Subjectivities of Risk and Environmental Uncertainty:

Residents, Regulatory Agencies, and Corporate Interests

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The undersigned, appointed by the dean of the Graduate School,

have examined the Dissertation entitled

SUBJECTIVITIES OF RISK AND ENVIRONMENTAL UNCERTAINTY:

RESIDENTS, REGULATORY AGENCIES, AND CORPORATE INTERESTS

Presented by Kristen Michelle Kalz

A candidate for the degree of

Doctor of Philosophy

And hereby certify that, in their opinion, it is worthy of acceptance.

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Abbreviations & Acronyms

AEC	Atomic Energy Commission
ATSDR	Agency for Toxic Substances and Disease Registry
CAA	Clean Air Act of 1963
CERLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMC	Computer Mediated Communication
CWA	Clean Water Act of 1972
DHSS	Department of Health and Senior Services, Missouri
DNR/MDNR	Department of Natural Resources, Missouri
DOE	Department of Energy
EPA	Environmental Protection Agency
FBI	Federal Bureau of Investigation
FUSRAP	Formerly Utilized Sites Remedial Action Program
HISS	Hazelwood Interim Storage Site
LLW	Low-Level Waste
MCE	Missouri Coalition for the Environment
MED	Manhattan Engineering District
Met Lab	The Metallurgical Laboratory
NIOSH	National Institute of Occupational Safety and Health
NRC	National Regulatory Commission
NPL	National Priorities List
NSF	National Science Foundation
OU	Operable Units
PRP	Potentially Responsible Parties
PUS/PUST	Public Understanding of Science/Technology
RCRA	Resource Conservation and Recovery Act
RIM	Radiologically Impacted Material
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SFS	Supplemental Feasibility Study
SLAPS/SLAPSS	St. Louis Airport Site
SLB	Shallow Land Burial
SNS	Social Networking Sites
SSE	Subsurface Smoldering Event
SWDA	Solid Waste Disposal Act of 1965
USACE	United States Army Corp of Engineers
VP	Vicinity Properties
WHO	World Health Organization
WWI	World War I
WWII	World War II

Elements & Chemicals

Ba SO_4	Barium Sulfate
DNT	Dinitrotoluene
TNT	Trinitrotoluene
Th-230 or ^{230}Th	Isotope of Thorium
Th-232 or ^{232}Th	Isotope of Thorium
Ra-226 or ^{226}Ra	Radium
Rn-222 or ^{222}Rn	Radon
U-238 or ^{238}U	Uranium-238
U-235 or ^{235}U	Uranium-235
U_3O_8	Triuranium octoxide
UO_2	Uranium Dioxide

Units of Measurement

μR	Microroentgen, one-millionth of a roentgen
rem	Roentgen equivalent man

ABSTRACT

The West Lake Landfill Superfund site in Bridgeton, Missouri made for a compelling place to explore how risk was framed and contested by social groups and expert institutions in the context of environmental uncertainty. The landfill has been contested by various stakeholders, because Cold War era radioactive waste was dumped in the unlined landfill prior to regulatory oversight, and most recently an underground fire has been detected in portions of the landfill. Residents organized because they were fearful of the potential for a large-scale disaster and for their ongoing health and safety. The West Lake Landfill, thus, was an important context for investigating shifts in the framing and contestations of risks through time, as well as their multi-layered socio-technical entanglements. A case study design was used which included methods such as, the use of archival data, content analysis, participant observation, and ethnographic interviews. I investigated how environmental risk and its complex entanglements with scientific expertise and citizenship have unfolded since the second world war during which the regulatory structure, understanding of environmental risk, role of scientific experts, and voices of lay people changed dramatically. Local mother-activists have become central to countering expert claims by drawing upon their social media networks and traditional gender roles and have forged new ways of knowing in the process.

CHAPTER 1: INTRODUCTION

"It's a really horrible situation just with the smell, and then you take into consideration … the radioactive waste part of it. We're scared to death. Every time we turn around there's a new report coming out saying they've found something new. And it's very difficult for anybody who lives around the site to feel like anybody has this situation, anybody is in control." --Dawn Chapman (as quoted in Phillips and Marsh 2014:4)

The West Lake Landfill Superfund site, just outside of St. Louis, Missouri, permeated the everyday lives of the residents living in its surroundings. As one of the residents, Dawn Chapman, quoted above explains, the entire site has enormous hold on residents' imaginaries and activities: "I think a lot of times we feel like we're being held hostage. You wake in the morning and you don't know what it's going to be like outside. Are you going to drive your kids to school? Are you going to let them wait outside for the school bus" (as quoted in Phillips and Marsh 2014:4)? The West Lake Landfill Superfund site, which contains multiple sections including the Bridgeton Landfill, has thus come to symbolize health risks that are at once encompassing and also tenuous – in large part, because of the contestations of different groups and institutions over the extent and nature of associated risks.

In the early 1970s, radioactive waste was illegally dumped in the West Lake Landfill (Fleishman-Hillard, Inc. 1967; Freivogel 1976a, 1976b; St. Louis Remediation Task Force 1996). The radioactive material originated from a downtown company's war time relationship with the Manhattan Engineering District (MED) and their top-secret project to make the world's first atomic bomb (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). Its dumping and discovery occurred at a time when the country was just coming to grips with issues of environmental pollution, just prior to when federal guidelines were issued about landfills and waste, and around the same time that federal and state governments created regulatory agencies to monitor the health and safety of citizens. The West Lake Landfill almost immediately became a site of contention between local, state, and federal governments, regulatory agencies, and local communities, due to differing ideas of risk and remediation. Under federal jurisdiction, residents, state, and local governments were asked to be patient while regulatory agencies like the Atomic Energy Commission (AEC), then the Nuclear Regulatory Commission (NRC) and later still, the Environmental Protection Agency (EPA), investigated the site.

A decade and a half later, the entire site was added to the National Priority List (NPL) and designated a Superfund site, which identified it among some of the country's most toxic sites (MDNR n.d.). Residents have been calling for the removal of the waste almost since its discovery and have grown frustrated over the last several decades (Leiser 2006b). Most recently, a "heat producing reaction" was discovered in December of 2010 by a contractor doing routine monitoring, which indicated, "high-levels of carbon monoxide in a large group of extraction wells" (Republic Services 2014a:1). Referred to by residents as an undergrown fire (Alvarez 2016; LaCapra 2014; Mannies 2014), the site has begun to produce a chemical-type odor (Bernhard 2014; Shusterman et al. 1991; Jeffrey Tomich 2013a) and has heightened resident's frustrations and concerns as they believe their health and safety are being put at unnecessary risk.

Since the 1980s, there have been a number of studies that have focused on community response to environmental risk and uncertainty (Bell and Braun 2010; Brown and Faith 1995; Bullard 2000; Checker 2005; Edelstein 1988; Krauss 1993; Malin 2015;

Perkins 2012). These studies highlight a number of important factors including what types of communities are most at risk, community mobilization and organization, and clashes between how different stakeholders understand and make decisions about risk (Bell and Braun 2010; Brown and Faith 1995; Bullard 2000; Checker 2005; Edelstein 1988; Krauss 1993; Malin 2015; Perkins 2012). The West Lake Landfill site is unlike typical sites of environmental contamination, in part, because it impacts predominately white neighborhoods, as opposed to communities of color. But it does share similarities to other sites of environmental uncertainty because it is being led by a group of mother-activists (Brown and Faith 1995; Krauss 1993; Tesh 2000) who call themselves Just Moms STL and believe the landfill has too many unknown factors and presents too high a risk to remain in its current state. Additionally, while the site has produced a vast amount of scientific data, various stakeholders such as the company who owns the site, federal and state regulatory agencies, state and local governments, and local citizens have differing ideas about risk and health, and how best to move forward.

