

Nuclear Power and Lay Perception: One Community's Fight for

Answers

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Submitted in partial fulfillment of the requirements for the Degree of Bachelor of Arts
program of Environmental Studies at Brown University.

Providence, RI

May 2009

This thesis is accepted in its present form as satisfying the thesis requirements for the
Degree of Bachelor of Arts in Environmental Studies.

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ACKNOWLEDGMENTS

First and foremost, I would like to dedicate this thesis to Cynthia Sauer and her daughter Sarah. I truly believe that without Cynthia's help, this thesis would not have been even remotely possible. From connecting me to people within the case community to sharing her personal thoughts and stories, Cynthia provided me with a very valuable real-world look into the impact that environmental health problems have on people today. In addition, I would like to give a huge thanks to Joe Cosgrove, who volunteered hours of his time to speak at length about his experiences fighting for environmental justice. It is to him that I owe the successful completion of the survey used for this thesis. I would also like to thank everyone else who volunteered their time to enlighten me throughout this process: Shirley Cavanaugh, Monica and Bonnie Mack, Professor Richard Clapp from the Boston University School of Public Health, Kathleen Moren, and Dr. Paul Rosenfeld from the UCLA Environmental Science and Engineering Program. Last, I would like to thank my parents for their unwavering support and encouragement throughout this process. All of your help has been greater than you could ever imagine.

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ABSTRACT

As evidenced by the successful coalition of citizen involvement at Love Canal, NY, Woburn, MA and Times Beach, MO, lay perception is gradually being recognized as a legitimate force in discoveries of human-produced toxic contamination. For the purposes of studying the process by which lay perception of toxic contamination translates into community action, lay perceptions of cancer risk and causation are examined using survey data and interviews that were carried out within a community located about 60 miles southwest of Chicago, IL. There, citizens have been at the forefront of a battle to address radioactive water leaks that have occurred over the past decade at the Braidwood Generating Station and at the Dresden Generating Station. Because communication is an important part of addressing human-produced toxic contamination, interactions between laypeople, government, and businesses are also examined. This process by which “members who are not scientists investigate disease patterns and causes and struggle with government agencies and professionals to ameliorate the situation” has been officially termed “popular epidemiology” by Brown and Mikkelsen (1990:2). The results of the interviews and survey suggest that a more serious consideration of lay perception is essential to properly identifying and addressing human-produced instances of toxic contamination. For example, lay observations of increased cancer rates, birth defects, and a diesel fuel leak within the area preceded the disclosure of the radioactive leaks. Efforts on the part of community members to address the contamination have so far been largely ignored, also suggesting that businesses and government are not doing their part to promote the health and well-being of socially and economically disadvantaged communities. It is apparent that greater, informed citizen involvement and a shift in scientific and lay understanding are necessary if productive changes are to occur.

Nuclear Power and Lay Perception: One Community's Fight for Answers

I. Introduction

“I have co-workers from the countryside, and let me tell you; they’re all dying of cancer. Every single one of them.” This urgently delivered statement by my friend gave me pause as I thought back to what my mother had once told me. Working as a Registered Nurse, she had often noticed that a disproportionate number of patients with non-Hodgkin’s lymphoma visiting the office where she worked were living in the countryside. After relating this to my friend, he told me that he had noticed something strikingly similar based on his day-to-day interactions. I began to wonder how many other people had noticed the same thing. Had anyone ever attempted to get the issue looked into? Was it really true that “everyone” living in the countryside was dying of cancer? And if so, then what was it about the countryside that caused everyone to develop this serious disease?

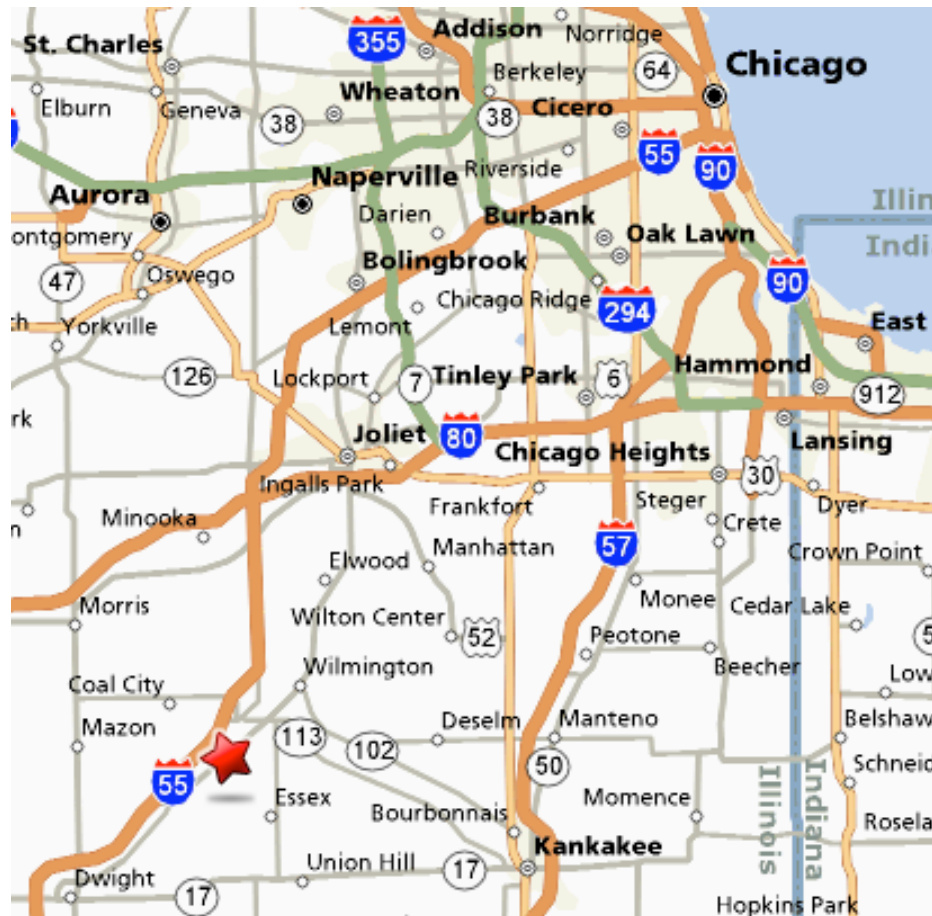
As I flipped through these questions which I had no way of solving, my mind turned to other communities suffering from environmental health issues severe and obvious enough to warrant action. How did they solve those questions too difficult for one person to answer alone? How did they gather enough attention and support to have their concerns addressed? And perhaps most important of all, were they successful in getting the perceived problem solved in a way that was acceptable to all parties involved? Love Canal has emerged as a symbol of successful community action geared towards a

very obvious environmental health problem, yet there remain hundreds of thousands of other communities which have unsuccessfully attempted to win back a healthy environment or at least gain recognition for their plight. It is estimated that on a yearly basis, about 1,000 communities contact a state public health department requesting an investigation into a perceived outbreak of disease (Wartenberg 2001:14). While it is unclear how many may continue to suffer, the sheer numbers provide an implicit message that everyone is vulnerable to the effects of environmental contamination. More significantly, as Alice and Philip Shabecoff (2008:xi) note, "...we tend to ignore the degradation of our habitat and its toll on our children or assume that someone else—the government, the medical community, industry—is correcting the problem. It is a false assumption."

Within this work, I will focus on a community in northern Illinois that came to realize the ineffectiveness of public agencies and government the hard way. Within a fifteen-mile radius of two nuclear plants located about 60 miles southwest of Chicago, IL lies a cluster of small towns (Braceville, Braidwood, Coal City, Dwight, Elwood, Gardner, Godley, Kinsman, Mazon, Minooka, and, Morris, IL). There, an unusually high incidence of cancer cases and birth defects has come to highlight the presence of the two nuclear plants, the Braidwood Generating Station and the Dresden Generating Station. In recent years both have been known to release radioactive water which has been thought to cause the cancer cases and birth defects. From the way in which community members came to recognize that there was a problem, down to the way in which they were treated by the government and public agencies when they requested help, this story remains similar to what other communities have dealt with in similar cases. By working

with key informant Cynthia Sauer, a former resident of the area, I was able to gain valuable insight into how her community coalesced to address this issue. It is important to note that she became involved in this cause after her daughter was diagnosed with brain cancer at the young age of seven. It is undeniable that such a personal assault motivated her to look for answers, no matter what roadblocks she faced.

Figure 1. Map of study area.*



Source: <http://www.mapquest.com/maps>

*The star on the map denotes the location of Godley, IL.

Attention will also be given to address lay perception of the sources and causes of cancer, as this guides the whole process of community action. In most cases where communities fight for answers regarding perceived environmentally induced health problems, a large company may receive blame for the elevated cancer cases and birth defects within the area. While such blame may be well founded, it is important to keep in mind that cancer has numerous invisible causes and pathways, making it impossible to pin down a single cause (Clapp et al., 2007). A cancer diagnosis, a diesel fuel leak from the Braidwood Generating Station, and two neighbor's concerns over the rate of cancer within their neighborhood were catalysts for investigative action in this case example. Yet, the features of these events are of greater interest because they reveal how humans view their relationship to the environment and the sorts of indicators that they respond to.

In covering these issues, this thesis is divided into several sections. The first of these deals with the research methods undertaken to address lay perceptions and attitudes towards cancer risks. The second section provides background information relevant to the community that was studied for this thesis. This includes a brief history of the nuclear industry and the process of community organization. The third section delves into the story of the Illinois communities of interest as a way to illustrate the processes that go into forming a community response to perceived environmental contamination. Understanding the finer details of this process is central to the purposes of this study. In addition, common themes and results of this investigation will be covered, using the results of the survey to help draw main points.

I. Methods

In order to assess community organization around environmental health issues and lay perception of cancer causation, several data collection methods were employed. Three interviews were conducted with health professionals who are or have worked in or near Chicago, IL, and five interviews were conducted with community leaders from the area of interest. In addition, surveys were distributed to the general population residing within the area of study. Interviews with physicians and community leaders would not have been possible without the help of Cynthia Sauer, who acted as my gatekeeper into the community. In addition, I was fortunate to get an interview with Richard Clapp, a professor of environmental health from the Boston University School of Public Health and an interview with Paul Rosenfeld, a professor from the UCLA Department of Environmental Science and Engineering. Professor Clapp's expertise in dealing with communities affected by environmental contamination along with Professor Rosenfeld's involvement in a study of radioactive releases within the area of interest made them appropriate resources.

Interviews were carried out over the phone and in person. Recording took place with the use of a digital program that was downloaded onto my laptop or with a digital recorder. A cassette recorder was also used as a backup device in case the digital recorder malfunctioned. MP3 files and transcriptions were then made for each separate recording. When carried out over the phone, I used a speakerphone in order that the conversation could be recorded. Sometimes this method was unsuccessful as excess interference could make it difficult to hear the other person. In such cases I resorted to

taking notes instead.

At the suggestion of Cynthia Sauer, I developed a survey to study lay perceptions of the causes and sources of cancer. These were distributed by way of an opportunity sample and distributed by Joe Cosgrove, the manager of the Godley Park District Recreational Center in Godley, IL. This center is visited each day by large numbers of people from within Godley and the surrounding villages and was thus a suitable distribution center. In addition, Mr. Cosgrove is a well-respected and well-known member of his community who has been very active in addressing the environmental problems within the area and confronting those responsible for them.

Surveys were left in a box within the reception area alongside another box with envelopes within which the survey could be placed and sealed (See Appendix A). Those working at the center offered potential participants the possibility of completing the survey and those who accepted were able to do so at their leisure in an anonymous manner. Consent forms were available to inform participants about the project, their rights and terms of participation, and contact information if further questions were needed. Because anonymity was an important consideration in the design of this survey, the consent form also took the form of a receipt which participants were asked to keep for their personal records. Once the survey was completed by hand, participants were to drop their sealed response within the drop-off box made available in the reception area. Of the thirty surveys that were left for potential participants, twenty were completed.

