outcomes are more valuable. It was more helpful to see community residents as pragmatists who made choices over their levels of participation and action based on their assessment of their social context, so intertwined with the chemical industry for over fifty years.

When we view the actions of the same community residents through a different lens, we gain the ability to see more nuances in their actions. Whereas for Gaventa corporate will leads to quiescence on the part of community residents, Cable and similar scholars find resistance in institutional participation (see Shriver et al. 2014). Whereas the former view strips agency from community residents, the latter increases it. In this latter view, protest did not emerge because protest did not appear as a viable option, something supported by my interview data. Similarly, in this view, biomonitoring participation is seen as a viable response activity. As borne out by
my interview data and secondary data analysis, it was quite successful in addressing the community’s need to level the informational playing field.

Overall, I now see the C8 exposure response process in the Mid-Ohio valley as the result of the interplay between the eco-social context and pragmatic decision-making in an arena of limited opportunity. Community residents have been quite successful in addressing the exposure episode. While it can be observed that they have taken little to no action to address the systemic issues which lead to chemical exposure, this was not their intent. Instead, the overall definition of needed response was to clean up the water without damaging the local economy. In that sense, community members were very successful.

Impression Management and Continued Response

Whether or not people will continue to pursue response actions depends on their understanding of their exposure experience and their interpretation of the need for future action. However, just because an individual or an aggregate of community members have decided their experience is over, this does not mean the experience is over for other individuals. Nor does it mean that the institutional wheels they have set in motion will necessarily stop. In fact, there is likely a connection between those who feel no more personal action is needed and those whose continual action allows people to believe action is unneeded. This would fit with the response patterns analyzed above, whereby the majority of response actions undertaken were low risk, low personal effort, institutional and quasi-institutional action. For example, let us return to the work of the LHWA. The LHWA has continued negotiations with DuPont for funding to keep the C8 filtration system online and is currently involved in litigation to this point. These actions taken
by the LHWA did not require any extra effort by exposed individuals; it was undertaken on their behalf under the LHWA’s mandate to provide clean water. Currently the need for clean water is being met; the issue is one of funding. Were clean water not able to be provided, it is likely that community members would become more directly involved in both the LHWA and the efforts to procure the means to provide clean water. However, since their needs are being met and their interests represented by a body which they can exercise agency over, community members are content. In terms of response process, this is more low intensity, low personal effort response via institutional action. The definition of the situation is that the water is safe, the funding is being pursued, and no further personal action is needed.

Continued Response Patterns Affected by Frames

Allowing the LHWA to act on members’ behalf is a response action that fits a general frame that arose from my respondents that influenced continued response patterns. This frame is that ‘things have gotten better,’ meaning that since exposure was discovered, the situation has improved to a level they find suitable. People spoke of this particularly in reference to the water clean-up, as an elderly man stated:

Well, they cleaned up our water, that’s one thing. We’ve been on this water ever since Little Hocking Water started and before that we had a well and so I think that was a real plus to get the water cleaned up.

The frame that things have gotten better was also exemplified through people’s discussion of DuPont’s improved safety measures. People believed that DuPont has improved
the safety of their plants and methods. For example, a former contractor for DuPont related this story when asked whether he thought that DuPont operated more safely now than in the past:

Oh, yes, now I know they have. Yeah, but at that time, that was in, oh, probably late '70s-early '80s. They weren't concerned. I know we worked around that butadiene, and that stuff's very explosive. It didn't bother them for us working all welding on it. We were more concerned than the plant was… I know I was working on one of those butadiene tanks down there and they told me everything was fine. I had to burn a hole in the top of the tank and put a new nozzle in it. Well, when the torch… blew through the tank, there was a nozzle down there that they had washed the tank out, and the tank was open, but they hadn't pulled the blind on that one two-inch nozzle, and I thought it was all over with. That thing blew up and it just shook that tank.

Interviewer: Did you fall off?

No. Well, that was a good thing 'cause we were probably 70-80 foot in the air.

Interviewer: Oh, my goodness. No ropes or anything? Well, I hope they wouldn't do something like that now.