The entire site has generated a great deal of scientific data as a result of being monitored. Regulatory officials and experts readily admit that the situation is complex, and to their knowledge the first of its kind, and despite explicit recognition and concern(s) among various stakeholders, the site remains contested and unresolved (Brooks 2014). Complicating matters for residents, the scientific information that is released often includes contradictory information and while a great deal of uncertainty remains, the only thing it seems that regulatory officials *do* agree upon, is that the site is safe and that no one is experiencing negative health outcomes (Brooks 2014). Officials also see the sections of the complex as separate, and while the radioactive waste and underground fire are at the same

200-acre complex, they are referred to separately, as the West Lake Landfill (radioactive waste) (U.S. EPA 2008a, 2018) and the Bridgeton Landfill (heat-producing reaction/subsurface smoldering event/underground fire) (U.S. EPA 2008c). They deem both sites nontoxic and not presenting a significant harm to the residents and surrounding communities (Brooks 2014). Residents, however, fear both the short-term and long-term effects of living near a landfill fire and radioactive waste, and the possible combination of the two, and many believe they are already experiencing significant negative health outcomes.

The situation is further complicated because of the legacy the St. Louis area has with radioactive waste and contamination (Fleishman-Hillard, Inc. 1967; Freivogel 1976a, 1976b; St. Louis Remediation Task Force 1996). To date, over 100 sites have been identified as contaminated due to Cold War era activities (U.S. Army Corp of Engineers n.d.). Many residents see these sites as interconnected and while some sites have undergone remediation, the West Lake Landfill site has not been one of them. The constant uncertainty and generation of more data, more reports, and more divergent expert opinions, not only continues to defy closure, but threatens to open up controversies at the other sites too. Frustrated by the lack of communication and the steady influx of often conflicting information, a group of local mother-activists, started a Facebook group to not only, try to keep up on the steady flow of information but to also, share their stories about how to cope with the struggles of living with uncertainty in their daily life. In doing so, they have challenged and forged new articulations of knowledge and created new ways of engagement with local, state, and national entities.

Undoubtedly, managing risk and uncertainty is often fraught, as it always already involves making decisions about a future that is unknowable. How someone responds, or does not respond to something today, may impact something tomorrow. Therefore, decision making, and risk go hand in hand. Risk is an interdisciplinary endeavor and is often further complicated when more stakeholders are introduced and as more information is collected (Althaus 2005). This is especially true, when information is lacking and/or contradictory. To put it another way, "more uncertainty demands more knowledge, more knowledge increases the complexity, more complexity demands more abstraction, more abstraction increases uncertainty" (Van Loon 2002:41). The site has thus become an ongoing site for debate among a variety of entities.

For this project, I was interested in the ways in which issues of risk and uncertainty, health and safety, the role of experts and lay people, and citizenship and decision making at the site changed over time. As such, the overarching question of my project asks, "How do lay people make sense of risk in environments of high uncertainty when narratives of risk are being contested by experts and stakeholders?" The main issue here was not only how residents have lived with environmental uncertainty and are managing and living with risks, but also how they are producing and contesting knowledges in the process. Additionally, my project asked, how do lay people communicate risk to one another and forge new ways of understanding?

The ongoing uncertainty at the site makes it an ideal location to study these issues. Oftentimes sites are studied after a site has already been determined to be hazardous to residents and/or after remedial action(s). In the book *Flammable: Environmental Suffering in an Argentine Shantytown*, researchers were able to study how residents make sense of living in a known toxic environment (Auyero and Swistun 2008, 2009). The proposed study is different from previous studies because regulatory agencies believe the site to be safe and in

2008, the EPA released its plan to leave the material in place (U.S. EPA 2008c). Some of the residents who live around the landfill believe they are experiencing negative health outcomes and/or believe that they may experience them in the future and remain dissatisfied with the way the site has been managed. They continue to call for the waste's removal. Thus, the considerable backlash makes the West Lake Landfill site an ideal place to study these tensions.

This project is sociologically significant because an active citizenry is a cornerstone of democracy. For democracy to be realized, citizens must be made aware of the circumstances that affect their lives and be able to make informed decisions about best courses of actions. To that end, citizens must have a way to petition the State when they feel as though their rights are being violated. As a federal agency, the Environmental Protection Agency was formed to focused on, "research, monitoring, and stand-setting and enforcement activities to ensure environmental protection" (U.S. EPA 2014:1). Residents feel as though they are being ignored and that the EPA is not taking all information into account, because the information that residents are collecting is not being given the same level of importance as information collected by other sources.

In order to answer the above questions, my research design was a case study. Case studies involve "…and individual, group, organization, or event – [which] rests implicitly on the existence of a micro-macro link in social behavior" (as cited in Gerring 2017:1). The boundaries of case studies have a tendency to be porous (Feagin, Orum, and Sjoberg 1991; Gerring 2017) and as such, I collected data from a variety of sources. The problem at the landfill is ongoing and as such, this project included the time periods between when the radioactive waste made its way to St. Louis up until 2015[1]. I utilized a mixed methodological approach that included: observation/scraping of the public Facebook group(s), semi-structured interviews, archival data, content analysis, and observations of townhall meetings. Computer mediated communication (CMC) such as Facebook, is at once seen as mundane, but its influence is also under researched (Hine 2015). The Facebook group was but one modality for how people were contesting claims, but they had to be supplemented within the context of the everyday, which provided a window into how lay knowledge was produced and citizenship was constituted, on the ground. In line with Brian Wynne (1996), residents saw themselves as creators of important lay knowledges, which allowed them to challenge expert systems. Using multiple data sources and methods provided me a much deeper understating of risk(s).

In taking on a project such as this, it was important to keep in mind that making sense of and managing risk is embedded in multiple disciplines and therefore is used differently by multiple entities and groups. This project is informed by several disciplines other than just political and environmental sociology, such as science studies, feminist studies, media studies, and history. The field of science studies adds a richness and depth to this project, which can be thought of as " a conceptual tool kit for thinking about technical expertise in more sophisticated ways" (Hess 1997:1). The future may be uncertain, but decisions about the future, what our values are, the ways in which we want to live, and how

[1] It is acknowledged that this is a somewhat arbitrary deadline. The subsurface smoldering event/underground fire was detected in 2010 and cutting off this dissertation at the end of 2015 still allowed for 5 years' worth of experiences with this event. However, the Facebook Group grew exponentially after this time frame and because dissertations need to be written and completed, I felt it was a reasonable stopping place. I attended meetings and collected data far after 2015 and hope to analyze and report that data in subsequent publications. In many cases, significant events unfolded even as I wrote drafts of chapters. In some cases, I provide updated information, when it was available.

best to move forward are all caught up systems of power and our imaginaries about the future.

Feminist studies kept this project grounded and served as a reminder of the importance of social location and the power dynamics involved in speaking for something/someone (Ackerly and True 2010; Harding 1991; Sprague 2016). Additionally, it was important to bear in mind that historically, experts in scientific fields are often male-dominated and tend to be automatically given a more privileged stance than lay people, whose lives are most impacted (Harding 1991; Keller 1986). In the case of my project it helped to, for example, better situate the knowledges produced and contested by the mother-activists. Many of the people in my study communicated through computer mediated interactions and the field of media studies helped shed some light on the important role's social media plays in civic engagement (Chambers 2013; Uldam and Vestergaard 2015). Finally, history played such an important role within this project, because in many cases, the historical record had to be relied upon to make sense of how risk was understood in the past, and how those ideas shaped current understandings of risk.

Site of Study

The focus of this project was the West Lake Landfill Superfund site. Before diving into the specifics of the site, it is important to discuss its location in relation to the St. Louis area as a whole. The vast majority of the St. Louis area sits between two rivers, the Missouri River and the Mississippi River. For context, the Mississippi river creates the border between Missouri and Illinois, and downtown St. Louis, begins right at the riverfront. Marking this area, sits the Gateway Arch, which is perhaps the most recognizable monument in the city.

Approximately 20 miles west of the St. Louis Arch, is the West Lake Landfill, which is centered in Figure 1 and is just before crossing the Missouri River (Rock Road Industries, Inc. 2017). The West Lake Landfill is near the Missouri River and within its flood plain (U.S. EPA 2008a).