II. Background Information

A Background on Nuclear Power

Introduction

It is impossible to think about the beginnings of nuclear power generation without first considering the atomic bombings of Hiroshima and Nagasaki. Both a metaphor for the atrocities of World War II and the military might of the United States, the new technology also held the hope of a limitless energy source that would make the U.S. wealthy beyond measure (Makhijani and Saleska 1999:53). Heightened by the power struggles of the Cold War period and its desires to be recognized as a peaceful promoter of nuclear energy, the U.S. hastily constructed its first nuclear plant in Shippingport, Pennsylvania in 1946 (Caufield 1989:150). The impetus behind the subsequent growth of nuclear reactors nonetheless clashed with communities' desires for accountability and assurances of safety from the nuclear industry. Currently, there exist 66 separate plants within the U.S. with a combined total of about 132 reactors (Energy Information Administration 2009). The risk these nuclear plants pose to the environmental health and safety of human populations remains uncertain due to inadequate and missing data. Nuclear plants are the most obvious physical manifestation of nuclear technology, yet there remain strong ties between the nuclear establishment, the military, and government. It is important to acknowledge these ties because the initial military uses of nuclear technology set the stage for many of the health and safety concerns over nuclear power

generation that followed in later decades (Lown 1995:xiii).

Secrecy: A Dominating Factor in Nuclear Power

What had only five years before its creation been characterized as “science fiction,” the development of the atomic bomb was hidden under an impermeable political cover that remained well in place decades after the end of World War II. One of the first indications of this was the withholding of nuclear technological support by the U.S. for European countries shortly following the end of WWII (Goldschmidt 1982:237). Around the same time, in 1946, the Atomic Energy Act (AEA), was passed in order to help maintain a policy of “nuclear isolationism” to protect national security. In addition, the Atomic Energy Commission (AEC) and the Joint Commission on Atomic Energy (JCAE) were created. The AEC was placed in charge of creating and researching nuclear weapons and maintaining a supply of materials necessary for their creation. In order to help fulfill these mandates, the AEC was given responsibility over the entire scope of the nuclear enterprise, including sole ownership over all fissionable materials. Given the strong military connections and large nuclear infrastructure already in place, it was well known that the AEC held almost unquestioned power. It was the JCAE, however, that really held the top position. One government study concluded that the JCAE, “. . . in terms of its sustained influence in Congress, its impact and influence on the Executive, and its accomplishments, [is] probably the most powerful Congressional committee in the history of the nation” (Duffy 1997:23-26).

In 1954, the AEC was amended to enable the spread of nuclear information for

peaceful, domestic purposes (Walker 2004:3). Greenberg (1996:136) states that a domestic nuclear power program was necessary to help justify the enormous amounts of money that the government had already spent on the nuclear weapons program. Byrne and Hoffman (1996:13) argue that nuclear power fit with Western notions that technological progress and energy are directly related to social and monetary wealth. Specifically, “The Nuclear Project embodied all of the essential elements of the industrial dream – material abundance, technological acumen, and independence from the constraints of nature” (Byrne and Hoffman 1996:28). Partly because of this thinking and partly because of the horrific devastation caused by the atomic bomb, scientists involved with the Manhattan Project were eager to tailor the new technology for domestic usage (Jasper 1996:51). Nonetheless, there was a strong public relations component as well. In the throes of the Cold War with the Soviet Union, the United States was eager to portray itself as a peaceful promoter of nuclear technology (Makhijani and Saleska 1999:59). As had been done for the atomic bombings in Japan, the development of the first nuclear reactors was approached with overzealous fanfare. Newspaper journalists were quick to make outrageous statements that all the world’s problems would be solved through atomic energy. In fact, such claims were highly encouraged by the AEC and the military so that people would have no reason to even court the possibility that radioactivity might be dangerous (Caufield 1989:65).

Early Consideration of Nuclear Health and Safety Issues

The advent of WWII and the quest for an atomic bomb dramatically increased the

number of people exposed to radiation, thus necessitating a more serious consideration of health and safety issues during this period of time. Unfortunately, precaution often took a back seat in creating the first atomic bomb. Although a Health Division was created within the scope of the Manhattan Project, a lack of resources and qualified assistants made protecting soldiers and determining safety standards extremely difficult (Caufield 1989:47-50). By 1950, with the revelation that spies had given atomic information to the increasingly hated Soviets, it was clear that a nuclear arms race had begun. In response, atomic bomb testing commenced at a feverish pace in the Nevada desert in January, 1951. There were two purposes for the weapons tests. One was to provide U.S. soldiers with first hand exposure to an atomic bomb detonation in order to obtain "...observations of the psychological effects of an atomic explosion." The other was to help test new atomic bombs for potential wartime use (Ball 1986:27-29).

Over the course of the U.S. atomic bomb testing program, public opinion of the U.S. government and the AEC dropped considerably among citizens living near the Nevada testing site. Although there were many gaps in what the Health Division studied (due to political considerations), what they did discover was barred from public release (Caufield 1989:123). For example, it was already known among scientists that radiation caused cancer, yet this information was not acted on to protect the public during the course of the testing program (Ball 1986:39). As another example of how health issues were handled, before the mid-1960's, no serious studies had yet been completed to determine the full range of effects that radiation might cause (Makhijani, Ruttenber, Kennedy, and Clapp 1995:261).

Even without publicly released health information, those living just outside the

testing site gradually recognized that radioactive fallout could result in serious side effects. Prior to the existence of the Nevada nuclear testing program, cancer was almost unheard of within the communities situated near the site. In fact, before the nuclear weapons testing program began, Nevada was the state with the lowest cancer rate in the U.S. (a 17% lower rate among males and a 15% lower rate among females). Despite unwavering reassurances from the AEC that radiation exposure was safe, leukemia cases had become disturbingly common by 1961. In 1965, a report released by the Utah State Division of Health revealed that the four counties surrounding the test site exhibited the highest rate of leukemia deaths per 100,000 within the U.S. (Ball 1986:85-89). Growing revelations like these moved the debate around the dangers of low-level radiation from the scientific realm to the public arena (Walker 2004:9).

Community Response to Nuclear Power and the Mechanisms of Trust

Introduction

When nuclear technology first came into domestic use, it was so new that people did not know what to expect. The government and nuclear regulatory agencies grossly misrepresented the dangers of atomic substances in order to maintain support for nuclear testing and keep new developments secret (Lown 1995:xv). At first this method worked. However, as more cancers, leukemias, nuclear accidents, and warnings from outside the government emerged, people were finding it increasingly difficult to accept the same reassurances that radioactivity was harmless. If nothing else, these setbacks revealed that

public opinion plays an extremely important role in the future of nuclear power generation (Greenberg 1996:127-128). Goldschmidt (1982:274) writes that, “Of all the difficulties encountered or created throughout the history of the exploitation of the benefits of fission, the psychological and emotional obstacle, the basis of antinuclear opposition, seems today to be the most difficult to overcome.”

Mechanisms of Trust and their Applications to the Nuclear Industry

Despite the fact that experts cite nuclear power production as extremely safe, laypeople have consistently ranked it as one of the most risky and fearsome technologies (Greenberg 1996:155). Physical evidence of this fear was seen first hand during the Three Mile Island (TMI) accident during which 150,000 people evacuated the area around the nuclear plant. This was 146,500 more people than what the government advisory called for. Dubbed the “evacuation shadow phenomenon” this was the largest gap ever observed between the number of people advised to evacuate a particular area, and those who actually did (Erikson 1994:139-140). Yet, there are a specific set of features associated with nuclear power production which can help explain why nuclear technology invokes such a large amount of fear. It is best to first start by explaining Sandman’s risk equation: risk equals hazard plus outrage. Hazard refers to the magnitude of a certain technological disaster multiplied by the probability that it would ever happen. Outrage is the amount of fear that the public feels, irrespective of how dangerous the hazard actually is (Sandman 1993:5-6). In order to fully understand the risk equation, it is also important to describe the factors that account for the amount of outrage laypeople

feel. Sandman lists 12 different criteria including: voluntary-ness, naturalness, familiarity, memorable-ness, dreadfulness, chronic-ness (versus catastrophic-ness), how knowable it is, whether it is controlled by others, fairness, moral relevance, trust, and whether the process is responsive or not (Sandman 1993:11). Nuclear power has come to be associated with an exceptionally high amount of outrage when evaluated in terms of the 12 criteria.

Due to the way in which atomic technology was first introduced to the world, people have come to attribute a high amount of catastrophic-ness and unnaturalness to it. The large numbers of people killed by the first atomic bombs led to the characterization of nuclear weapons use as a catastrophic rather than a chronic problem. To distinguish between the two, a catastrophe tends to elicit much greater outrage than a chronic problem. For example, a plane crash that kills 50 people will attract media responses from major news networks, while 50 people killed in 50 separate car accidents over a wide geographic area might only be mentioned in the obituary section of the local newspaper. The likelihood of dying in an airplane crash is considerably smaller than the risk of dying in an automobile accident, yet people tend to have a much greater fear of flying (Sandman 1993:24). Likewise, the chance of dying from a nuclear warhead or a nuclear power plant meltdown is extremely low, but the potential consequences are almost unimaginably high. In 1965 a group from the Brookhaven National Laboratory estimated that a core meltdown would result in 45,000 deaths, 70,000 injuries, 10,000 to 100,000 square kilometers of contaminated land, and cause \$17 billion or more in damages. A later study completed in 1971 determined that the probability of such an accident was one in one billion (Greenberg 1996:146-7). Despite the low probability of

occurrence, such an accident would still be the result of a human produced technology, making a nuclear accident highly unnatural (Sandman 1993:14).

Contributing to the memorable-ness and unknowable-ness of nuclear technology were the domestic nuclear disasters that followed the first atomic bombings. Since the public first witnessed atomic weapons use under the setting of a war attack, it has been difficult to dissociate nuclear power generation from the deployment of nuclear weapons, thus making nuclear technology highly memorable (Duffy 1997:61). Unlike familiarity, memorable-ness is “how easy it is for you to envision something going wrong” (Sandman 1993:19). The highly publicized nuclear attacks on Hiroshima and Nagasaki along with the broad media response to the Chernobyl and TMI accidents created a large amount of memorable-ness in association with nuclear technology. In fact, these events have become strong representations of what the public tends to expect from nuclear technology (Byrne and Hoffman 1996:2). Overlapping with this effect is the issue of how knowable nuclear technology is perceived to be. Part of knowing something means being certain of what the risks are. This can be compromised if experts are in disagreement with each other or if the substance in question is undetectable through human senses (Sandman 1993:26-27). Safety hearings that were held during the early 1970’s between the AEC and the Union of Concerned Scientists contributed a significant amount of outrage when it was revealed that there was much internal disagreement over the safety of nuclear reactors (Greenberg 1996:143). In addition, starting from the early debate over low-level radioactive fallout, it was clear that there was something dangerous about radioactivity, even if there was no way to physically sense it (Ball 1986:70-71). Erikson (1994:148-9) notes that unlike natural disasters, human-produced disasters lack a

clearly defined “time frame” during which the disaster begins and ends, so people are left feeling permanently “contaminated” and unsafe.

Focusing more on how nuclear power plants have been built and managed, nuclear power production runs high in terms of its perceived uncontrollability, involuntary-ness, unfamiliarity and lack of trust. The first of these, controllability, refers to how much control one has in *implementing* the technology, while voluntary-ness refers to having the ability to choose whether to use something or not. With this in mind, people tend to feel most comfortable when they are in control instead of somebody else (Sandman 1993:29-30). Nuclear power plants are complicated structures with many different components, each of which must be fully operational to prevent a serious accident from occurring. In addition, nuclear plant staff must be able to respond within a matter of seconds in the event of a potential emergency (Greenberg 1996:132). To give a real world example of the seriousness of this issue, the Chernobyl disaster in Ukraine occurred within 90 seconds of a computer printout warning that the reactor had to be immediately shut down (Makhijani and Saleska 1999:150). The large role of human misjudgment in this and other past nuclear accidents has enhanced the lack of control and voluntary-ness that many people feel with regards to nuclear power production.