Yeah, I know it. Now, they've changed a whole lot, well, just all the chemical plants up and down the river, you have to wear those suits that supposed to keep you from catching on fire and supposed to be chemical-resistant. But I don’t know how good that is. It only makes it hotter for you to work in days like today.
This quote is striking. Firstly, if safety precautions were as lax as he describes, how much value can be given to the idea that DuPont has improved its safety precautions without referencing how far they have had to come? Even more striking is the sentiment that he seems to lament some of the safety precautions due to their impact on the comfort of the work experience. He was not the only person to express this sentiment. A DuPont retiree put it this way:

Well, when I first started down there it was pretty well kind of like a family-oriented company. It was a good place to work even when I left there. But I know since then things have tightened up, you know. Things are tight everywhere. And probably some shenanigans that we pulled back then would get you out the gate real quick, although we did do our work. And as far as any lost time accidents, there were darn few. I was impressed with their safety. I think it was a good thing. I know all the time I was there they had people working on construction and people with different labor unions working in there and some of those guys didn't like all that safety, they liked to do it their way. But they had to or they wouldn't be working.

Other community members who did not have such a personal connection to the work process at DuPont still expressed belief that the company had improved safety. For example, the business owner mentioned earlier tied increased safety to her belief in the ongoing need for DuPont:

I think they are very safety minded, because they want to keep these plants open. And I think they will do everything possible to be safe. I mean they want to make the product and I don’t want them to go overseas.
When asked about the relationship between DuPont and other chemical companies in reference to the state funded chemical production zones she brought the conversation to this intersection of safety and the need for the industry:

They have a polymer group that they get together to support one another in safety. And they have safety classes and they have safety prizes… If your unit has had no accidents in, what is it, month or time period that they give, you all get a prize… They are very safety conscious. But it… hey, this is wicked stuff and ahh, you know, you really don’t want to eat or breathe or ingest in anyway. On the other had it’s a very useful product. A lot of the products that they make, Teflon and the other chemicals that they make here… it’s very much appreciated in our lifestyle, everybody’s lifestyle….

Interviewer: And a lot of jobs?

Yeah, a lot of jobs. And they have downsized and automated a lot of stuff. But… still, useful products come out of this valley. And I don’t want to stop that. On the other hand you can’t endanger human life either.

This belief in ‘safety getting better’ fits the general frame that ‘things have gotten better’ and likely influences the lack of more aggressive, risky, and or effort intensive response actions. However, just because they are not marching in the street and are for the most part allowing representatives to conduct more active response activities, the people I spoke with are not done with their concerns. Instead, many are waiting to gather more information as it is made available. Due to ongoing research efforts by the C8 Science Panel and affiliated researches, along with other academic and government experts, the scientific investigation of C8 and other
perfluorinated chemicals is ongoing. Community members did not directly access this information via expert publications. The majority of interviewees mentioned the continued coverage of this emerging science via local media, and, to a lesser extent, legal representatives. Moreover, more than half of interviewees expressed the desire for further biomonitoring study. For example, this DuPont retiree expressed his desired for more study related to his children:

They only thing I'd like to do is a lot more follow-up, and even for my children. Our children I should say (laughter). She had a big part of it... Even them, have a follow up because they lived here until she was out of high school and he was out of college. So that should affect them some way. They both have problems yet today.

Ultimately, the C8 exposure experience will play out as a result of the action of community members in interaction with the other main stakeholders: DuPont, regulators, researchers, and the plaintiffs legal team. While there is desire for more study, there seems to be comparatively little will on the part of community residents and other stakeholders to move this idea from desire to reality. Their exposure experience is not over; many community residents are ‘actively waiting’ for more information which could prompt more response. Others have already filed their medical monitoring claims. However, it appears that the major events in this exposure episode have passed. The frames that have emerged to define this stage of the process, that ‘things have gotten better’ and ‘DuPont is much safer’ are interpretive schemas which do not lead most people to call for more drastic actions. Still, the experience is not over. Were the continuing research to yield information which tied C8 to clear and present dangers the definition of the situation would likely change and as would the prescription for action. Such is the ongoing nature of the exposure experience.
Conclusion

This chapter examined the exposure response process, the third part of the exposure experience. By examining the response patterns which emerged and community members’ views of these activities we have arrived at three insights. First, the exposure experience is an ongoing process. Once exposure is discovered, the exposure experience becomes a cycle of information gathering, interpretation, and response. Response actions bring new information, which starts the cycle anew. It only ends when people define it as over, however, when it is over for one person it may continue for many.

Second, exposure response is a context-influenced process that can take place through both institutional and extra-institutional behavior. Stakeholders examine this context and make judgments of the most advantageous opportunities available in their view. Through their actions, they can also modify this context for themselves and other stakeholders. In order to understand why response patterns played out the way they did for a specific exposure it is essential to attend to the context in which the exposure occurred. In the case of C8 in the Mid-Ohio Valley, one cannot explain the response patterns fully without understanding the frame of the need for DuPont.