Figure 1. Aerial view of the metro St. Louis area.
Data Source Rock Road Industries, Inc. (2017)

Figure 2 is a computer-generated depiction of the landfills' proximity between the West Lake Landfill OU-1 Area 1, and Area 2 which are the areas containing radioactive waste, the warehousing district, and the Missouri River (Rock Road Industries, Inc. 2017). Starting from the Missouri River and moving east (towards downtown St. Louis), sits Earth City, Missouri, a largely warehousing district, and the site borders Earth City and the sprawling residential areas that border it to the south and the east.

If you were to be driving in the area, the West Lake Landfill is easy to visually miss because even though it is accessible and somewhat close to interstates 70 and 270, the topography conceals the site well. Throughout my time studying the West Lake Landfill complex, even people who were familiar with the area had a difficult time locating it.

Figure 2. Distance between the Missouri River and OU-1, Area 1 & Area 2.
Data Source Rock Road Industries, Inc. (2017)

Figure 3 shows that this is in part, because there is another landfill nearby that is visible from the highway, especially when foliage is cleared, that is often noticed first. Many people know it because it is close to a popular outdoor amphitheater. This is not the West Lake Landfill site (green), but the Champ Landfill (blue). Figure 3 also marks Lambert International Airport (orange).

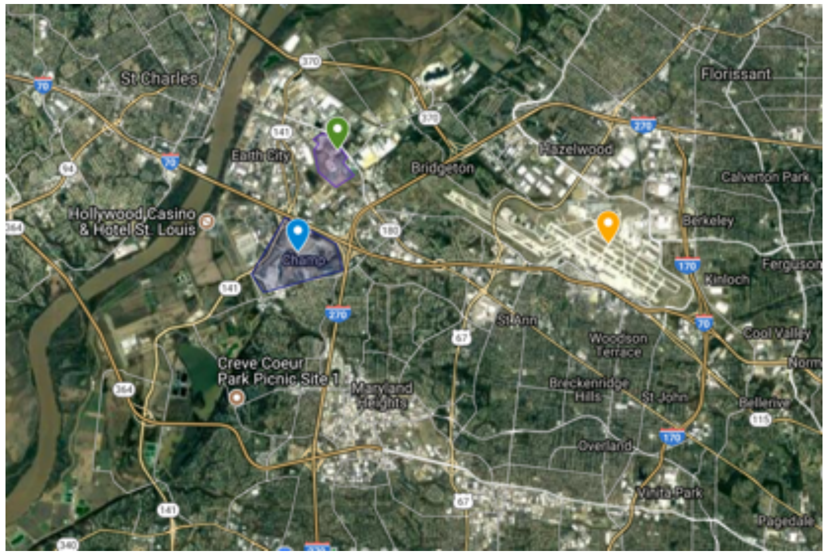

Figure 3. West Lake Landfill, Champ, & St. Louis Airport.
Data Source Google Maps (2019)

As part of the St. Louis metro area, the West Lake Landfill Superfund site is located in Bridgeton, Missouri (11,600 - 2010 census), a northwestern suburb of greater St. Louis County, with the Missouri River serving as its northwestern border (World Population View 2020). Up until the late 1930s, the land was primarily used as fertile farmland. In 1939, the site was transformed into a limestone quarrying and crushing operation, which was in operation until 1988 (Rock Road Industries 2013; U.S. EPA 2008a). The operation created two quarry pits, and in 1950s, before both federal and state oversight on landfilling and waste, these pits were used as landfills (U.S. EPA 2008a). In total the entire complex occupies around 200 acres and is further divided and sectioned off into areas containing local municipal solid waste, industrial solid waste, and construction/demolition debris (Rock Road Industries 2013; U.S. EPA 2008a). Each landfill or section, within the complex stopped taking waste at different times and the final section stopped collecting waste in 2004 (Republic Services 2014a). In addition to the closed and inactive landfills, the site is currently used as a waste transfer station, and houses both an automotive repair shop and concrete and asphalt batch plants (U.S. EPA 2008a).

Today, the landfill is housed in St. Louis County, within a densely populated area with some residential neighborhoods, an industrial sector, which includes warehouses for various companies, manufacturing facilities, and a couple of local landfills. Most outsiders know St. Louis County because of the events in Ferguson surrounding the tragic and violent death of Michael Brown (Buchanan et al. 2014). While Ferguson is a predominately Black/African American area, the West Lake Landfill Superfund site, is within ten miles, and is within a predominately white area. In the same county and sharing many of the same resources these two issues have in many ways shaped what is known about the area and its place within the suburbs of St. Louis.

Based on 2018 Census Data, the population of Bridgeton, Missouri is predominately white, 68.59% of the population, followed by 26% Black or African American (World Population View 2020). The vast majority (73.16%) of people who live there were born in the state (World Population View 2020). The average age of residents is 40 years old and the average income of residents is $36,624 a year (World Population View 2020). While there are many facets to social class, many of the people who live in this and the surrounding areas are working class. Many people rent, but most residents, about 80%, own their own home (World Population View 2020). There are many subdivisions in the area, but the closest to the landfill complex is a mobile home park and the Spanish Village subdivision which are within a mile (U.S. EPA 2008a).

One of the more challenging aspects to understand, and a major point of confusion, is in making sense of how the site is divided. This is further exacerbated by how the sections of the site are named and labeled. The entire site is approximately 200 acres and roughly divided into six sections and three operable units (OU's) (MDNR 2019; U.S. EPA 2008a, 2018). OU-1 consists of the areas within the complex that have been impacted by radionuclides and they are: Radiological Area 1, Radiological Area 2, and the Ford Property/Crossroad Property/Buffer Zone (U.S. EPA 2008a, 2018). When people speak of the West Lake Landfill, they are most often referring to this portion of the site. The parts of Figure 4, which are purple and pink, represent OU-1 Area 1 and OU-1 Area 2, and where testing has indicated the presence of nuclear waste (MDNR 2010; U.S. EPA 2008a, 2018). Area 1 is estimated to contain 24,400 cubic yards of radiologically impacted material (RIM) and Area 2 contains approximately 118,000 cubic yards (U.S. EPA 2008a, 2018). In some places in both Areas 1 and 2, radionuclides are at or just below the surface and contain uranium-238 (U-238), uranium-235 (U-235), and thorium-232 (Th-232) in concentrations above background levels (U.S. EPA 2008a, 2018). Sometimes, the radioactive waste areas are referred to as the West Lake Landfill; at other times, the West Lake Landfill is used to mean the entirety of the complex, i.e., all 200 acres. To avoid this confusion, I use West Lake Landfill Superfund Site and/or West Lake Landfill complex, when referring to the entire 200 acres, and use West Lake Landfill when referring to the areas where radiologically impacted materials are located.

OU-2 consists of the areas not impacted by radionuclides, and more or less, is everything else (U.S. EPA 2008a, 2008c, 2018). These areas are individual landfills, as each section received different types of wastes at different times and were under different permits (U.S. EPA 2008c, 2008a). This includes a closed demolition landfill, an inactive sanitary landfill, and a former active sanitary landfill (U.S. EPA 2008c, 2008a). The former sanitary landfill is made up of two quarry pits: the north, which is most near OU-1 Area 1, and the south quarry, which is where the subsurface smoldering event started in 2010 (Republic Services 2014a; U.S. EPA 2008c, 2008a). In Figure 4, the area that is neon yellow, labeled OU-2 Former Sanitary Landfill, is roughly 52 acres of the complex, and also commonly called the north and the south quarry, with the area in-between called the neck (MDNR 2010). This section of the complex is most often referred to as the Bridgeton Landfill. Throughout the paper, I use the Bridgeton Landfill to denote the 52-acre section of the landfill within OU-2. Figure 5 is a picture taken from the Bridgeton side of the landfill. Over the years, the site has been sold many times and Republic Services Inc. currently owns the site after it was acquired through a merger (Berfield 2017).