A lack of trust and familiarity towards nuclear power production can also be explained by the way in which the nuclear industry has been run since WWII. As has already been recounted, the nuclear industry has historically been an extremely secretive organization that has overwhelmingly responded to citizen concerns with false reassurances (Hu, Makhijani, and Yih 1995:xxi). Within the U.S., the TMI accident and increasing revelations of safety inadequacies led to a growing public mistrust of the

nuclear industry (Walker 2004: 20). Trust, once lost, becomes extremely difficult to gain back. Companies may give information that they believe to be correct, but lay people will be unlikely to believe it if there is little trust to back it up (Sandman 1993:39-40). Going hand in hand with this is a lack of familiarity with nuclear power generation. Since the nuclear industry has a history of glossing over the risks of radiation exposure in the past, the public remains distrustful, and thus unfamiliar with it. The irony is that because of this, efforts to educate the public about potential risks and dangers can backfire. This is in spite of the fact that people tend to feel much less outrage once given information from a source that they perceive as trustworthy and reliable (Sandman 1993:17). Nonetheless, as already mentioned, without trust, such efforts are futile.

Even aside from nuclear weapons or nuclear energy production, nuclear waste presents its own set of serious problems, making it undesirable due to its dreadfulness, moral relevancy, and unfairness. To give some idea of the waste generated, about every four years nuclear power plants create an amount of plutonium equal to the total amount contained within the world's stockpile of military nuclear weapons (Makhijani and Saleska 1999:8). As of 1999, there existed 40,000 metric tons of irradiated fuel within the U.S. Irradiated fuel, while consisting of 1% of all radioactive wastes in the U.S., contains 95% of the radioactivity present among all nuclear wastes. These will require hundreds of thousands, if not millions, of years to reach a level of radioactivity that is safe enough for humans to be exposed to (Nuclear Information Resource Center 2001:2). According to Sandman (1993:22-23) toxic waste, particularly nuclear waste, is extremely dreaded because of the way in which it threatens human health and safety. In particular, because of its long lasting danger to humans, nuclear waste brings up serious questions of

moral relevancy. In other words, should we be relying on a technology that will create ever-increasing amounts of highly toxic wastes for our future progeny to deal with? (Erikson 1994:212). People expect companies to promise that the highest standard of safety will be undertaken, yet this is impossible with nuclear power because of the waste problem it creates (Sandman 1993:35-36).

Coupled with the problems of radioactive fallout and radioactive releases from nuclear plants, efforts to create a national nuclear waste repository have failed miserably because of the perceived unfairness for whomever it would be located near. In 1982, the Nuclear Waste Policy Act (NWPA) was established to help locate two suitable sites for the permanent disposal of high-level nuclear waste. Almost from the start, it was clear that no state was willing to be the nation's nuclear dumping ground. Furthermore, surveys that were carried out to gauge public opinion overwhelmingly found that citizens did not trust the federal government or the Department of Energy (the agency responsible for determining a site). This was in spite of education campaigns to alert the public to the potential risks of having nuclear waste stored nearby (Duffy 1997:185:188). A recent article from *U.S. News and World Report* concludes that public support is the most important step for establishing any kind of waste site. In other parts of the world such as Sweden, waste sites are not chosen unless the community agrees to it. This policy helps eliminate the high costs and time that must otherwise be spent to ameliorate a socially unacceptable arrangement (Garber 2009).

Linking with the issue of trust is the perception of how responsive the nuclear industry has been. Responsiveness refers to how open, apologetic, courteous, sharing, and compassionate a company is when people voice complaints. Since responsiveness is

linked to trust, a company that is unresponsive is unlikely to be trusted or to be viewed as safe (Sandman 1993:49). As already mentioned, the nuclear industry has historically been an extremely closed organization which maintained the respect of U.S. citizens up until it was revealed how dangerous radioactivity was and how inappropriately it was often handled (Makhijani et al. 1995:261). Unfortunately, it does not appear that the nuclear industry today is any more open than it was in the past. On the contrary, Greenberg (1996: 130) notes, “That the U.S. regulatory system has been more open than most to intervenor and public participation does not mean that it has in fact been very open at all... Since the mid-1980s, there has been a disturbing trend to close the regulatory system even more tightly, and to raise more and larger obstacles to public participation on all matters, including issues of accidents and safety.”

Popular Epidemiology, Community Action and Environmental Justice

While outrage is considered a negative force against those whom it is directed, it can serve as the motivation behind community action and efforts towards environmental justice. Environmental justice is defined by Bullard and Johnson (2000:558) as, “...the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” Encompassing the multiple domains of public health, social equality, and the right to a clean environment, environmental justice is meant to be a dynamic term that addresses a wide range of social issues while serving as a challenge to the status quo (Roberts and

Toffolon-Weiss 2001:10). Driving this process is "popular epidemiology", a term used to describe the process whereby laypeople independently gather data on perceived disease outbreaks and interact with government agencies and professionals in an attempt to resolve the problem (Brown and Mikkelsen 1990:2). The success of communities in addressing environmental contamination has been demonstrated by the large role of Love Canal members in the passage of Superfund legislation and by the subsequent role of Woburn citizens in the re-authorization of Superfund (Brown and Mikkelsen 1990:47). In 1994, Executive Order 12898 was passed, stating that the EPA must guarantee that, "no segment of the population... suffer disproportionately from adverse health or environmental effects, and all people live in clean and sustainable communities" (Bullard and Johnson 2000:570). In general, it is also significant that many of the public laws in place to provide information to the public would not have been possible without long-standing community fights against polluting companies (Steingraber 1997).

A set of startling figures helps illustrate the extent to which human-made chemicals have pervaded our environment and harmed us. Since World War II over 70,000 different chemicals have become available on the market with about 1,500 new chemicals added each year. In 1994 alone, 2.26 billion pounds of toxic chemicals was released into the ambient environment by 22,744 facilities (Tesh 2000:3-4). Clapp, Jacobs, and Loechler (2007:2) write that, "...environmental and occupational contributions to cancer in the U.S. are substantial and justify continued efforts to prevent these types of exposures." One indicator thought to be associated with exposure to manmade toxins can be seen in the prevalence of childhood cancer cases. From 1950 to 2001, childhood cancer rates increased 67.1%. Since the 1970's, pediatric brain cancer

cases have increased by 35% and childhood leukemia cases have increased by over 47% (Shabecoff and Shabecoff 2008:39). In addition, the rates of certain types of cancer known to be caused by environmental contaminants have been on the rise in recent years, including brain cancer, breast cancer, leukemia, lung cancer, non-Hodgkin's lymphoma, and prostate cancer (Clapp, et al. 2007: 1). Rising rates of birth defects also raise alarm bells. Within the U.S. about one in every 33 babies is born with a defect, and little appears to be done about it (Gavigan 2009). Four out of every five birth defects remains unexplained (Davis 2002:194).

With the proliferation of so many chemicals in the environment and a lack of adequate information about them, establishing a definitive link between cancer and chemical exposure remains extremely difficult. Although it usually takes years for the effects of a contaminant to result in a clinically diagnosable illness, the facts are irrefutable that contamination by toxins results in physical illness. To date, the International Agency for Research on Cancer has identified 415 known or suspected carcinogens. It is highly likely that there are far more carcinogens given that of all the chemicals on the market, 40 percent lack any kind of screening, and of the 2,863 produced at a rate of over one million pounds per year, only seven percent have undergone complete toxicity testing (Wakefield 2000:A25). Besides the many untested chemicals currently out on the market, it is the many different pathways and exposures that can lead to cancer that make quantifying risk so difficult, if not impossible (Clapp et al. 2007:2). Synergistic effects that occur between different toxins complicate exposure assessments since the effects of two chemicals may be much greater than the sum of their individual parts. When one takes a viewpoint that only considers one toxin at a time,

these important interactions are missed, and understanding the cause of a cancer case becomes much more complicated (Howard 1997:192).

Despite the existence of regulatory agencies designated with ensuring environmental safety, it is almost always the case that instances of environmental contamination are discovered and addressed by those who experience it first hand. In other words, it is the people who live with and suffer the consequences of toxic contamination that are the most effective at recognizing that an environmental health problem exists (Brown 1992:270). Tesh (2000:108) characterizes lay knowledge as “concrete, specific, and dynamic,” noting that it is based on the tangible experiences of everyday life. In addition, Paul Slovic, a leading specialist on public perception notes that, “the public is neither ignorant and irrational” (Greenberg 1996:158-9).

Despite the invisibility of chemical toxins, there has been a documented history linking lay perception to the discovery of various environmental and occupational health problems. For example, in 1977, a group of men working at a chemical plant producing dibromochloropropane (DBCP) were among the first to recognize that it causes sterility (Davis 2002:196). Other examples include the discovery of buried chemicals by citizens of Love Canal and the discovery of contaminated drinking water by community members of Woburn, Massachusetts (Brown 1992:267).

While in theory government and state agencies are supposed to aid citizens who present environmental health concerns, the reality is that community members are often left to fend for themselves. Every year about 1,000 communities request a health study because of a perceived disease outbreak. Because going through this process is time-consuming and expensive, health departments typically use a standard screening process

to determine which cases warrant further investigation. Political or publicity considerations are also an influencing factor in selection (Wartenberg 2001:14). Yet, studies have found that state departments, as a matter of course, are unhelpful, often delivering standard replies that fail to offer any meaningful support for those affected. Unhelpfulness extends further when state departments require excessive data from community members before even agreeing to investigate a potential problem (Brown 1992:725-6). Recently, the Agency for Toxic Substances and Disease Registry (ATSDR) was publicly scolded for its lack of competence in helping communities. A recent government report noted that, “Time and time again ATSDR appears to avoid clearly and directly confronting the most obvious toxic culprits that harm the health of local communities throughout the nation” (Beamish 2009). Congressional hearings are currently underway as many angry communities are stepping up to gain recognition for the unacknowledged contamination they have had to endure in the meantime (Committee on Science and Technology 2009).

Examples of how government agencies have obstructed or ignored community requests for help abound. During the 1980’s in Dickson, Tennessee, community members noticed a cluster of birth defects near a location where illegal chemical waste dumping had recently occurred. A request to the Centers for Disease Control (CDC) for a health study looking into the defects led to a visit from a group of rude and disgruntled officials who seemed more interested in accusing the parents of the affected children than in investigating the problem (Shabecoff and Shabecoff 2008: 8). In Woburn, Massachusetts, health studies to investigate a childhood leukemia cluster were poorly designed and carried out, with statistical tests and control groups improperly chosen so as

to reveal no statistically significant problem (Brown and Mikkelsen 1990:11). Davis (2002:198) notes that government ties to business and the lack of an objective outside agency to evaluate human environmental health factors have contributed to this method of handling public concerns. The Government Accountability Office (GAO) recently came to the conclusion that, “The EPA is at high risk for waste, fraud, abuse and mismanagement and needs a broad-based transformation.” Improving the EPA is currently ranked by the GAO among the top three priorities for the new Obama administration, along with overhauling the financial system and the Food and Drug Administration (Kissinger 2009).

Even when communities are successful in getting a government agency to conduct an investigation into a perceived disease outbreak, community members are still often unsatisfied with the results. One reason for this is that scientists coming from outside the community to investigate a cancer cluster or disease outbreak often lack local knowledge that could lead to a thorough and accurate investigation (Tesh 2000:5). Following from this, scientists often discount the wisdom of lay people in favor of an unrealistic scientific standard that treats each community as distinct from social and economic factors (Brown 2004:74). Implicit in this thinking is also the idea that laypeople do not possess the scientific knowledge necessary to accurately recognize whether there is a real problem or not. This is unfortunate because many community activist groups have demonstrated a solid handle of scientific knowledge and an ability to carry out basic epidemiological research (Legator 1993:6). In order to adequately account for the unique characteristics present within each community, scientists must be willing to collaborate with community members. Without this, both sides do not

understand the other, and the end result leaves the community no better off than it was before (Brown 1992:275). Davis (2002:21) acknowledges this, noting that it is difficult for epidemiologists to walk into a new community and automatically know which questions to ask.