Third, the ‘free-rider problem’ is not necessarily a problem for the exposure experience. In a situation where social movement activity is needed to address exposure, which means a situation where there are not suitable institutional opportunities to deal with exposure, then lack of participation and or uneven participation could be problematic. However, this study also reveals that institutional participation may be preferable for exposure response activities because
it allows for a conservation of effort. Institutional participation implies that there are mechanisms and functionaries through which peoples’ interests can be represented and which would limit the individual effort needed to accomplish response actions. It seems quite logical that LHWA members would allow water system representatives to do their prescribed job of providing clean water. Why would residents attempt to negotiate with DuPont on their own when previously designated representatives responsible to community members, were already engaged in that process. Overall, I think it logical to expect individuals and communities to participate in response patterns which require the least amount of personal effort if they believe that the actions will be similarly effective.

These insights are limited in their generalizability due to the sample size of this study. However, I do believe that they are justifiable propositions for further empirical study. Chemical exposure is something unlikely to decrease in prevalence and impact and researchers must continue to understand how the process plays out, and particularly how context impacts the experience. Doing so will allow us to improve the situations of exposed people and to help them better construct response efforts which fit their specific context.
Chapter 7: Conclusion

Introduction

This dissertation sought to contribute to the concept of exposure experience by answering two questions. These questions focused on the exposure experience which occurred in the Mid-Ohio Valley. The questions are: 1) “How did the Little Hocking Water Association community members respond to contamination in their community”; and 2) “What factors influenced LHWA community members’ response to contamination.”

The exposure experience is an important concept in need of development in light of the modern world’s chemicalized environment which brings with it the expectation of more chemical exposures. Development of better understanding of the process of exposure experience will help improve both how we study and respond to chemical exposures. Examining the case of C8 exposure in the Mid-Ohio Valley this study develops several insights. This conclusion will summarize these insights and, in doing so, provide the reader with an update of the current situation in the Mid-Ohio Valley.

The Exposure Experience is an On-Going Process

Writing brings a certain finality to the subject in question but the C8 exposure experience in the Mid-Ohio Valley is anything but final. The scientific understanding of C8 exposure increases every year, lawsuits are on-going for medical monitoring. A community group has recently launched a campaign to shame DuPont. Where once my respondents had informed me that public spectacle would not work, now a group has formed “Keep Your Promises DuPont”.
This organization is dedicated to holding DuPont to the agreements it made in response to the C8 spill, especially the administration of over $200 million in medical monitoring funds set aside for affected individuals. Their grievances are not new, rather they are the current manifestation of an exposure experience that began ten years ago. Time is not the central factor in bringing out these grievances, rather the process of understanding and response has evolved to this current stage where public political action in the form of a social movement group makes sense to its members in light of their community context.

Exposure experience must capture this capacity for ‘on-goingness’ in order to serve as a useful concept. Once exposure is discovered one should expect the exposure experience to take the form of a cycle of understanding and response such that new understandings prompt new responses and these responses prompt new understanding. Every success or failure of response does not end the process, it contributes to the next iteration, the next turn of the cycle. Due to this on-going nature, some type of longitudinal study design would be required to better study an exposure experience process; to capture the cycle of understanding and exposure which can proceed indefinitely.

Different factors will influence what makes for the on-goingness of the exposure experience. Chemicals for which much is known may provide more circumscribed experiences depending on what the recommendations are for a specific chemical. Acute poisonings from chemicals with short half-lives may become relegated as insignificant as soon as symptoms pass. More chronic symptoms from similarly well known chemicals will prompt longer exposure processes, but may bring less uncertainty due to a more developed state of knowledge. For chemicals which we know less about the health effects, one can expect uncertainty to continue.
However, what if, suddenly, a new study emerges which says that the well known chemical, now has a new toxic concern, one that slowly builds into cancer. Now that acute exposure one has relegated to the past now has new meaning. New understanding must be created and from this, new responses. The exposure experience process can capture this because it is open-ended. The exposed are the ones who determine if their exposure experience is over.