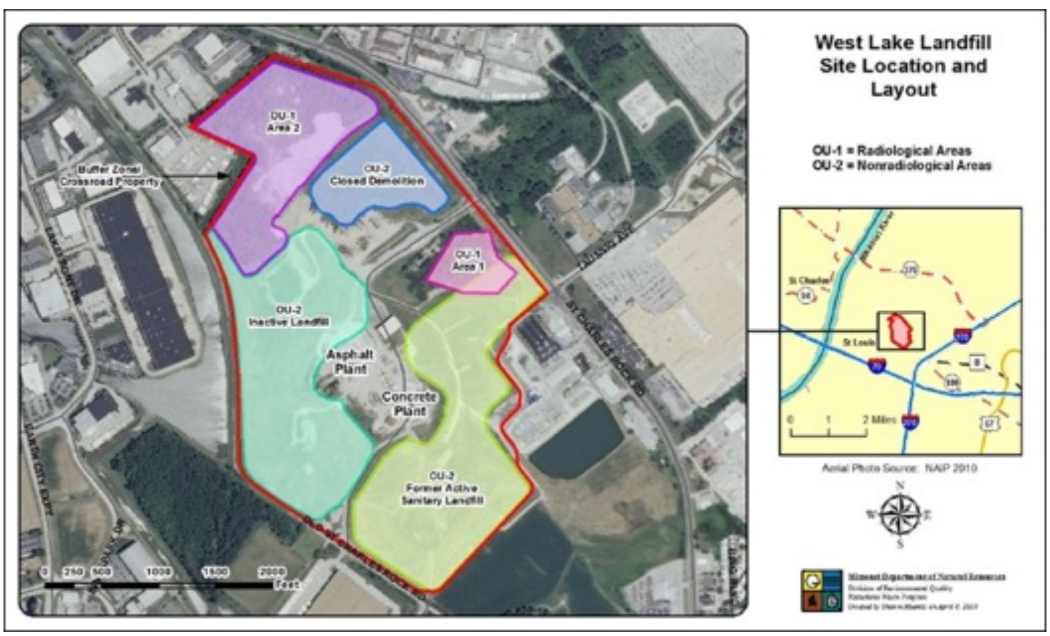

Figure 4. Aerial view of sections of the West Lake Landfill site.
Data Source MDNR (2010)

Figure 5. Bridgeton Landfill.
Data Source Author, 2018

OU-3 was added in 2019 to characterize the groundwater at the site (Trihydro Corporation 2019). Studies conducted under the Missouri Department of Natural Resources (MDNR) and the Environmental Protection Agency (EPA) found several wells at the site that were contaminated with radiological contaminates like radium (Trihydro Corporation 2019). As this operable unit (OU) is the newest, experts argue that many more studies are needed to be completely characterize the groundwater at the site. Most recently a Remedial

Investigation/Feasibility Study[2] has been completed, but a final Record of Decision[3] is likely still years away (Trihydro Corporation 2019).

The EPA, a federal agency, is the lead agency in charge of oversight of all OUs, but MDNR, a Missouri state agency, has greater decision making power over OU-2 and holds an advisory role on all OU's (Trihydro Corporation 2019; U.S. EPA 2008c, 2008a, 2018). In short, the EPA has relatively full oversight on all areas, but it is mostly concerned with the areas where radioactive waste is present, while MDNR takes on a greater role on everything else, including where the subsurface smoldering event (SSE) currently is. Each OU undergoes a long and arduous investigation, proposal of plans, and public comment periods before a final Record of Decision is made.

Terminology

At times, using and agreeing upon terminology has been somewhat arduous to all parties involved. In terms of the complex, referring to a specific area as the Bridgeton Landfill has led to a great deal of confusion. On one level, naming the specific sections serves to aid in the discussion of specific locations within the complex, but on another level, the separate names hide that it is a linguistic one, and not a physical divided boundary, as Figures 6. and 7. show. While there is a fence that surrounds the entire complex, it is not

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[2] "The remedial investigation (RI) serves as the mechanism for collecting data to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and conduct treatability testing to evaluate the potential performance and cost of the treatment technologies that are being considered. The feasibility study (FS) is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions" (U.S. EPA 2015).

[3] A Record of Decision (ROD) is the remediation plan for a Superfund site (U.S. EPA 2015).

sectioned off within the complex itself. For example, if you were to go to the site, there is nothing to denote when you cross into one area or the other. They are somewhat distinguishable now, only because the area referred to as the Bridgeton Landfill is covered in a tarp, but this has only been present within the last decade or so.

Additionally, if you were to use "Google Maps" to search for "Bridgeton Landfill," you would be hard pressed to locate this specific section. The city of Bridgeton has several landfills, including the West Lake complex and nearby Champ Landfill, and in a sense, both of these are Bridgeton Landfills, in the most general sense of the label. In my research, referring to this section of the complex exclusively as the Bridgeton Landfill appears to be somewhat of a recent occurrence, going back a little over two decades or so. Through much of the historical record, this section of the landfill was not explicitly discussed, nor was it explicitly excluded as something set apart.

Figure 6. Across the Complex.
Data Source Author, 2018

Figure 7. Unofficial Tour Group outside the Complex.
Data Source Author, 2018

This divide has also translated online too. The section referred to as the West Lake Landfill (OU-1) and the section referred to as the Bridgeton landfill (OU-2) each have their own separate web pages (Republic Services 2014a; Rock Road Industries 2013). Each page addresses separate histories, timelines, and frequently asked questions (FAQs) of only its specific portion of the complex. While this is not brought up as an indication of wrong-doing or that it's inherently sinister in nature, this is an important point of contention with regards to the site.

People who are searching information about the site often have a difficult time understanding the characterization of the entire site and where the underground fire and waste are. In some cases, it may be easy to visit one of these sites and conclude that the sites are completely separate entities, without realizing that they are not physically separated and instead, are part of one somewhat continuous site. At times they are both considered separate, overlapping, or parts to the same whole. Therefore, the naming conventions stated above will be used, as it is keeping with how each area is most often referred to in many articles and documents. But again, while spoken about separately, these landfills border one another and are not to be thought about as completely separate places divided by a vast distance.

Another point of confusion sometimes appears in the discussions of radioactive material. Up until the 1970s, the historical record refers to the radioactive material in the area and stored at sites as simply residues and/or material. After its sale and illegal dumping, it is referred to as radioactive waste in newsprint and casual conversation. The distinction, as will be discussed in later chapters, likely has to do with waste fetishism (Gille 2007) and the ways in which things *become* useful and not useful (Strasser 2000). In official documents, such as the Record of Decision (U.S. EPA 2008c, 2008a, 2018) overseen by the EPA, the material is referred to as radiologically impacted material or (RIM). It is important to bear in mind that these terms reflect the material and physical properties of things, but are not used to denote strength, degree, volume, size, use, etc.

There is also a divide, and perhaps the greatest point of contention, in characterizing what the EPA refers to as a subsurface smoldering event (SSE), which has also been called a heat producing reaction (Republic Services 2014a) and underground fire (Alvarez 2016). Residents most commonly refer to it as underground fire, which has led to clashes between Republic Services Inc., regulatory agencies, and citizens. For example, when residents are asking questions and/or conveying experiences, they are corrected for not using the right jargon. SSEs are hard to define, categorize, and characterize because there are many factors involved in the breakdown of waste (Thalhamer 2011, 2013). While the company and regulatory agencies are fairly adamant about not referring the SSE as a fire, this distinction is also far from clear with experts who work within the field (Thalhamer 2011, 2013). The main point of contention is whether or not something can be a fire without oxygen (Thalhamer 2011, 2013). Regardless, experts themselves often freely use terms like “underground landfill fire,” “subsurface smoldering event,” and “operational fire,” interchangeably (Thalhamer 2011, 2013). Fires that reach the surface and/or are on the surface are usually managed on site and/or by local fire departments, as was the case with this site. This is important because that means local fire departments must be equipped to whatever may happen at the site.

Residents and lay people often do not have the same access to information that expert systems do, and therefore, the insistence on using proper terms is not only a facet of professional gatekeeping (Kuhn and Hacking 2012), but also about power and control (Lukes 2004). While lay people and/or lay persons are sometimes imagined as being ignorant and/or unknowledgeable, I do not conceptualize the term in this way. I use the term in good faith to simply mean anyone who is not an expert. Experts, “are to provide expertise (i.e. scientifically sound information about the facts), recommendations on feasible solutions, and guidance in a world that is ever more entangled with technologies” (Maranta et al. 2003:150). Both experts and non-experts make knowledge claims on the basis of the knowledge they possess; the experts most often in terms of technical and scientific, and the laypeople in terms of lived experiences (Epstein 1996; Wynne 1996), even as there is a great deal of overlap between the two.