A second reason that community groups are often dissatisfied with the results of government health studies has to do with the format used to determine statistical significance. Formally known as risk assessment, the typical epidemiological study consists of four steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization. These steps are supposed to help identify recognized hazards, determine how much of the hazard people are coming into contact with, how many people are being exposed, and how great a risk the hazard poses (Barnes and Dourson 1988:479-482). Tesh (2000:38) argues that this process is fundamentally flawed, writing, “A link between health problems and pollution can seldom be established because there are so many confounding variables, because health differences between exposed communities and unexposed communities are hard to detect, because in small communities the data are rarely statistically significant, and because it is nearly impossible to get reliable exposure information.” Typically, once a thorough study has been completed, a true cluster is discovered less than five percent of the time (Jacquez, Waller, Grimson, and Wartenberg 1996:320). This can partly be accounted for by the fact that as a general rule, scientists tend to take a conservative view that favors false negatives to false positives during statistical testing (Wartenberg 2001:15). Nonetheless, a lack of statistical significance should not preclude efforts to address a potential problem, particularly when the scientific evidence reveals dangers to public health

(Brown and Mikkelsen 1990:134).

Proponents of environmental justice along with community activists often argue that science is not a neutral topic that exists separate from the social and political spheres under which it operates (Brown 2004:79). Beverly Paigen, an epidemiologist who aided toxic victims of Love Canal, notes that, "...value judgment involves deciding whether to make errors on the side of protecting human health or on the side of conserving state resources" (Brown and Mikkelsen 1990:136). Scientific findings escape notice when they conform to the status quo but can create a stir if they challenge existing institutions and values (Tesh 2000:79-80). Because so many scientists are employed by the corporate sector, scientific studies often conform to those interests (Brown and Mikkelsen 1990:151). Davis (2002:132-133) recounts how it took 60 years before tetraethyl lead was removed from gasoline in response to scientific studies citing its dangers. Before then, the scientists responsible for demonstrating lead's true health effects endured untold abuse as industry-employed scientists consciously worked to discredit their findings. Another example can be made of hexavalent chromium, which, despite numerous studies indicating its carcinogenicity continues to be unregulated by the Occupational Safety and Health Administration. This is a direct result of industry efforts to undermine steps towards tightening regulations (Michaels, Monforton, and Lurie 2006:1). One scientist once commented that, "If you ever want to be intensively peer reviewed, just produce a study with billions of dollars of implications and you will be reviewed to death" (Davis 2002:127).

When scientists fail to even acknowledge that there *might* be a problem, government and state agencies de-legitimate the suffering of the community, in turn

prompting them to address the larger social and political inequalities that have led to their toxic waste problem (Tesh 2000:108). As a result, environmental justice advocates tend to emphasize the responsibility of polluters and government to protect all members of society and not just those who “matter” (in other words, those with large amounts of economic and social power). They also call for a precautionary approach to health that targets pollution before it results in cancer clusters (Bullard and Johnson 2000:559-560). In sum, they stress the importance of equality, democracy, and the maintenance of environmental integrity (Roberts and Toffolon-Weiss 2001:216). Bullard and Johnson (2000:557) state that affected areas tend to be economically poor and politically disempowered. A recent study by Scammell, Kangsen, Senier, Darrah-Okike, Brown and Santos (2008:9) found that tangible evidence, trust, and power tend to have significant influences on how communities perceive environmental health and interpret the results of community health studies. Those from areas with less political power tended to lack trust in community health studies (and the government agencies producing them), relying more on tangible evidence as a means to evaluate environmental quality. By contrast, individuals from communities with greater political and economic power tended to trust government institutions, finding fault with health studies only in terms of methodology.

Given the ideals of democracy, equality, and a clean environment that community activists embrace, how much risk is considered acceptable and how does risk communication fit into this? In reality, there lies a wide gulf between what experts and the public view as acceptable. Experts tend to discredit public perceptions of risk as uninformed and unreasonable, while the public tends to be confused by the technical jargon that accompanies scientific explanations of risk. As a result, government agencies

may withhold scientific findings altogether in order to avoid public outrage (Brown and Mikkelsen 1990:148-9). This is because informing the public of their risks is much more complicated than simply listing off a list of figures and explaining what they mean.

When the community lacks trust, they are unlikely to believe anything a polluting company says. One of the best strategies for overcoming the divide between lay and industrial perceptions of risk appears to be collaboration between the two sides (Fischhoff 1995:139-143). This is necessary as risk is a subjective science inherently linked to existing political structures (Brown and Mikkelsen 1990:152).

When community members become aware of an environmental health problem, becoming an activist is not the typical response. This is because, "...being an activist means pitting oneself against the established order and is in itself a form of deviance. Not only do toxic waste activists threaten the established political, economic, and social order, but they are also seen as obsessed with a toxic waste problem" (Brown and Mikkelsen 1990:54). The physical illnesses that result from environmental contamination can have a deep emotional toll on those within the community and can hinder efforts to recruit members. The constant, never-ending blows associated with cases of environmental contamination can create a sort of "group culture" that is greater than the sum of the community's individual traumas (Erikson 1994:231). The Woburn community was marked by depression and hopelessness, a condition also present at Love Canal, and Three Mile Island. Another factor preventing community action comes from the reality that often most people do not want to risk being fired by the company that has employed them for most of their life or lose part of their property value by admitting that their neighborhood is blighted by toxic contaminants. In such cases, community members

may even treat activists with outright hostility (Brown and Mikkelsen 1990:84-86).

Cancer Causation

Part of acknowledging lay perception as a legitimate form of knowledge means exhibiting greater consideration and respect on the part of industry and government. Richard Clapp, who has previously worked with contaminated communities, notes that when laypeople have a gut instinct that something is wrong, they are almost always correct about it (Clapp 2009). Perhaps the most baleful feature of radioactive contamination has been its invisibility to those exposed to it. The readily observed natural disasters and plagues of the past have been largely supplanted by invisible, human-made attacks that appear unexpectedly, sometimes years after the first initial exposure (Brown and Mikkelsen 1990: xxi). The human-made aspect of such disasters violates human expectations of honesty and neighborliness, contributing to a sense of inhuman-ness and unnaturalness that permanently changes the way affected people view their surroundings and relationships with others (Erikson 1994: 228-236).

In order to effectively confront instances of environmental contamination, activists argue that there needs to be new modes of collaboration between activists and scientists. As mentioned earlier, activists are often unhappy with the results of health studies, while scientists must conform to standards that are extremely difficult to satisfy (Tesh 2000:38). Without collaboration, neither side is able to understand the other, and valuable observations and knowledge risk being missed (Brown 1992:275). Furthermore, because unofficial clusters of illness tend to be ignored by health officials,

activists argue that the lack of statistical significance does not warrant inaction (Brown and Mikkelsen 1994:134).

With the presence of the nuclear plants and the unusually dominant presence of brain cancer, thyroid cancer, and leukemia within the case community, it is useful to examine the major risk factors known to elevate these illnesses. For both leukemia and brain cancer, non-ionizing radiation has long been known to increase the risk of developing either of these illnesses (Clapp et al. 2007: 5-11). According to the most recent of a series of reports on low-level radiation issued by the National Academy of Sciences, even an extremely low amount of radiation is capable of causing cancer in a small number of people within any given population. In other words, a “linear-no-threshold” (LNT) risk model exists in which the higher the level of radiation, the greater the number of people who will develop cancer and other adverse radiation-induced illnesses. (National Academy of Sciences 2005:1-2).

Since nuclear plants produce radiation, several studies seem to indicate higher rates of cancer near nuclear plants as a result of higher background radiation levels near those facilities. A recent study by the Michigan Department of Public Health found that people living near the Fermi II nuclear plant in Monroe County, Michigan have experienced cancer rate increases among people under age 25 that are three times greater than the state average between 1996 and 2005. Before the plant began operating at full capacity in 1988, the cancer rate in Monroe County was below average compared with the rest of the state of Michigan. Although the NRC denies that they are responsible, stating that radiation levels around the plant never exceeded limits they deem dangerous, Dr. Janette Sherman, a specialist in environmental health, retorts that pediatric cancers

are an indicator of excess radiation and merit serious attention (Melzer 2009). This is not the only example of documented cancer increase. One study found that there is a 14 to 21% increased chance of getting leukemia among 0 to 9 year olds and a 7 to 10% increased chance of getting leukemia among 0 to 25 year olds living near nuclear plants (Clapp, et al. 2007: 11). Another study completed in 1997 by Steven Wing, an epidemiologist from the University of North Carolina, found that the rates of leukemia and lung cancer among people living downwind of the Three Mile Island nuclear plant were two to ten times higher than areas upwind of the plant (Pfister 2009). It is clear that more research is needed into why these increases have occurred.

Exposure to pesticides presents other risk factors for developing brain cancer and leukemia. One study found that the risk of brain and other Central Nervous System (CNS) cancers increases 85% among commercial pesticide applicators, but not among private pesticide applicators. The risk of developing leukemia has also been associated with commercial pesticide applicators exposed to organochlorine pesticides such as aldrin, chlordane, DDT, dieldrin, and toxaphene, in addition to metals, dioxin, and 1,3-butadiene. (Clapp et al. 2007:11). Taking these risk factors into account, it is important to keep in mind the presence of a Dow Chemical plant and Mobil Oil within the immediate area of the case community. It is likely that residents of the area are exposed to higher-than-normal levels of certain carcinogenic chemicals.

Thyroid cancer has also been associated with radioactivity, particularly from ingestion of milk from cows raised in areas that were exposed to radioactive fallout. One estimate states that the rate of thyroid cancer has multiplied 10 to 100 times on account of this (Makhijania and Saleska 1999:160). A recent article from The New York Times

makes note of the fact that New York State, home to the largest population of Eastern European immigrants, has also become home to the largest rate of thyroid cancer in the U.S. Doctors treating those from Ukraine, Belarus, and western Russia have noticed that the bulk of the increase in thyroid cancers appears to come from these people in particular. All of course, lived near the Chernobyl nuclear plant that suffered a core meltdown in 1986 (Pérez-Peña 2006).

In consideration of the fact that exposure to radiation has been most thoroughly documented through tritium, it is worth examining the way this substance is regulated. The current EPA drinking water standard for tritium is set at 20,000 picocuries per liter. While in theory this standard should protect all members of the population, there are some troubling issues with it. While most members of society consist of women and children, many health guidelines continue to be geared towards the “Reference Man,” a hypothetical fully-grown Caucasian man of average height and weight. This is a dangerous way to measure exposures because children often receive larger doses of radiation and have a higher risk of cancer per radiation dose than fully-grown adults. Furthermore, fully-grown women are 52 percent more likely to develop cancer than fully-grown men when both sexes are exposed to the same dose of radiation. Despite these findings, the Environmental Protection Agency (EPA), Department of Energy (DOE), and NRC continue to rely on the ‘Reference Man’ when formulating new exposure standards (Alliance for Nuclear Accountability 2009).

III. The Story Behind the Contamination

An Emerging Cancer Cluster Around a Nuclear Facility

When Cynthia Sauer's daughter was diagnosed with brain cancer at the age of seven in 1999, she had reason to be extremely concerned. There was no history of cancer on her or her husband's side of the family, and she was informed by her daughter's neurosurgeon and pediatric oncologist that the cancer was environmentally produced. Given the relative rarity of pediatric brain cancer in Illinois (the 2005 Illinois rate of Central Nervous System and miscellaneous intracranial and intraspinal neoplasms was 33.2 per one million) and the high prevalence of it that doctors have noticed within the area, they felt they had sufficient reason to state this (IDPH 2007). As Cynthia began to look around her neighborhood in Minooka, IL, she noticed many more rare pediatric cancers and became even more worried. Living just a mere three miles away from both the Dresden Generating Station and about 8 miles from the Braidwood Generating Station, it was clear where at least one cause of her daughter's cancer might lie (Shabecoff and Shabecoff 2008:220).

In a quest for answers, Cynthia began requesting public documents that might shed light on the cause of her daughter's illness, but quickly realized that many of these documents were 'public' in name only. Records that should have been retrieved within weeks were either produced after several years or not at all (Lightly and Hawthorne 2009). Cynthia recounted one particular incident in which she had requested detailed documents from the Illinois Emergency Management Agency regarding their emergency

plans in the event of a nuclear meltdown. After multiple phone calls starting in 2000, Cindy finally received a letter on November 29, 2005, stating that her request had been denied. Nonetheless, she was given the option of appealing the ruling if she submitted it through fax, U.S. Airmail, or Express mail within the following two weeks. Given that the letter was dated November 21, the only option was to submit the appeal through fax, which she did. On December 13 she received a letter stating that her appeal had been denied. Within the first line of the letter, she was told that submission by fax was ‘inappropriate.’ Furthermore, she was told that her denial stemmed from the fact that the documents in question were still under revision, despite the fact that they had been drawn up about 15 years earlier in 1990 (Sauer 2009b).