**Information is the Fuel of the Exposure Experience**

In the exposure experience, information is that fuel that propels the process and it can also be the wall which hides exposure. Informational portals make any forward progress possible, helping overcome the informational barriers which stall or shield it. Without a first portal, an exposure impetus, a first bit of information pointing towards exposure, the exposure experience does not begin. It is this initial information which jogs people out of their normal, everyday taskscapes that begins the entire process. In areas dominated by the polluting company, we should expect the exposure impetus to take place in a context of some counteracting propaganda by that entity. In the case of C8, DuPont promoted concurrent frames that C8 was safe and the DuPont was safely operated and necessary. Furthermore, activities of polluting companies seem to become normalized overtime such that daily triggers of smoke from smokestacks, or repeated strange smells can become part of taskscapes. In the case of the Mid-Ohio Valley, both of these factors influenced the delay of an exposure impetus taking hold. It was not until official messages came from local water boards warning of exposure that the majority of the community began to take notice of C8.
The developing health information showing that C8 contributes to six different diseases, combined with the fact that little of the medical monitoring funds have been dispersed, forms the understanding that more response actions are needed. These actions seek to open medical monitoring not just to access funding, but to further increase medical knowledge. In turn this will contribute to new understandings. Medical monitoring is the next portal in a series of portals residents of the Mid-Ohio Valley have used. Without portals to access and help interpret information there would be no way to overcome the ever-present barriers which plague the chemically exposed. Scholars studying the exposure experience must attend to the portals used to overcome the barriers of highly technical information, intellectual property, and private property which help shield contamination from coming to light. Similarly, they must attend to the barriers corporations put in place to shield their activities. Failure to point out these barriers as barriers to the exposure experience means they can exist unquestioned.

Information and Re-Establishing Control

Chemical exposure brings with it a loss of control over how one’s body will be effected; this is the uncertainty tied to exposure. Information allows for regaining of some control in the face of this uncertainty. However, exposure information is often difficult for lay people to comprehend. It must be translated from the biological chemist’s bench into the vernacular. It must be made available to the exposed and it must become tied to their situation so the information makes sense in their context. For example, so-called safe levels of C8 expressed in parts per billion are not readily understandable when one is filling a glass of water and simply wants to know if it is safe to drink. While information exists, people need a lens to view it through. Biomonitoring studies became this lens helping people to understand not only if they
had been exposed, but how much they had been exposed to, and what such exposure could mean in terms of health effects. Biomonitoring overcame the ‘hiddenness’ of C8 exposure data, making visible the C8 that was lying wait in people’s bodies. This gave people concrete proof that DuPont was at fault and ammunition against DuPont if they chose to use it. In other words, the collective responses helped people reestablish some type of control over their situation, a control that was taken from them and one which they collectively took back, at least partly.

The Power of Context

When I began researching the Mid-Ohio Valley contamination I expected some sort of community group to emerge in response to the exposure experience. One of the formal questions throughout the interviews directly asked about the role of community groups. Answers to this question pointed to a belief that organized extra-institutional action would not work in this community and to the belief in the need for the chemical industry jobs. This however did not strike me as classic case of hegemony, where the power of the ruling elite sets the agenda for the less powerful. I felt that I was seeing a variety of responses utilizing existing institutions which ranged from the least confrontational level where people let their elected water board members represent them, to more confrontational biomonitoring study participation, to confrontation via legal action. The people I spoke with did not seem quiescent, rather they seemed to have responded pragmatically to the situation. They acted in a way which fit their view of their community and opportunities presented to them. In the face of the C8 contamination, the effected communities were able to regain clean water in the short and long term. They did so by working through existing institutions, namely local water boards. Furthermore, people who felt more action was needed had the opportunity to utilize the legal system to address their concerns.
to DuPont. Finally, the entire effected community gained access through legal action or through expert partnership, to detailed biomonitoring which not only reported back their C8 levels but also contributed to building a strong field of scientific inquiry. Both these outcomes greatly increased the information about C8 available to community members.

This series of responses fit within the prevalent frame that the community needed DuPont in order to maintain its economic health. At the time of my interviews, federal legislation had put a crimp on the coal industry, and as coal fired power plants were shut down, jobs there and in the larger coal industry were threatened, compounding the need for DuPont and other chemical industry jobs. This was the understanding of the situation for years until it became untenable, as people learned that DuPont was selling the Washington Works plant.

The formation of a community group was not just attributable to economic change; it was also due to increasing dissatisfaction with the administration of medical monitoring funds (Interview with Plaintiff 1). In KYPD’s view the fund administrator was too closely tied to DuPont and had only distributed roughly six million of the over two hundred-million-dollar fund. John informed me that if these funds were not distributed they would eventually revert back to DuPont, giving DuPont a financial interest in having them remain undistributed. To combat DuPont’s perceived foot dragging KYPD has launched an awareness campaign and begun to work politically by meeting with regulatory officials to put pressure on DuPont. For example, in August of 2015 KYPD and the Environmental Working Group met with the EPA, urging the agency to update its recommendations for C8 in drinking water (KYPD August 31, 2015). They based their claim on the recent work that which found that current recommendations for C8 in drinking water “may be at least 100-fold to high” (Grandjean and Clapp 2015, pg.1) In this way,
KYPD showed its willingness to work on the national level for the public good, not just its own exposure experience. Furthermore, this demonstrates how the progress of scientific understanding influences new response actions even ten years after exposure.