This divide becomes more fraught in the context of a “risk society” because we live under the uncertainty of what industrial societies produced, namely chemical, nuclear, and other things in which the long-term impacts are unknown (Beck 1992, 1999, 2006; Giddens 1997). A task of vital importance in the risk society is the struggle for defining such risk(s), where scientists/experts are often pitted against lay people to determine the "scale, degree, and urgency" of risk (Beck 1992:46). The struggle to define, redefine, and manage the production of risk cannot be overstated, as it not only produces winners and losers, but what is also at stake, is individuals' imaginaries of self that are being constructed through ongoing negotiations and their understanding of risk (Beck 1992).

In the case of West Lake and Bridgeton landfills, this struggle has become fraught, because it is at once encompassing, as I discussed earlier, but also tenuous – largely because there is no expert agreement on the nature and extent of risk posed by these landfills. Parts of the complex are sectioned off and data have been produced about that specific section. Since the site is divided between three OUs, each has its own plan for remediation. With multiple regulatory agencies and stakeholders, residents simply do not have the same access to information and are beholden to the reports that are produced by the very people who have a vested interest in the site being seen as managed and controlled. Additionally, this conflict has produced political and power struggles about who gets to speak, and when, and what count as data.

Historical Overview of Trash and Landfills

How radioactive waste would eventually end up in an unlined landfill in a suburb of St. Louis, Missouri, surrounded by neighborhoods, is a long and winding tale that spans decades. How the other landfill, which sits adjacent to the first, begins to smolder from within, while shocking to hear, is much more commonplace than one would expect (Thalhamer 2011, 2013). The history and stories of these landfills run parallel to one another, and the fear that these separate story lines may meet, has captured the imaginaries of various stakeholders and people that live around their perimeters. To more fully grasp this situation, it is necessary to back up quite a bit, first to how waste has emerged as something that must be managed through technical expertise, and second to review the history of this specific case. While there is quite a bit of information on the former, the latter presents a challenge, because various pieces may be missing, and/or the public story may be different than private ones.

At times, key parts of the story seem to be missing from the public record and the experiences of private citizens has countered what was known about the site. To further complicate things, even the parts where stakeholders more or less agreed, there remained large gaps, since it so often involved complex and contradictory scientific data and a legacy of top-secret security clearances and illegal activity. The experiences of lay people are included and are noted when they arise, to show readers how contested this site truly could be at times. Controversies have a way of blurring the line between what is recognized as "unquestionably technical" and "unquestionably social" (Callon, Lascoumes, and Barthe 2009:25). If the issues at the landfills had remained simply a technical issue, like some stakeholders would likely preferred, then it would have been removed from public influence and debate (Callon et al. 2009).

Recognizing the social dimensions of the problem and who may or may not be affected increased the discussion in the political arena and often the people involved (Callon et al. 2009). Since residents began to smell the landfill and started experiencing burning eyes, noses, and throats, it moved outside the realm of fully technical and private, into the social realm where residents were able to comment and influence decision making at the site. Socio-technical controversies often result in unexpected problems with unforeseen effects and as more information is revealed, more actors may come forward. Uncertainty may increase as the number of actors do, which makes closure that much more complicated.

For many, something like a landfill is out of sight and out of mind, even when it is somewhat close by, but this hasn't always been the case. In her socio-historical analysis of waste, Susan Strasser (2000) notes that our connection to waste has fundamentally changed as humans created and consumed more. As "there is no waste in nature," the concept and construction of waste is of human design (Shukin 2009:71). When households were creating most of what they were consuming, items were used until they were worn out and then often transformed into something else, rather than discarded because they were no longer *wanted* (Strasser 2000).

Early households, be it in the country or the city, had strategies for extending the life of items, and/or for discarding items once they could no longer be of use (Strasser 2000). It was customary, for those less fortunate to coming calling near backdoors in search of a warm meal and livestock/animals roamed town streets and scavenged close to dwellings for food scraps deemed inedible (Strasser 2000). Sheets were turned, socks were darned, animal fat was made into soap, a sweater too small was unraveled and remade larger (Strasser 2000). Early households also had a much more reciprocal relationship with early industries as they brought extra animal fats/oils, fur, bones, and rags from households (Strasser 2000). Rags, in particular, were very important, patriotic even (Strasser 2000). Used to make paper, an industry dominated by the English, the newly minted American industries romanticized and encouraged women to save their old clothing and rags; where they were told that rags today, could very well be the paper on which a suitor declared his love or wrote a letter home

(Strasser 2000). Rags also allowed women and children a source of domestically produced income, some of the only money that was within their control (Strasser 2000).

As industrialization took shape, manufacturing, especially paper mills, were notorious polluters and as large firms developed more products, they began to utilize their own waste or marketed them independently, rather than relying on households to supply them with their raw materials (Strasser 2000). In short, industries moved from buying waste from households to selling their own waste and byproducts to other industries instead. With newspapers came advertisements, which were used to entice people to buy even more. By the end of the 19^{th} century, the reciprocal relationship between household need and industry re-use had changed drastically, "industrialization broke the cycle. In an industrial system, the flow is one-way: materials and energy are extracted from the earth and converted by labor and capital into industrial products and byproducts, which are sold, and into waste, which is returned to the ecosystem but does not nourish it" (Strasser 2000:14–15).

Once waste leaves the control of households and the purview of the domestic sphere, it becomes something that needs to be managed. In short, "For the first time in human history, disposal became separated from production, consumption, and use" and for the first time trash became an important facet of class distinction, as well as a civic concern (Strasser 2000:109). Wealthier households that could throw things away did, and mended clothing became identified with poverty, but trash became a larger civic concern as waste was often thrown outside windows and in streets (Strasser 2000). By all accounts, early communal life created quite a bit of odor, pollution, sanitation, and hygiene issues. Early sanitation reformers in cities across the country began calling for sanitation reform, including the Civic Improvement League of St. Louis (1906), which had a separate public sanitation committee, but many people were initially resistant and/or refused to give their waste over to municipal refuse collection because they saw it as a violation of their civil rights and because relationships had often been formed between the people who threw things away and the people who used the discarded items (Strasser 2000). In short, wealthier households were often times familiar with the people who used what they gave away and saw it as charitable, and giving unwanted items to the city, which people nearby could use, seemed terribly wasteful (Strasser 2000).

Even so, trash collecting was slow to roll out, and not without its issues. While it had been a concern for decades, the first attempts at solid waste management in Missouri did not occur until 1955, but even so, since it was left up to individual counties to adopt the law, it was largely ineffective (Hull 1999). Congress passed the Solid Waste Disposal Act of 1965 that funded a survey aimed at taking stock of current practices of waste management in the state, which later found that, "solid waste management in Missouri was largely unplanned and was causing serious threats to public health and the environment" (Hull 1999:2). This gave way to the Missouri Solid Waste Management Law of 1972, which required local governments to create a plan to manage solid waste and outlawed open dumping (Hull 1999).

As the management of solid waste became the purview of the state, citizens became even further removed from the waste they created. The boundaries of the household further shrank in the 1988 Supreme Court case, *California vs Greenwood* which, "declared that the borders of the household do not encompass the contents of trash cans…The Court maintained that citizens may not reasonably expect their trash to be private and that law enforcement officers looking for evidence do not need a warrant to search the trash"

(Epstein and Carter 1988; Strasser 2000:7; Uviller 1988). In effect, when you put your waste outside of your house, it quite literally, is no longer yours or your concern, as it is now the concern of expert systems and can be used by the state. This was a dramatic change from times past, as people are further removed from the waste that they create.