Sadly, what Cynthia experienced is nothing unusual. Although Illinois has an open records law stating that, “all persons are entitled to full and complete information regarding the affairs of government and the official acts and policies of those who represent them,” taking advantage of what this law has to offer is a different story. When public documents fail to reveal a history of impeccable management and honest oversight, the typical response is to simply ignore requests and hope the people making them will go away (Lightly and Hawthorne 2009). Mr. Cosgrove, mentioned earlier as the Godley Park District Director, has dealt with this many times. Because he is well known and well connected within the community, according to Cosgrove, unanswered phone calls and ignored letters become all the more significant and obvious in their intent. In his mind, public agencies are there to serve the public. When this no longer occurs, they become “no better than criminals” (Cosgrove 2009).

In the case of Cynthia Sauer and her husband (a practicing physician), it was also

their requests for a health study to the Illinois Department of Public Health (IDPH) that led to unsatisfactory answers. Cynthia had observed what appeared to be higher than normal rates of pediatric cancers within the immediate area of the nuclear plants. As she put in, “[If your kids had cancer] in the 70’s, you took your kids to St. Jude’s. Now, you have all these pediatric oncology units. Something has changed” (Sauer 2009a). Her observations were supported by her conversations with other physicians and residents of her community. Wanting solid evidence, she requested that the IDPH carry out a health survey in an attempt to have this trend verified. Two studies were eventually carried out by the IDPH in 2000 and in 2006. Both found no statistically significant relationship between pediatric cancer incidence and proximity to a nuclear plant (IDPH 2000 and 2006).

What bothered Cynthia and her husband was that the studies were designed in such a way that no statistically significant relationship would be realized. The 2000 study used county-level tracts as the population of interest. Each county with a nuclear facility was matched with another county that had similar population characteristics but no nuclear facility. The nuclear counties were then compared with the non-nuclear counties on the basis of pediatric cancer incidence from the ages of 0 to 19 and from ages 0 to age 4 (IDPH 2000:2). The 2006 study used nuclear facility county groups and nuclear facility ZIP code groups as their populations of interest. Again, these were compared with non-nuclear county and ZIP code groups that were matched on the basis of population characteristics and then compared with regards to cancer incidence and mortality rates for children aged 0 to 14 years old (IDPH 2006:3). Because the populations of interest were so large, any cancer excesses within a few miles of the

nuclear plants could easily be concealed. Nonetheless, the IDPH refused to investigate on a smaller scale, noting that even if there were more cancer cases than would normally be expected, the numbers would still not be large enough to yield statistical significance (Cosgrove 2009).

One complication to studies like these is that investigators often use death certificates as a way to determine how many have died of cancer within a particular area. A person that dies out-of-county may not be counted as a death within the area where he or she lived. For example, a child from Will County (where the Braidwood Generating Station is located) may die in Cook County and then be counted as a death from that area. This is reasonable to assume given that Will County does not have the medical resources to care for children with aggressive forms of cancer or birth defects. Cindy has the death certificates of two children from Morris, IL, one of whom died of brain cancer and the other of leukemia. Yet, the IDPH refuses to acknowledge those deaths as originating from the area because they died at hospitals in different counties (Sauer 2008). Even if one dies within the area, cancer may not be listed as a primary cause of death, obscuring the actual rate of cancer-related mortality. A person could die of heart failure during a surgery to remove a cancerous tumor and then be listed as having died primarily from heart failure rather than from cancer. Mr. Cosgrove spoke of going through death certificates of people he had known and noticing that deaths from cancer were often hidden in this way (Cosgrove 2009). Unfortunately, while many epidemiological studies to determine cancer increases caused by radiation have relied on death certificates, no work has been done to quantify this effect (Makihijani et al. 1995:263).

In 2008, Cynthia and her husband compiled their own set of health data using

statistics already available through the IDPH website. The data was rearranged so that one would be able to examine how the rates of several different types of cancer had fluctuated within a fifteen-mile radius of the Dresden and Braidwood Generating Stations. Cynthia's husband, a physician with degrees in bioengineering and electrical engineering, was able to oversee the creation of this data set so that it fit professional standards of accuracy. Once compiled, this information revealed that within a fifteen-mile radius of the Dresden and Braidwood reactors, the cancer rate had increased 29% between the five-year periods from 1988 to 1992 and from 1998 to 2002. Within Morris alone, the leukemia cases more than doubled between these two time periods from 22 cases in the 1988 to 1992 period to 48 cases in the 1998 to 2002 period. Cynthia and her husband brought this data before the IDPH and the Nuclear Regulatory Commission (NRC). While the NRC had the validity of the data confirmed by the IDPH, they maintain that the data means nothing. The NRC denies the possibility that there might be increased cancer rates within the area, citing that the area is not large enough to conform to scientific standards of statistical significance (Sauer 2009a).

A Diesel Spill as an Indicator of Radioactive Leaks

In June of 2000, one year after Cynthia's seven-year-old daughter was diagnosed with brain cancer, residents in the village of Godley started noticing that something was horribly wrong. According to Joe Cosgrove, plants and animals were dead for miles around the vicinity of Godley. People's eyes were burning, and they smelled a strong unpleasant odor that was permeating their shallow groundwater wells and homes. When

Joe phoned the Environmental Protection Agency (EPA) and the IDPH to find out what was going on, he discovered that they knew nothing, despite the obviousness of the problem to those who were affected. It was only after making these phone calls that he learned that there had been a massive diesel fuel leak from the Braidwood Generating Station. Diesel fuel is stored on the grounds of the nuclear plant in order to provide an alternate source of power should the nuclear plant unexpectedly shut down. As he recounted it, Exelon, the company which owns the station, first claimed no responsibility, announcing that the diesel fuel had escaped from a nearby parking lot. They then admitted that “no more than one to three gallons” of diesel had been leaked. As the severity of the incident became more obvious, they changed their estimate into the tens of thousands of gallons. It was clear that no matter which way one looked at the situation, Exelon had miserably failed in monitoring environmental conditions around the nuclear plant, and by extension, the health of those living nearby (Cosgrove 2009).

While the diesel leaks caused great concern within the community, the real fear was, “What if that had been radioactive water instead of diesel fuel?” The diesel leaks were obvious as they could be seen, felt, and tasted. Yet, with radioactivity, one could not be sure without laboratory testing whether it was present or not. The response to the diesel leak had been so sloppy that many questioned the abilities of any public or governments agency to respond in the event of a more serious disaster (Cosgrove 2009). Disturbingly, a lawsuit filed by the Godley Park District in 2001 in response to the diesel leak led to the discovery of several large leaks of radioactive water from the Braidwood plant that had started in 1996. Exelon had done nothing to inform the public about those leaks and no remediation was carried out to clean up the spills. When Godley officials

requested information about the radioactive leaks in court, Exelon requested and received an order making it impossible for those on the side of the Godley Park District to ask any questions outside the strict realm of the diesel leak. It was requests to the EPA for water testing that finally yielded irrefutable evidence of unusually high levels of radioactivity in the water (Dardick 2006a).

The radioactivity found in the water was in the form of tritium. Tritiated water is formed when tritium, a radioactive isotope of hydrogen, reacts with oxygen to form water. In this form it can easily move throughout the ambient outdoor environment, contaminating private groundwater wells and nearby rivers. When ingested by humans, it has the potential to cause DNA damage and miscarriages (Makhijani 2006b). It was gradually discovered that the Braidwood Generating Station had leaked Substantial amounts of tritiated water on numerous occasions starting in 1996 and continuing on through 2006. Unfortunately, tritium is the least dangerous out of a long list of radioactive isotopes, meaning that little, if any, attention is given to the more dangerous isotopes capable of greater damage (Dardick 2006b). However, tritium releases are a common occurrence at nuclear plants. Early on in the history of nuclear power some scientists from within the industry began to speak out against the supposed “safety” of allowing these regular releases, which in turn, created more skepticism among the public (Walker 2004:10). This especially became in issue when states tried to impose restrictions on radioactive releases that were more stringent than those created by the AEC (Duffy 1997:59).

Tritiated water from the Braidwood Generating Station is disposed of in the Kankakee River through a three mile long Blow Down Line (BDL) paced with 11

Vacuum Breakers (VB). VB's are supposed to monitor the pressure within the BDL but can lead to leaks if they malfunction. A study by a group of researchers from the UCLA School of Public Health found that there were at least three very large separate leaks along the line (See Appendix B). The first of these occurred in 1996 when VB-1 (the VB closest to the plant) broke, releasing over 300,000 gallons of tritiated water. In 1998, VB-3 broke, releasing 2,900,000 gallons of tritiated water. In 2000, VB-2 broke, releasing about 3,000,000 gallons of radioactive water. Little to no remediation was done to clean up the spills, and it is highly certain that the level of radioactivity released greatly exceeded the EPA limit of 20,000 picocuries per liter (Rosenfeld, Clark, Scott, and Hensley N.d.). The Dresden Generating Station has also had its share of tritiated water leaks. In 2004, tritium levels were over 500 times the EPA limit following a large leak. In 2006, tritium levels were found to be 25 times greater than the EPA limit following another separate leak (Dardick 2006a).

In 2005, Shirley Cavanaugh and her neighbor, Irene Clark, discussed their concern over the fact that most of their neighbors had died of cancer. Due to the large prevalence of cancer that both of them observed within the nearby area it struck them both that there was a problem and that something should be done about it. Both are life-long residents of the neighborhood that lies right along the Braidwood Station BDL and almost all of their neighbors had resided there for at least the past 30 to 40 years. In response to this, they decided to hold a public meeting to discuss the worrisome cancer trend. After dropping off notices in mailboxes around the area, they arrived to find about 45 to 50 other concerned citizens at their first meeting. Nearly all of them had the names of others who had had or were dealing with cancer. After several such meetings in which

about 50 people showed up, Shirley and her husband created a map and plotted the location of each cancer case. Almost all of them were in the area immediately adjacent to the BDL (Cavanaugh 2009).

Much like Cynthia, Shirley had to deal with a skeptical health department (in this case the Rural County Board) which initially preferred to discount the cancer cluster as a “coincidence.” One member of the board was greeted with outrage after suggesting this at one of the community meetings. Shortly after the incident, Shirley, her daughter, and Irene Clark were called before the board where they were chastised for discussing what the board informed them was not an actual cancer cluster. Despite the outcome of her meeting with the board, Shirley has continued to hold meetings and look for answers, noting that the Rural County Board now pays more attention to what goes on at the community meetings. Cancer cluster or not, Shirley also mentioned her efforts to examine the death certificates of those who had had cancer, noting that in most cases the primary cause of death was listed as something other than cancer (Cavanaugh 2009). Shirley, Cynthia and Joe have had to face many challenges in their struggles for answers, but they maintain that if they do not do this, no one will.

Other Signs of Environmental Contamination

As mentioned in the second section of this thesis, lay perception is often the starting point for uncovering instances of toxic contamination. Although this is demonstrated through the stories of Cynthia, Joe, and Shirley, there are other community members who have joined in the movement, motivated by their observations, personal

experiences and by what they perceive to be a serious public health and equal rights issue. Among these are Monica and Bonnie Mack, two sisters who have lived within the area their entire lives. Another is Caron Prettyman, a young mother who lost one of her babies to an unusual and extremely rare heart defect.

Although not personally affected by cancer or other health problems, Monica and Bonnie Mack both feel that the current political and industrial climate unfairly excludes the public at the expense of personal health and peace of mind. Both sisters have lived within the area their entire lives, so they have been able to compare how the personal and environmental health of their community has changed in response to the opening of the nuclear plant. Ironically, Bonnie initially moved away from the area in response to the opening of the nuclear plant because she was suspicious of how it might affect her health. Nonetheless, after 12 years of seemingly benign plant operation, Bonnie moved to a home located near her sister's, right across from the nuclear station. Almost immediately after, news reports of the tritium leaks began surfacing (Mack and Mack 2009).