These new actions are another iteration of pragmatic response; informed by the evolution of the understanding and response cycle of the exposure experience. As DuPont began decoupling from the valley, the strength of the ‘DuPont is needed’ frame became increasingly threatened. This combined with rising dissatisfaction with the administration of the settlement and the beginning of new lawsuits to gain medical monitoring has led to a new definition of the situation. It is felt that organized, extra-institutional response are needed now in combination with institutional activities. Community members have now added a pressure campaign and political outreach to their established methods of legal action and expert partnerships. Their progress is chronicled on their website www.keepyourpromisesdupont.com.

The Future

I plan to continue to follow the events in the Mid-Ohio Valley through their website, as well as newspaper publications and by periodically checking in with my interviewees. While I am not rooted in this community, a fact that made this study difficult both for travel and for access, I feel connected to the people I spoke with. They entrusted me with their story and the knowledge it contains. This knowledge needs to be passed on as it has important insights about the nature of the exposure experience in a corporate dominated area. I have already discussed this study in one of the classes I have instructed. My students were drawn in by the story and very intrigued by the concepts of quiescence, framing, and resistance. I think with a good deal of
work this project could evolve into a book telling the tale through the lens of continuing
exposure experience. It could work as an individual case study or in comparison with several
case studies.

This case could also fit into a project explaining the EPA’s recent actions against long-
chain perfluorinated chemicals (LCPFC). The EPA and eight major manufacturers have
committed to the phasing out of PFOA 2015. PFOA is but one of a large family of LCPFCs
which the EPA is reviewing. The EPA has already passed two Significant New Use Rules
(SNUR) requiring manufacturers and importers to report for review any new uses of a subgroup of
PFCs, perfluoroalkyl carboxylates which are often used are part of carpets. (EPA No Date).
Another PFC subgroup Perfluoroalkyl Sulfonates were part of a voluntary phase out between
manufacturers in the early 2000s (EPA No Date) and had similar SNUR placed on them in 2007
(EPA 2007). These actions are interesting in that the EPA has often favored the regulation of
specific chemicals rather than chemical families. It will be interesting to see what role
community action played in these EPA decisions and if this marks a change in EPA regulatory
policy.

The Bigger Picture

While this study focuses on a single case for the purpose of informing the exposure
experience concept there is a larger lesson we can learn from this story, which is that there is an
imbalance between actual exposure and exposure experiences. The modern world is
contaminated to the point where we should expect people to be exposed to numerous chemicals.
Yet, the majority of people do not develop exposure experiences. This means that exposure must
be hidden in some way or that people are aware of their exposure but do not entertain it as a problem needing their attention. Maintaining this current situation, where exposure is not discovered and problematized, is not just an effect of the relative invisibility of exposure at the molecular level; it is as Michelle Murphy argues “purposefully assembled” (2008 pg 698) through social action. In the C8 case we saw such purposeful action through the work of DuPont penetrating the state regulatory regime and through their quasi-scientific public relations style action of promoting safe levels and community exposure standards for C8.

Each chemical, each aspect of externalized pollution will have its own specific history which allows it to be counted “irrelevant from corporate responsibility” as Murphy argues (2008, pg 687). This should not surprise us however as capital is expected to privatize profits and externalize costs (Kapp 1950). What is more surprising is how science can be used to both discover and obscure exposure, even when in the hands of technical experts tasked with chemical regulation (Murphy 2006). While we should expect industry science to hide exposure due to the material interest in doing so, we need government to be able to better discover chemical exposures, hopefully before they cause problems. This leads us to hope that the EPA has shifted their focus to the regulation of chemical groups that have similar properties and concerns, as they seem to have done with PFCs. By moving towards the regulation of chemical groups or classes, they are developing a “chemical class consciousness” in which each specific chemical need not be studied and proved harmful if there is enough evidence that the class is harmful. The onus would then be put on industry to demonstrate the need of a specific class member to in order use it. This is the model of the SNUR for PFOS substances discussed above.
Time will tell if the EPA is moving in this direction or if its actions around PFCs are an anomaly. However regardless of government action social scientists need to continue pressing exposure as a social problem. Deployment of tools such as biomonitoring studies can help bring legitimacy to this fight and can be leveraged politically in order to prompt both government and corporate action. Tying a corporation to a chemical trespass into people’s bodies can be a powerful statement in a campaign to make change within that company or industry. Just as important is the beginning of the exposure experience, for it is through this process that people can make change both individually and collectively.
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