While the focus from the 1950s to the 1980s was the safe collection of waste, the 1990s, were focused on the reduction of waste and environmental impacts, recycling initiatives become more popular, and while landfills collected the vast majority of the municipal solid waste in the state, landfills themselves were in decline (Hull 1999). Today, the overall the number of landfills has decreased, but since trucks must travel further between landfills, the number of substations has increased (Hull 1999). Additionally, most of the landfills in the state of Missouri are privately owned and operated. As such, there is a great deal of autonomy in how their businesses are run (Hull 1999). The landfills in this project were no exception, and the tensions between the responsibility of who should manage waste was an important part of the story.

Outline of Chapters

While this chapter introduced the project and the site, Chapter 2, "Literature Review, Theoretical Framework, and Methodology," describes the literatures that I used to guide my work. This project draws upon three over-lapping themes. First, this project discusses the welfare state in the post- WWII climate, and how social imaginaries reflect certain expectations and responsibilities of the state. How people understand and make sense of risk is deeply embedded in economic, political, and legal systems. In order to fully understand what is currently happening, it is necessary to examine how people made sense of futures that were largely unknown and how that has impacted current situations. Second, this project draws on literature that highlights the expert and lay divide, that so often doesn't adequately account for lay knowledges. Nor does it capture the ongoing complexities of the subjective (and temporal) nature of risk. The final theme draws upon individual and collective understandings of risk, in which experiences are tied to not only a person's social networks, but also highlight the complexity of how risk(s) are entangled within larger institutions. The second part of the chapter outlines the methodologies used to complete the study.

Chapter 3, "How Radioactive Material Came to St. Louis: Creating a Legacy of Harm," provides an overview of the historical, political, and economic circumstances that brought radioactive material from the Belgian Congo to the St. Louis area. Spurred by a pre-WWII partnership between the Manhattan Engineering District (MED) and a downtown St. Louis company, they were able to pull off what was described as an unthinkable task in an unimaginably short amount of time, which helped scientists at the Metallurgical Laboratory (Met lab) produce the world's first self-sustaining chain reaction of an atomic reactor (Gosling 2010; Jones 1985; Rhodes 1986; U.S. DOE 1996). This was a crucial component in advancing the Manhattan Project, which producing the world's first atomic bomb, and later nuclear weapons production (Fleishman-Hillard, Inc. 1967). However, decisions made during this time, over 70 years ago, have coalesced and have impacted the lives of the people who live around the West Lake Landfill complex today. Changing ideas about nuclearity (Hecht 2012) and what counts as proof of harm, when the harm is not easily detected (Murphy 2006), has both influenced residents' notions of risk and created the conditions under which they must live.

Chapter 4, “Creating Separate Trajectories of Remediation,” picks up the story where chapter 3 leaves off by discussing how radioactive material made its way to the local landfill. The West Lake landfill has been an important site for how federal, state, and local issues coalesce and impacted one another because radioactive material was illegally dumped before most state and federal policies governing hazardous waste were created and prior to the creation of federal and state environmental regulatory agencies. Once created, federal supremacy and decision-making created frictions between the various agencies themselves and levels of government. While citizens have called for the removal of the waste since its discovery; they were largely left out of the decision making process until the discovery of the underground smoldering event, which marked when citizens were able to seize an opportunity for citizen participation on the grounds that they cannot enjoy their property. They have used this as a way to contest the narrative that the site is managed and contained and claimed that their health and safety risk has increased.

Chapter 5, “Smell, Risk, Knowledge and the Strategies In-between,” expands upon various stakeholder’s contentious ideas about risk and harm. The discovery of the SSE in a section of the complex further created uncertainty at the site. This uncertainty has in many ways compounded the issue and disagreements between the company and regulatory agencies have led to widespread disagreements within the expert systems. While the EPA and the company state that the site is safe, various issues have led to several standstills, as uncertainty abounds within scientific decision making. In short, there is no obvious way forward because so much about the site is unknowable. As the landfill produced and continues to produce odors, residents have grown fearful that they are not just being inconvenienced by the smell, but that it has caused health problems. Residents are then left to make sense of and manage their own risk. Without any information and/or insufficient information, residents used Facebook to track the location, strength, and severity of landfill odors so that they may make determinations about risk. Residents have used strategies in-between (Zinn 2008a, 2016), by combining experiential data along with scientific data to both make decisions and challenge expert systems.

Chapter 6, "Conclusion: Subjectivities of Risk Moving Forward," summarizes each chapter's findings and looks to possible future avenues of risk research. This project focused on the ways that risk is managed by various stakeholders and the impact that it has had on residents. Put into a larger context, the chapter discusses the possible implications for citizenship in the welfare state. It then moves on to discuss regulatory agencies and how individuals manage risk. The final section discusses the study's limitations and possible avenues for research moving forward.

CHAPTER 2: LITERATURE REVIEW, THEORETICAL FRAMEWORK, AND METHODOLOGY

Planning for an unknown future has always occupied human thought, as the future is always uncertain. It was once believed that humans' ability to plan was what separated us from the rest of the animal kingdom, but it is now known that the great apes and some species of birds are also able to plan for future events (Kabadayi and Osvath 2017). Their planning and the subsequent behaviors they engage in, such as food hoarding, tool-use, and bartering, are similar to past human activities (Kabadayi and Osvath 2017). Early settlements and civilizations had to face uncertainties brought on, or complicated by, illness, death, natural disasters, warfare, as well as issues related and/or exacerbated by communal living (Polanyi 2001). In early civilizations, future planning often involved traditions and rituals that conveyed expectations of reciprocity and the redistribution of goods, which externalized the values of the group and offered the most promise of survival (Polanyi 2001).

The European feudal systems of long ago were paternalistic and based on the idea that future planning was best managed by the direct control over peasants by feudal lords who would provide some form of responsibility for, and assurance of, their survival (Polanyi 2001). Early philosophers, such as John Bellars, Daniel Defoe, Joseph Townsend, Thomas Malthus, and David Ricardo, and many others, were preoccupied with unknown futures and spent a great deal of time imagining the survival of civilization, and after the advent of capitalism, how best to manage poor populations (Polanyi 2001).

This, too, can be seen in early North American Native populations, who planned for the future by freely trading and giving away goods and planned for winter months by adjusting their food intake, often going for many days without food, rather than stockpiling and storing food (Cronon 2003). Native populations valued reciprocity between tribe members and were more likely to view land as communal, a practice European colonists found baffling and quickly categorized native populations as lazy and illogical, which would later be used as evidence for their subjugation and mistreatment (Cronon 2003; LaDuke 2005). In short, embedded within the organization of society, while not often explicitly stated, is not only the notion of risk, but also ideas about who and what societies value, which undoubtedly informs what problems are *seen* as problems and/or who or what groups are seen *as* potential problems that threaten the survival of the group.

Welfare State, WWII, & the Social Imaginary

Premodern forms of a social safety net fostered through ideas of reciprocity and traditional practices eventually gave way to state sanctioned planning. This not only served to plan for the future by managing risk and uncertainty, but also became a form of nation building through citizenship rights. The modern day welfare state got its start in Europe and Australia between the 1880s and 1920s; the idea of a welfare state lagged considerably in the United States (Skocpol 1995). Early U.S. social policy conveyed the nations values and, as such, it prioritize primary and secondary education through local and state support, but largely opted to stay out of post-secondary education (Kaiser 2011; Skocpol 1995). Educating the masses took precedence over higher education. Universities were initially largely private and relied on private donations, student tuition, occasional foundation grants, and private philanthropy (Kaiser 2011; Skocpol 1995).

The U.S. federal government also looked at how best to support veterans and their families. While the federal government did provide benefits after the Civil War to some aging veterans and their dependents, social insurance programs for working men did not emerge until after the Great Depression (Skocpol 1995). The New Deal policies of the 1930s expanded the states' responsibility for citizens by offering old-age pensions, unemployment insurance, and programs for poor and dependent children (Skocpol 1995). These policies offered help to many citizens, but benefits varied greatly by state, and policy loopholes led to discrimination and systematic exclusion, especially in minority populations (Coates 2014; Skocpol 1995). However, these policies do mark a change in state responsibility and redefined the role of the state in the lives of citizens.