With their location right across from the plant and their dependence on private wells for drinking water, Monica and Bonnie were approached by Exelon to have their well water tested for tritium. While Monica's water was discovered to have the highest level of tritium in the area (but still below the federal limit), she believes the level was far higher than what was revealed to her. To begin with, the company that tested her water was hired by Exelon. Furthermore, the employees who came by to pick up the water samples were later photographed by Joe Cosgrove *diluting* them with bottled water in a convenience store parking lot. Egregious as that is, nothing has been done to follow up on the incident (Mack and Mack 2009).

Other, more tangible signs in the outdoor environment have also led Monica and Bonnie to believe that the nuclear plant is creating health problems within the community. Community members have discovered ducks and geese with abnormal growths, local sheep near the plant have died of mysterious and unknown causes, and numerous pet dogs have died of unusual liver problems that elude the best guesses of local veterinarians. Heat pollution, the result of normal plant operations, has also resulted in the deaths of numerous fish, which Monica claims are quickly removed by Exelon staff before community members have the chance to get photographs. Trees downwind of the nuclear plant also appear to be dying in large swaths. Although various agencies have been made aware of the wildlife problems and have come to investigate, the public has never been informed of what is causing these problems (Mack and Mack 2009).

In the case of Caron Prettyman it was the patterns of deaths among babies with hypoplastic left heart syndrome that convinced her something was wrong. Shortly after her baby, Grace, died of the syndrome, she began attending a local support group that consisted of her and one other couple whose baby had also died of the defect. What quickly caught her attention was that every six months, a new couple joined the group. Nonetheless, participation eventually dwindled again. For an extremely rare condition with an incidence rate of only 0.16 to 0.36 per 1,000 live births, Caron was shocked at the numbers of parents showing up to the support group meetings (Rao, Turner, and Forbes 2006 and Prettyman 2009). Only about 4,000 people live within each small village within the case area (U.S. Census Bureau 2006). After speaking with Cynthia and examining when radioactive releases occurred and when participation swelled, she found that there appeared to be a direct connection between the two (Prettyman 2009).

Efforts to hold Exelon and government agencies accountable have so far yielded little success. Both sisters acknowledged the near impossibility of getting any useful information or answers from Exelon or nearby public agencies, noting that while the same questions are asked each year, there are never any answers. Most people become frustrated and stop trying. When Exelon carries out studies to determine the level of radioactivity present in the area, the methods employed are often grossly inadequate. For example, a recent study to determine the amount of tritium present in vegetables and dairy milk grown in the area used vegetables that were grown in another state and dairy milk from another town (Mack and Mack 2009).

In the meantime, community members continue suffering. The Mack sisters mentioned that each week they seem to read about another child who has been newly diagnosed with cancer (Mack and Mack 2009). In an almost insulting move, Exelon holds yearly cancer fundraisers at the Godley Park District, located adjacent to the Braidwood Generating Station. Known as “fishing for a cure,” the fundraiser is held in waters that almost certainly contain unsafe levels of radioactivity (Exelon 2009). One year, Monica placed a large sign at the entrance of the park reading, ‘Contaminated fish. Eat at your own risk.’ When Exelon officials requested that she remove the sign she simply laughed (Mack and Mack 2009).

The Formation of an Alliance Around Environmental Health

Significantly, Shirley, Cynthia and Joe each independently investigated their respective issues before discovering one another. Cynthia first contacted Joe about the

pediatric cancers she had noticed after reading in the local newspaper about his role in the lawsuit that the Godley Park District filed against Exelon in 2001 (Sauer 2009b). Shirley and Irene first met Cynthia after she came up to introduce herself following one of their community meetings which she had read about in the local paper (Cavanaugh 2009). In addition, Monica and Bonnie Mack first met Joe through a community group known as the Citizens' Information Network, an off-branch of the EPA designed to facilitate citizen involvement in environmental issues (Mack and Mack 2009, IEPA 2007). From that time on, all five of them have been meeting once or twice a month to discuss the environmental health issues within the area (Cavanaugh 2009).

Clearly, this is a very small group of people working to improve the quality of life within the area, but what they lack in numbers they make up for in their commitment to this cause. Together, they have taken up the role of activists, serving as a public resource for community members, organizing public meetings with health professionals, affected community members and radiation experts, and challenging the social and political norms that have made it nearly impossible to get environmental problems adequately addressed in their community. Implicit in their mission is an attempt to provide the members of their community with what they believe everyone is entitled to: a clean environment, accurate information and help from the government agencies slated to protect the public, and accountability from the corporations that are currently poisoning their environment. As a well-connected park superintendent, Joe is best able to deal with technical issues. At the other side of the spectrum, Cynthia deals with health-related issues (Sauer 2009b).

Together the group has petitioned local officials and politicians to change the way risks are determined and industry accountability is managed. For example, the Mack

sisters mentioned that the group has been trying to get the state of Illinois to adopt a new framework for analyzing risks that excludes the use of the ‘reference man’ as a model for the human body (Mack and Mack 2009). In some instances, members of the group have traveled across the country in order to meet personally with politicians. To the great chagrin of Exelon executives, Joe has traveled to Washington, D.C. in an attempt to directly confront politicians about the nuclear plant leaks and the lack of accountability. Another time, community members traveled to Springfield, IL to speak with then-Senator Barack Obama about their fight against Exelon. Although they had been told beforehand that they would be allowed to speak with him, Obama’s secretary told them once they arrived that he was unavailable. Soon after, they read in the paper that he had met with Exelon officials the day they were supposed to speak with him (Cosgrove 2009).

Although committed to serving the needs of the public, the group has been extremely conscious of how they portray themselves to the public. Before Cynthia, Joe, the Mack sisters, and Shirley began meeting on a regular basis, Monica, Bonnie, and Joe were aligned with the Citizens’ Information Network. However, as the network leaned more towards being known as “anti-nuclear” they decided to separate themselves. One of the points strongly emphasized by the group members was that they consciously avoid being labeled in any way (Mack and Mack 2009). Both Cynthia and Joe mentioned that once labeling occurs credibility tends to be lost because they are then categorized into a rigid mold that masks what they really stand for. Joe used the example of “...people wrappin’ tin foil around their head and chainin’ themselves to the front gate,” noting that they may have the “best intentions” but they ultimately come across as crazy and unworthy of public or government support (Cosgrove 2009). The group members fear

that if they were to be labeled as anti-nuclear, they would become associated with the “crazy” image of a protester, instead of the well-reasoned, educated group that they wish to portray themselves as (Cosgrove and Sauer 2009).

Similarly, because Joe, Cynthia, and Shirley feel that industrial interests have too much of a hold over government agencies, they mentioned the importance of objective outsiders in analyzing the situation within their community. Joe made a point of this saying, “Why don’t [Exelon officials] follow the rules like we have to follow the rules? And that’s not even [like] they can’t fight” (Cosgrove 2009). It appears that the only way any serious consideration will be given to the problems at hand will be through the analysis of an objective, educated outsider with no ties to the community or industry. Even if such a person were to deny the existence of a problem, all remarked that it would still be better than being lied to (Cosgrove 2009, Sauer 2009a, and Cavanaugh, 2009).

Much focus has so far been given to the possible contribution of radiation to the increased rate of cancer within the area. Nonetheless, Cynthia, Joe, and others within the community group maintain that the synergistic effects of multiple exposures must also be given due consideration. Within an area containing a Dow Chemicals plant, a Mobile Oil plant, and acres of chemically treated agriculture in addition to the two nuclear plants, it would be inappropriate to only blame the nuclear facilities for the increase in cancer. At this point, however, the nuclear plants are the only industry within the area known to have released excessive pollution into the environment.

IV. Common Themes

Among communities facing environmental health problems, there tend to be several characteristics that remain similar across all such cases. These include:

Prevalence of Human-Made Toxins: *Cases of environmental contamination by man-made toxins are extremely prevalent throughout the U.S. and the rest of the world and require extensive and immediate clean-up.*

Cynthia, Joe, Shirley, Caron, and the Mack sisters all feel that there is a serious and disturbing prevalence of human-made toxins that unfairly targets innocent people. Significantly, environmental issues were not always on their radar. For Joe and the Mack sisters, the diesel fuel leak and the water testing were the first indications that there might be a bigger problem underfoot. For Cynthia and Caron, it was the prevalence and occurrence of unusual diseases and defects that made them suspect something in the environment was affecting them. This is noteworthy because it indicates that the community was not actively looking for a problem. Rather, the pollution manifested itself before them in a very tangible form that could not be ignored.

Two physicians and one nurse were interviewed for this thesis about their opinions on the general cancer rate within the area. One physician said that he had noticed what he perceived to be an unusually large number of community members with cancer (the other physician that was interviewed for this thesis has only lived in the case community for about five years and was thus unable to adequately form an opinion about

the cancer rate in the area). In addition, he mentioned that he had spoken with other physicians who also felt that there was a problem with the area on the basis of the seemingly high rate of cancer cases. When patients bring up environmental concerns, he warns them not to drink the water and to bring bottled water when eating out (Physician 2009a). Kathy noted that all the babies from the area around the nuclear plants had shockingly similar deformities. She says that if she had not been so new to nursing at that time, she would have seriously considered bringing the cases up with a superior because of the unusualness of the deformities. In an important indication of the medical community's responsiveness to the elevated cancer rates within the area, Mr. Cosgrove mentioned that a large oncology clinic will soon be opening in Morris, IL. Cynthia, Joe, and the Mack sisters believe this is in direct response to the abnormally high cancer rate within the area. They claim that doctors are referred to the area after they complete their medical studies because of the high demand for medical services. They further attribute this demand for medical services to the prevalence of toxic contamination in the area (Cosgrove 2009 Mack and Mack 2009 and Sauer 2009a).

The way Exelon has handled the tritium leaks and the way they have communicated with the public seems to have ignited the community's belief that there is a serious environmental health problem. Joe strongly emphasizes that while Exelon holds regular informational meetings, they are often inadequate for educating the public about what is really going on. For example, when they first began meeting with the public, Joe noted that, "What they would do is they would give free hot dogs, they would hand out balloons, yo-yos...and it infuriated me that they would have this attitude, this callousness...you think this is a joke?" (Cosgrove 2009). As another example of

unwillingness to cooperate with the public, both Joe and Cynthia said that Exelon and other public agencies often refuse to be videotaped at community meetings (Cosgrove 2009 and Sauer 2009a). Nonetheless, as of late, Joe feels there have been slight improvements in how Exelon communicates with the public. He claims that once Exelon has discovered a new radioactive leak, they promptly alert him with a text message or phone call. Nonetheless, he is skeptical that this direct communication will become the norm.

Although the nuclear plants have been at the center of this case study, it is also important to point out the presence of a Dow chemical plant, a Mobil Oil plant, and several chemical dumps within the area. As mentioned in the background section, with so many different chemicals in use, it is hard to piece together in what ways each is affecting human health (Clapp et al. 2007:2). Each group member believes that the chemical sources within the community are as big a problem as the nuclear plants. It is simply the extra publicity the nuclear plants have gotten that has made the nuclear issue more recognizable. Nonetheless, the individual pollutant load of each industry is irrelevant in the face of the greater mission of the group: ending irresponsible and unaccountable corporate management of dangerous toxins in order to protect the health and welfare of all individuals (Cavanaugh 2009, Cosgrove 2009, Sauer 2009a, and Mack and Mack 2009).

The Interests of Big Business: *The personal interests of big business and its support by the government explain to a large extent why so many instances of environmental contamination by man-made toxins have occurred in the first place. Such factors*

continue to place a roadblock in front of clean-up efforts.

Cynthia, Joe, and the others within their group feel that, as a major contributor to the local economy, government and public agencies are more interested in staying on the ‘good’ side of industry at the expense of protecting the less politically and economically powerful lay public. Mr. Cosgrove spoke often of the connection between businesses and government, expressing his belief that, “Layers of government just don’t seem to get it done. There needs to be a third partner in all of that...an educated public.” Before the radioactive releases came to light, everyone assumed that the government would always be there to help if things ever got out of control. Nonetheless, even when people try to educate themselves, businesses are hard pressed to provide adequate answers. When Cynthia Sauer wrote to the NRC and Exelon for information, she was consistently brushed aside with empty assurances of safety. Even the IDPH, whose purpose it is to protect the health and welfare of the public, was strangely uneager to help. Agencies either did not respond to her or referred her to other agencies with no answers to give. It became uncomfortably clear that government and public agencies were more interested in protecting those with large amounts of economic and social power (Sauer 2009a).