During the outbreak of WWII, the State called upon all citizens to do their part to end the spread of fascism. Notably, academics were asked to develop technologies, the likes of which were little more than fantasy, to help assist either the troops in the field and/or in weapons technology that could bring about an end to the war (Feiveson et al. 2014; Gosling 2010). For the first time, quite quickly, the office of the presidency, authorized huge investments, many of which were huge gambles, in the development of science and technology. As time was of the essence, products moved quickly from development to testing, largely free from any restraints and/or considerations of public safety (Gosling 2010; Jasanoff 2007). Science and technology, in turn, delivered technological advances such as Penicillin, Radar, the first programmable computer, helicopters, color television, nylon, aerosol cans, the electron microscope, microwaves, and fissile materials (Mindell 2009). All were either created, produced, or adapted in new ways during this time (Mindell 2009). The atomic weaponry, in particular, the likes of which the world had never seen before, went from its first test at the Trinity Site to being dropped on Hiroshima, Japan, in less than a month's time (Feiveson et al. 2014; Gosling 2010). A second bomb, dropped on Nagasaki, Japan, only a few days later, subsequently brought about the end of WWII (Feiveson et al. 2014; Gosling 2010). However, what is of particular note is that not only were more products created, whose future implications were largely unknown, but it also transformed imaginaries about science and technology's ability to advance the nation's health, prosperity, and welfare (Jasanoff 2007).

In the afterglow of WWII, the U.S. benefited from the having very little economic competition among other industrialized countries, and as the dawn of the nuclear age was well underway, the United States had a thriving middle class. As such, the U.S. entered into what some call the golden age of capitalism (Esping-Anderson 1996). The G.I. bill enabled many returning soldiers to go back to school, and under some of the most lenient lending terms in U.S. history, homeownership soared (Reich 2011; Stiglitz 2013). The newly minted National Science Foundation (NSF) streamlined government supplied money and agenda-setting to further maximize its gains through policy, which forged new relationships between state-science-industry and changed the relationships between science-academia and citizen-state (Jasanoff 2007). These relationships led to increases in mass production, increases in use of material resources, and increases in consumption and waste production, in ways that had been previously unknown (Strasser 2000).

Sociologists have since highlighted the connections between the products and practices often used in industry in the name of economic growth and free market expansion, which has led to the destruction of the environments of both humans and nonhumans, and has led to a whole host of adverse health effects (Carson 2002; Farrell 2015; Guthman 2011; Jasanoff 2007; Kosek 2006). These health effects were unevenly experienced within the United States and globally, as some groups bear a disproportionate environmental burden

(Auyero and Swistun 2009; Bullard 2000; Chavis and Lee 1987; Checker 2005; LaDuke 2005; Mohai, Pellow, and Roberts 2009; Smith 2005). As stated in the previous chapter, while there was increases in products and production, the management of waste, lagged considerably behind. Many of these newly created products have not been properly controlled and/or have defied control once they have been released into air, soil, and water (Feiveson et al. 2014; Latour 1993; Morton 2013; Tesh 2000; Tsing 2015).

World War II ushered in the dawn of the nuclear age and the birth of the chemical industry. Many Americans were happy the war had been won, however, the initial acceptance of radioactive products (e.g., toothpastes, cold creams) and excitement of nuclear technologies gave way to fear (Weart 2012). Additionally, a few large-scale air pollution events, increased people's concern about environmental pollution and toxicity (Edelstein 1988).

After the end of war celebration, the news media began publishing the first images of the atomic blasts and the impact the bombs had on civilian populations, and the imagery of nuclear weapons increased in popular culture (Weart 2012). As the U.S. entered the Cold War, Americans, by and large, became unaccepting of products and technologies associated with radioactivity (Weart 2012). Additionally, Rachel Carson's book, *Silent Spring,* first published in 1962 spoke of the horrors of pesticides, such as DDT, and their impact on the environment (Carson 2002). While the book came at the expense of attacks on her character, it was a scathing critique of the chemical industry and, in many ways, foreshadowed what was to come (Carson 2002). Carson's book and these other events ushered in a wave of environmental awareness that led to the creation of the first Earth Day and made its way into national policies and to the creation of regulatory agencies.

The Making of the Expert and Lay Divide

As the 1970s ushered in an era of environmental awareness, it paved the way for stories of communities dealing with environmental uncertainty to emerge (Brown 1992; Edelstein 1988). Cases such as Love Canal, New York, and Leger, New Jersey, along with international incidents such as Chernobyl and the Bhopal disaster, took center stage as people came face to face with man-made disasters and environmental entanglements (Brown 1992; Edelstein 1988; Jasanoff 2008). Emerging from these stories was most notably the important role that women, such as "angry housewife" Lois Gibbs, played in linking environmental illnesses among friends and neighbors, which resulted, in the now all too common battle that occurs between unyielding corporations/government/regulatory agencies and communities (Brown and Faith 1995; Krauss 1993; Mazur 1991).

Disruptions and disagreements happen all the time when people are not on the same page. But in times of high uncertainty, the divide between experts and lay people are often exacerbated. Experts are conditioned within a social world that provides a particular lens in which to see problems (Kuhn and Hacking 2012). For particular experts, such as the scientific community, their socialization experience not only teaches a person about the way that "normal science" within a discipline is done, but also helps frame and create boundaries to the problems being studied (Kuhn and Hacking 2012). It is within these settings that a person becomes professionalized within a field.

The presence of times of uncertainty do not necessarily trigger the same kind of alarm bells for experts within fields, as they might, for residents of a community, for example, because experts often utilize their fields' paradigms in order to investigate a problem or situation (Kuhn and Hacking 2012). Experts then occupy their own lifeworld's, with their own subjective lives and social worlds that further involve typical ways of functioning. Most often experts and scientists are employed by a particular client, be it private industry, institutions, and/or governments, which may act to further constrain their communication and action. It may be of no wonder that a prominent theme within risk literature is the widely documented disconnect between how lay people determine risk and how experts determine risk (Fischhoff, Watson, & Hope, 1984; Slovic, 1999; Tesh, 2000).

However, this "division" is overly simplistic and ignores the overlap among groups and tends to privilege experts and scientists. Studies are quick to note that lay people are notoriously bad at estimating the probability or likelihood of events (Glassner 2009; Slovic 2010). But this critique ignores the variability in definitions of risk. Risk is a difficult concept to define, as a variety of domains engage in the conceptualization, investigation and study of risk, and no one entity can claim the word as solely under their purview (Althaus 2005). This makes the study of risk, by nature, multidisciplinary, but in practical terms, it opens the door to multiple stakeholders (Althaus 2005). In viewing how specific scientific disciplines order, account, and make sense of the unknown, varying constructions of risk are present within each discipline; this has implications for, and informs the methods, applications, and analysis of risk (Althaus 2005).

In a comprehensive analysis on the ways in which disciplines understand risk, Catherine Althaus (2005) sets aside debates on whether or not risk is a metaphysical category, and instead focuses on epistemological understandings of the category of risk. She states, "an epistemological definition of risk conveys information about the disciplines themselves, with risk being a mirror that reflects the preoccupations, strengths, and weaknesses of each discipline as they grapple with uncertainty" (Althaus 2005:567–68). The level of disciplinary self-reflexivity to which Althaus (2005) is referring often goes unacknowledged, but it is precisely why differing definitions between domains and disciplines often lead to problems of translation and create hurdles for communication, cooperation, and collaboration among groups.

Complicating the matter further, risk has evaded all attempts at a universal definition, and this is not for want of trying. Tracing the etymology of the word is little help, as it reveals a variable and unclear past. Risk and uncertainty have been used so interchangeably that they have all but lost any conceptual and analytical difference between them (Althaus 2005). As a way to rectify issues of definitions and translations, the "Society for Risk Analysis" formed a committee in order to define risk (Kaplan 1997). In a talk given at the 1996 Annual Meeting of the "Society for Risk Analysis," Stan Kaplan (1997:408) put forth the following two theorems based on his experience on the committee:

> Theorem 1: 50% of the problems in the world result from people using the same words with different meanings.
>
> Theorem 2: The other 50% comes from people using different words with the same meaning.