The reality is that industry often locates into areas with low economic and political resources (Bullard and Johnson 2000:565). A low-income community like Godley is not in a position to gain ready supporters because of their lack of resources (Cosgrove 2009). Although Cynthia, Joe, and the Mack sisters postulated that most people would leave if they had the chance, most simply do not have the economic means to do so (Sauer 2009a, Cosgrove 2009, and Mack and Mack 2009). According to the

U.S. Census Bureau, the median household income in 2007 for the state of Illinois was \$54,141 with an unemployment rate of 11.4 percent. The median household income for Kankakee, IL, the city closest to the case study area, has a median household income of about \$30,000 and an unemployment rate that is about double that of the Illinois rate (U.S. Census Bureau 2006).

Those who have tried to help the community through scientific support have been mercilessly attacked. Dr. Paul Rosenfeld, who was one of a team of researchers to carry out a study of tritium releases from the Braidwood Generating Station, is one such person. Because he is currently serving as a witness in trial on behalf of a community that has filed a lawsuit against Exelon, Exelon is doing everything they can to discourage him from attacking further. The community, located in California, claims that property values have decreased within five miles of the plant because of Exelon's failure to notify the public about radioactive releases. In a recent interview with him, he talked heatedly of how Exelon's lawyers have done everything they can to "poke holes" in his contract with UCLA where he works as a professor. Dr. Rosenfeld empathizes with communities battling similar environmental health problems saying, "It's not rocket science; if tritium gets released into the air, it's going to end up in the environment" (Rosenfeld 2009). Joe recounted that when he initially tried to enlist the help of outside experts, many would pull out at the last minute, often because they had either begun working for Exelon or did not want to risk possible retaliation from Exelon (Cosgrove 2009).

In fighting unfair business practices and abuses, the importance of community involvement is key. Testifying to the importance of this sector are core pieces of legislation such as the Emergency Planning and Community Right-to-Know Act and the

establishment of the Toxics Release Inventory (Steingraber 1997: 101). Nonetheless, fighting for accountability is difficult and uncertain. For some people it is easier to cope with an environmental health problem by not acknowledging it. Inadequate resources and depression further hinder involvement (Brown and Mikkelsen 1990:81). For others, the maintenance of property values is a greater priority than improved health (Mack and Mack 2009). Cynthia and her family moved to Indiana to get away from the environmental contamination. Yet, most others do not have the means to do so (Cosgrove and Sauer 2009). These two effects significantly decrease the ability of a community to effectively fight for a cleaner environment and can seriously downplay efforts that are already underway. In all of this it is still important to remember that the community is ultimately left facing the consequences.

Toxic Contamination as a Physical and Mental Health Problem: *Environmental contamination by man-made toxins results in both physical and mental damage.*

One of the central themes in my discussions with Cynthia was the need for recognition of the fact that toxic contamination is a growing reality for many communities and the underlying root of many fast growing health problems such as cancer. As already written in the previous section, the widespread use of hazardous materials and technologies has been resulting in widespread increases of certain types of cancers. Nonetheless, when there appears to be a cancer cluster, it is often deemed insignificant within the scope of a larger area. Cynthia argues that there is great need for a new understanding of cancer clusters that takes into account statistically insignificant

“hot spots.” In other words, she argues that a statistical finding of insignificance does not necessarily mean there is not a problem. If all the cancer cases within a particular town are concentrated within a certain neighborhood where the cancer is deemed statistically insignificant within the scope of the entire town, then is this enough to say that there is not a problem? Cynthia does not think so (Sauer 2008a).

Cancer outcomes have been discussed at length, but birth defects also warrant discussion given the extreme sensitivity of fetuses to environmental toxins. Because acute doses of radioactive water can result in miscarriages early in the pregnancy, this effect has not been well studied (Makhijani 2006). Nonetheless, layperson accounts suggest that miscarriages and defects have occurred on a significant scale. Caron’s observations suggest that radioactive leaks are associated with increased rates of birth defects. In addition, she recounted a conversation she had with a man who approached her after a public meeting she once spoke at. According to him, his wife had worked with victims of the Chernobyl nuclear disaster shortly after it occurred and had noticed that every single pregnant woman within or near the area miscarried (Prettyman 2009). Kathy, a pediatric nurse who used to work in the neonatal intensive care unit of a Chicago hospital noted that every year at least one newborn from the case community would arrive there. She noted that all the babies from this area were distinctive because of their strikingly similar defects: very large foreheads, misshapen heads, poor skin tone, and cardiac problems that inevitably led to an early death. This nurse noted that she used to joke with her co-workers not to “drink the water in Joliet (the region within which the community is located).” It was obvious to all of them that there was something very environmentally wrong with the area based on the health of the newborns arriving at the

hospital (Moren 2009).

The health problems within the case community also extend to the emotional sphere. Within the Illinois communities, Joe, Cynthia, Monica, Bonni, and Caron stated that many people simply have too much going on within their daily lives to contribute towards fighting the pollution problem within their area. They know so many people who have been diagnosed with cancer that they become inured to the idea that it is almost inevitable. One physician remarked that a lady he had recently seen reacted calmly to a diagnosis of an aggressive form of cancer, stating that she was the “twelfth person in my suburb” to be diagnosed (Physician 2009a). The danger in this is that people could begin to view increasing cancer rates as a “normal” occurrence. And even if they do not, many simply feel unqualified to confront a large well-connected corporation like Exelon (Cosgrove 2009).

The Importance of Lay Perception in Discovering Cases of Toxic Contamination:

Affected communities are often the most significant drivers for remediation efforts of contaminated sites. This is because they are the ones who discover, and have been directly affected by, man-made toxins.

Compilation of Survey Results

The following table is a compilation of most of the answers obtained from the survey distributed at the Godley Park District Recreational Center in Godley, IL. While most questions are included, some have been excluded because some questions invited

the survey participant to include written comments. Although the results to these questions have not been included in the table, they are addressed in the discussion section following it. In addition, for questions not expanded on in the discussion section (i.e. Do you have your lawn sprayed with pesticides to control for weeds and/or other pests?), I did not include numerical questions that stemmed from that (i.e If yes, how many times a year?)

Table I. Case Community Survey Results

	Mean	Median
Age of Respondents	50.5 years	49 years
Years living in Grundy County	36.4 years	38 years
Self-assessment of health on a scale of 1 to 10 with 1 being very poor and 10 being excellent	7.6	8
Question	Yes	No
Do you depend on a private well for drinking water?	12	8
Are you satisfied with the quality of your drinking water?	8	12
Do you have your lawn sprayed with pesticides to control for weeds and/or other pests?	3	17
Do you work with chemicals as part of your occupation?	7	13
If yes, are you aware of the chemicals you are using?	7	0
Have you ever felt there is reason to be concerned about your health because of the local nuclear power plants?	14	6
Are you aware of the tritiated water leaks which have occurred at the Braidwood Generating Station over the past decade?	20	0
If yes, do you believe there is cause to be concerned?	16	1
Have you or anyone in your family ever had cancer?	14	6
Have you ever spoken with other people in your community about cancer?	13	7
Do you think there are connections between the environment and health?	20	0
Have you ever spoken with health professionals about cancer risks and cancer rates?	8	12
If yes, have they been helpful?	7	1
Have you spoken with any government officials about concerns over cancer?	5	15
If yes, have they been helpful?	1	4
Have you ever spoken with any private organizations about concerns over cancer rates?	5	15
If yes, have they been helpful?	5	0

Lay perception has arguably played the largest role in getting the tritium releases acknowledged. Without lay involvement, it is very likely that the leaks would have never been publicly revealed in the first place. As Mr. Cosgrove often pointed out in my interview with him, it is remarkable that the diesel leak, so obvious to everyone living near it, was yet unknown to those agencies whose responsibility it is to maintain environmental health and ensure that such things do not happen in the first place (Cosgrove 2009). Fortunately, survey participants tended to be older people who had been living in the area for all or most of their lives, indicating that they have been witness to the events unfolding around the nuclear plant. As indicated by the table above, the average age of participants was 50.5 years with an average of 36.4 years lived within the county where the Braidwood Generating Station is located.

Indicative of the level of trust the participants hold for Exelon is the percentage of those who are concerned about the diesel leaks and its effect on their personal health. For example, 80 percent of those surveyed are concerned about the Braidwood diesel leaks that have occurred within the past decade. Yet, after it was publicly disclosed that the leaks had occurred, Exelon declared that no tritium had been detected offsite of the plant and that the leaks posed “no health or safety threat” (Dardick 2006a). Nonetheless, for those living near the plant such statements clearly offer little reassurance. One survey participant mentioned being concerned about the nuclear power plants because of the tritium leaks and the clearly visible smoke that is constantly emitted from the reactor exhaust pipe. Similar remarks were noted by six other participants, with one person even commenting that, “We don’t know what is released into the air and water.” News reports have indicated that tritium is being released, but this survey respondent clearly did not

seem to agree that all is fully known about the releases.

Others have cited health problems as the reason for believing that their health is in jeopardy due to the nuclear plants. One respondent wrote that 14 houses in a row within his/her neighborhood have had one or two people with cancer in each of them over the past 20 years. Another person mentioned becoming sick with nausea, headache, rashes, and a swollen thyroid from the diesel fuel leak that occurred in 2000. Yet another wrote of knowing five women to experience miscarriages within a three-month period along with having a neighbor with cancer. Because of the high visibility of the nuclear power plant, and the media attention given to the leaks, people seem to make a strong connection to this potential source of cancer and sickness. Along the same vein, one physician remarked that in small print on the back of each water bill from that area is a notice that the water contains a certain amount of radioactivity (Physician 2009b). This could hardly be reassuring to those who are concerned about the tritiated water leaks.

One respondent jokingly commented about being worried about the tritiated water leaks from the Braidwood Generating Station because s/he doesn't want to "glow in the dark." Joe and the Mack sisters had mentioned that, because of the human health uncertainties involved with exposure to the tritium leaks, some people use jokes as a mechanism to deter from the seriousness of the situation. For the most part, people do not trust Exelon and they feel that there is not much they can do to improve their situation. Making light of the matter may be easier than facing the full gravity of the environmental health problem (Cosgrove 2009 and Mack and Mack 2009).

Given the paucity of information available through Exelon, it is interesting to note that survey respondents found health professionals and private organizations more useful

than government officials when it came to receiving information about cancer rates and cancer risks. Of the eight people who spoke with health professionals about cancer rates and cancer risks, seven found the information helpful while only one person did not. Of five people who spoke with private organizations about concerns over cancer rates and cancer risks, all five were satisfied with the information given. Yet, of the five who spoke with government officials about cancer rates and cancer risks, only one person was satisfied with the answers given. If the government is to actually help people, it is clear that much work is needed to bridge the gap between those whose job it is to serve the public and the public itself.

When it comes to providing the public with information, community activists are often the best source. Serving as a source of social support, information, and power, community activists and groups are often best able to meet the needs of the local community (Brown and Mikkelsen 1990:72-3). Joe and Cynthia seem to have taken up this role especially well. Joe is well known within the community, and he has the connections to access information that the community might like to know about. Cynthia and Joe are both very active in speaking with people at all levels of Exelon and have worked tirelessly to improve the situation in their community. By educating people, they hope to change the way laypeople are viewed by professionals and thus gain legitimacy for their concerns (Cosgrove 2009 and Sauer 2009c).

A Need for New Modes of Collaboration: *Changes are needed in the way the government and scientific community acknowledge lay perceptions of environmental contamination by man-made toxins. Once again, this is a serious problem that deserves*

more consideration (Brown and Mikkelsen 1990:3).

It should be clear from this case study that little meaningful collaboration is occurring between the affected community, business, and the government. This is not uncommon. Indeed, Roberts and Toffolon-Weiss (2001:12) remark that there is an unfair playing field in which the more powerful government and business groups often align against weak community members. While the Illinois case study described in this thesis has been unremarkable in the way the lay community has been treated by government agencies, it deviates from most others in one significant regard. Whereas physicians have typically been unhelpful in identifying or confirming cases of environmentally produced illness, the medical community in Illinois seems more willing to recognize and confirm citizen concerns about the potential threats within the area. They have not officially allied with the community, however (Mack and Mack 2009).

In order for the community to take part in collaborations, they must remain informed by the government and businesses. When Cynthia first began calling government agencies, she was shocked by what some of them had to say. After telling one CDC official over the phone where she lived, the reaction was, “Oh! You live in the nuclear Bermuda triangle.” This was in reference to the LaSalle, Braidwood and Dresden generating stations which all lie within a few miles of each other. In probing further, the official casually remarked that the area was known for its unusually high cancer rate. In response to a question about what was being done to fix the problem the official replied, “That’s not our area” (Sauer 2009c). As this example demonstrates, even when agencies admit there is a problem, they often claim no responsibility.

As mentioned already, collaboration cannot effectively take place unless people are educated and given the opportunity to actually change things for the better. Mr. Cosgrove especially expressed his belief that Exelon needs to invite speakers who can relate to the level of most of the people within the community. Rather, communication between Exelon and the community has often been inadequate and truncated because industry, wishing to avoid hysteria, presents risk as a black and white, yes or no, type of matter. Once radioactive leaks come into the picture, people are unable to define the danger they perceive themselves to be in and hysteria ensues regardless of the industry's prior statements of assurance. In his words, "Getting a health physicist come to this community and discuss radiation to 600 people doesn't work. They don't communicate at the same level. And... the health physicists are not trained in... those types of communication" (Cosgrove 2009). More importantly, since laypeople are the ones most closely dealing with any kind of environmental problem that occurs within their immediate area, it is only fair that they have the chance to communicate with others about it. Once they are educated on the rudimentary basics of risk, they are able to approach environmental contamination in such a way that problems can be more effectively confronted and addressed.

Concluding Remarks

The story discussed in this thesis is not meant to be viewed as a separate and distant event but as a reminder that we are all affected by acts of pollution. As something closely connected to social, economic, and political standing, it should also be evident

that the changes needed to improve one's environment cannot occur disconnected from improvements in these other areas. When people have little standing within the economic or political spheres, they often have little voice to express their concerns. Nonetheless, we can and should begin to take citizen concerns more seriously by demanding that companies be held responsible for the contamination that they release. Some successes have occurred, but much more needs to be done if any of us can hope to live a secure future. One comment Caron made during my interview with her spoke to the crux of the matter; "When you see these children dealing with what they're dealing with...there's definitely something wrong, and shame on those people who are supposedly watching out for us, because they're not watching out for us" (Prettyman 2009).

When large corporations and the government demean communities by withholding information and ignoring their pleas for help, the only source of power to turn to is that latent within the community. With the widespread and growing use of chemicals this is especially important to emphasize. Deficiencies in risk assessments and health studies already been recounted. Yet, because of this, lay perception should be given a higher role in future studies. Prevention and precaution should outweigh statistical significance. In 1963, President Kennedy remarked that, "The number of children and grandchildren with cancer in their bones, with leukemia in their blood, or with poison in their lungs might seem statistically small to some, in comparison with natural hazards, but this is not a natural health hazard – and it is not a statistical issue. The loss of even one human life, or malformation of one baby – who may be born long after we are gone – should be of concern to us all. Our children and grandchildren are not merely statistics towards which we can be indifferent" (Caufield 1986:132).

Appendix A

CONSENT FORM

Study Title: Lay Understanding of Cancer Rates and Environmental Hazards
I, Eva Kranjc, am a student at Brown University in Rhode Island conducting a research study investigating perceptions of cancer risks and environmental health risks. You have been offered the opportunity to take this survey based on your availability at this time. Please read the rest of this form and ask any questions you may have before agreeing to participate in this study.

Purpose of the Study

The main purpose of this study is to understand how people determine what constitutes a cancer risk or environmental health risk.

Risks and Benefits

There are no foreseeable risks in taking part in this survey. This study may not benefit you directly, however, by taking part you will help contribute to a greater understanding of how people assess risks, especially those that lead to cancer.

Confidentiality

Any answers you give will remain confidential. You are not required to sign your name anywhere on the survey.

Participation

Please be aware that your participation is completely voluntary. If you agree not to participate you will not suffer any penalties or loss of benefits to which you are entitled. Furthermore, please note that if you choose to participate, you may exit the interview at any point or choose not to answer any questions you may find too uncomfortable to answer.

If you have any questions or concerns regarding any portion of this project or the interview process you may contact the researcher of this study, Eva Kranjc. She can be reached by telephone at (401)-633-5372 or by email at eva_kranjc@brown.edu.

If you would like to question someone other than the researcher, you may contact the Principle Investigator for this study, Professor Phil Brown. He can be reached by telephone at (401)-863-2633 or by email at Phil_Brown@brown.edu.

In addition, if you would like more information about participants' rights in this study, you may contact Susan Toppin, Assistant Director for the Research Protections Office at Brown University. She can be reached by telephone at (401)-863-3050 or by email at Susan_Toppin@brown.edu.

Statement of Consent

By filling out this survey and sealing it in one of the available envelopes, you have agreed to take part in this survey. Please keep this consent form for your records. If you would like to take part in a more in-depth phone interview, please contact Eva Kranjc using the contact information already listed above.

1. What is your age? _____
1. For how many years have you lived in this county? _____
2. What is your occupation? _____
3. Do you depend on a private well for drinking water?
 - Yes _____
 - No _____

*If no, where does your drinking water come from (bottled water, community water supply, etc)?

4. Are you satisfied with the quality of your drinking water?
 - Yes _____
 - No _____
 - If no, what do you perceive to be the reason? (the area, agriculture, factories/facilities nearby)

5. Do you have your lawn sprayed with pesticides to control for weeds and/or other pests?
 - Yes _____
 - No _____

* If yes, how many times a year? _____
6. How many times in the average week do you use chemicals for cleaning or household purposes? _____
 - * For which purposes do you use chemicals? (pest control, household cleaning, etc.)

 - * Which chemicals do you use?

7. Do you work with chemicals as part of your occupation?
 - Yes _____
 - No _____
 - * If yes, are you aware of the chemicals you are using?
 - φ Yes _____
 - φ No _____
 - + If yes, what chemicals are you using? _____
 - + How do you get that information? (through the company, worker's union, government agency, other organization, etc.) _____

8. Have you ever felt there is reason to be concerned about your health because of the local nuclear power plants?

- Yes _____
- No _____

+ If yes, Why?

9. Are you aware of the tritiated water leaks which have occurred at the Braidwood Generating Station over the past decade?

- Yes _____
- No _____

i. If Yes, do you believe there is cause to be concerned, and why?

10. How would you rate your health on a scale from 1 to 10 with 1 being very poor and 10 being excellent? (Please circle the number that best fits your answer.)

1 2 3 4 5 6 7 8 9 10

11. Have you or anyone in your family ever had cancer?

- Yes
- No
- * If Yes, for how long? _____

* What kinds of cancer did you or your family members have? _____

- What kind of treatment was used to treat the cancer? _____

12. Have you ever spoken with other people in your community about cancer?

- Yes _____
- No _____

* If yes, what were these conversations like? (e.g., specific kinds of cancer; how many were getting cancer?)

13. What do you think are the main causes for the different types of cancer you may have already mentioned? (e.g., environment, diet, smoking, etc.)

14. Where do you get or hear information about health? Newspaper, news from the T.V., friends, relatives, etc.)

15. Where do you get or hear information about the environment? (Newspaper, news from the T.V., friends, relatives, etc.)

16. Do you think there are connections between the environment and health?

- Yes _____
- No _____

17. Have you spoken with health professionals about cancer risks and cancer rates?

- Yes _____
- No _____
- If yes, have they been helpful?
 - Yes
 - No

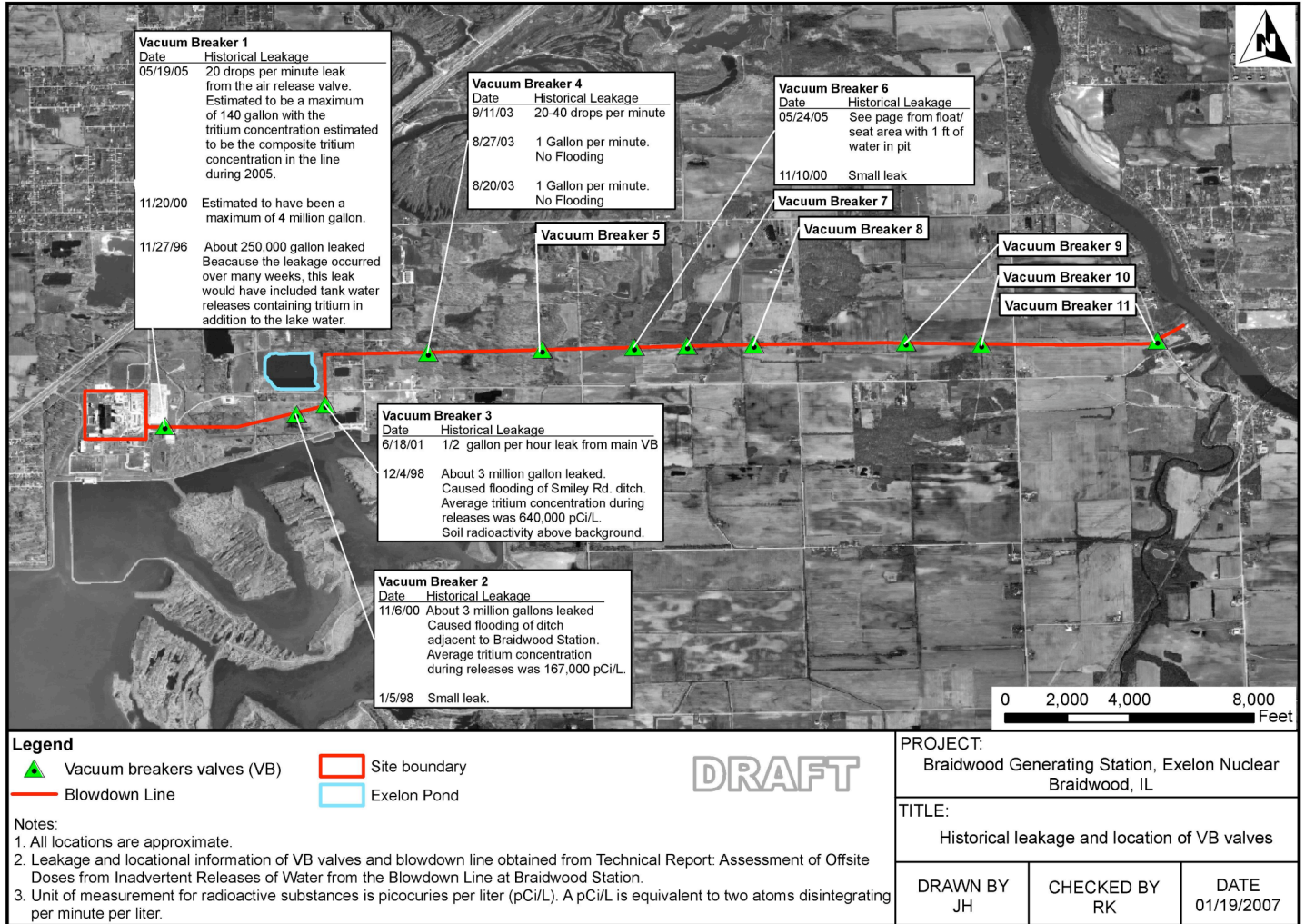
18. Have you spoken with any government officials about concerns over cancer?

- Yes _____
- No _____
- If yes, have they been helpful?
 - Yes _____
 - No _____

19. Have you ever spoken with any private organizations about concerns over cancer rates?

- a. Yes _____
- b. No _____
- If so, have they been helpful?
 - Yes _____
 - No _____

Appendix B



Source: Rosenfeld, et al. N.d.

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