In the end, "This committee labored for 4 years and then gave up, saying in its final report, that maybe it's better not to define risk. Let each author define it in his *(sic.)* own way, only please each should explain clearly what way that is" (Kaplan 1997:407). Cline (2004) draws on this sentiment stating, that while it may no longer be feasible to create a meta-definition of risk, lack of a shared definition causes "clear operational costs, in the form of conceptual errors"(2004:2). Furthermore, in more a dire outlook, Cline (2004) cautions the define-it-your-way approach as "irresponsible" and explains that some industries have clearer operational definitions and research approaches (2004:15). He concludes, "the result being that a stakeholder with an unstable operational definition of risk will remain at a disadvantage when arguing for a specific position in the face of an uncertain outcome against a stakeholder with a clearer definition" (Cline 2004:15).

It is no wonder then, that lay people often have an uphill battle to climb when challenging expert opinions, especially as one considers the unspoken multiplicity of definitions of risk evoked by various experts. As problems arise, the struggle to define and speak for a problem or issue becomes of central concern for all parties involved (Beck 1992). While lay people are often those who initially tip experts off that there is an issue, they are often quickly dismissed by those in power (e.g., experts) as too emotional or too subjective. Laypeople sometime perceive something as a risk sooner because they intuitively sense it as such and do not statistically determine actual risk before reacting (Fischhoff, Watson, and Hope 1984; Kraus, Malmfors, and Slovic 1992; Slovic 1987; Tesh 2000).

Cases about the risks of environmental toxicity most often involve low income and minority neighborhoods, and community advocacy tends to involve a large number of women (Bell and Braun 2010; Brown and Faith 1995; Bullard 2000; Chavis and Lee 1987; Checker 2005; Krauss 1993; Malin 2015; Mohai et al. 2009; Perkins 2012; Stein 2004). Poorer communities, especially communities that contain a large percentage of minority residents, experience environmental exposures at a much greater rate than wealthy communities and predominately white communities (Brown and Faith 1995; Bullard 2000; Chavis and Lee 1987; Checker 2005; Krauss 1993; Malin 2015; Mohai et al. 2009; Stein 2004). In fact, "the percentages of people of color in the zip code proved to be the best predictor of where commercial hazardous waste facilities were located—even after controlling in a multivariate statistical analysis for mean household incomes, mean housing values, quantity of hazardous waste generated, and number of abandoned hazardous waste sites in the zip codes" (Chavis and Lee 1987; Mohai et al. 2009:409).

While women often are the catalysts for opening their communities' eyes to the threats of toxic environments and become an integral part in getting lawmakers and government officials to take notice, they often pay a high price for challenging existing structures and are often deemed too emotional, downright hysterical, and/or painted as nothing more than angry housewives (Brown and Faith 1995; Krauss 1993; Mazur 1991; Tesh 2000). Additionally, individuals and/or activist groups often do not have the resources and political clout to easily challenge decisions made on their behalf. Indeed, scientists and other experts are often better posed to influence the knowledge shaping process, as they can devote more power and resources to influencing the narrative (Bond 2014). That is not to say that activists do not find alternatives, and often more subversive, forms of challenging authority.

In many cases, lay people often become frustrated, angry, and grow tired of waiting on experts, and instead start collecting their own data, often referred to as "popular epidemiology" or "lay mapping," which is when, "lay persons gather scientific data and other information and also direct and marshal the knowledge and resources of experts in order to understand the epidemiology of the disease" (Brown 1992:269). After collecting data, lay people are often dismissed as being too self-interested or not objective; they often counter this by bring in their own experts to challenge the claims of other experts (Brown 2007). Additionally, lay people are often simply not as well-versed in complex technological systems, unfamiliar statistical analyses, and jargon-filled academic research with which experts are familiar (Brown 2007; Tesh 2000). Ambitious lay people often experience barriers in accessing the same types of information as experts because access to academic journals/technical information is often reserved for experts associated within their respective fields. Experts are often quick to further capitalize on these distinctions and state that the lack of public understanding of science itself is simply to blame, leading to an inability to understand the present situation (Irwin and Wynne 1996).

Scholars in the natural sciences tend to view risk as real and objective and as such analyze risk in terms of technical risk assessments, insurance, epidemiology, and toxicology (Tesh 2000; Zinn 2008b). The ultimate goal is most often to produce an equation that will guide decision making. This assumes that experts/scientists have all the variables and know which ones to test, but in instances of environmental uncertainty, this is notoriously difficult to determine (Fischhoff et al., 1984; Tesh, 2000). To make sense of uncertainty and the unknowable, experts often create apparent affinities as proxies, to serve as symbolic links (Clarke 1999). As such, animals may stand in for humans and natural disasters may stand in for man-made ones (Clarke 1999; Tesh 2000). Typically, when this is the case, rather than admit that too much is unknown to act, experts often make judgements based on similar conditions, which often helps experts maintain their control over the situation (Clarke 1999). However, even in the best of cases, uncertainty remains. In the end, in many cases of environmental contamination and toxicity, while interventions have taken place, official word is still elusive. For example, at three of the most well-known cases of environmental toxicity, Guilford, Connecticut, Alsea, Oregon, and Love Canal, NY, the science at these places are inconclusive and often contradictory, even many years after the fact (Tesh 2000).

Experts and lay people are often categorized as representing two separate and distinct groups, with scientists and experts who use cost-benefit and probability analyses to calculate the actual probabilities of certain events occurring on one side, and on the other side, lay people who tend to use their own experiences and knowledges to determine risk (Fischhoff et al. 1984; Kahneman and Tversky 1973; Kraus et al. 1992; Slovic 1999). However, to suggest that lay people are completely risk adverse and/or that experts and lay people do not engage in meaningful dialog with one another is incomplete because people make decisions and do take risks within their daily lives. Additionally, Starr (1959) found that the public is willing to accept some behaviors widely recognized as hazardous, particularly those that they deem elected hazards and those with which they associate reciprocal benefits. The issue then becomes one of risk acceptability, and who is allowed to determine what an acceptable risk is.

An overemphasis on the expert and lay divide disregards the interactions between the two, the degree to which experts and lay people are actively reflexive about their notion of risk(s), and often ignores the ongoing complexities of the subjective (and temporal) nature of risk. In short, experts and lay people do come in contact with one another, often to varying degrees, but as Steven Epstein (1996) in his study of AIDS experts and activists found, the interaction between expert and lay has the potential to change the ways a subject is studied and/or "the way rules governing the kinds of evidence [are] required to determine efficiency"(1996:332). Experts and lay people do engage with one another and lay people sometimes do yield some power and influence (Epstein 1996). However, in times of uncertainty, where not even the experts and/or regulatory agencies agree, the ways in which risk is negotiated and reimagined become visible.

Regulatory agencies, institutions, and experts routinely make decisions about the environment and human life, and most of the time, these decisions are not overly questioned or challenged by the public. Under what can be considered normal times, where controversies are not present, information is "black boxed," and people do not question how conclusions are drawn, but in times of uncertainty, too many aspects of a problem are unknown, which often makes finding a solution difficult (Callon et al. 2009; Latour 2003). Bruno Latour (1993, 2003) points out that controversies have a way of opening up these black boxes and scientists and experts are called upon to unpack and explain how facts were constructed and how subsequent conclusions were then drawn. If they are successful, an issue will reach closure, but if they are not, then it will remain open until closure can be reached (Latour 1993, 2003).

In controversies, the line between what is recognized as "unquestionably technical" and "unquestionably social" is blurred (Callon et al. 2009:25). If a problem remained simply a technical issue, like some stakeholders would likely prefer, then it would be removed from public influence and debate, but if there is much that is disagreed upon, there may be little consensus on what constitutes a "fact," let alone what it could mean. Recognizing the social dimensions of problem(s) and who may or may not be affected increases the discussion in the political arena and often the people involved. Socio-technical controversies often result in unexpected problems with unforeseen effects, and as more information is revealed, more actors may come forward (Callon et al. 2009). Uncertainty may increase as the number of actors do, which makes closure that much more complicated.

Individual and Collective Responses to Risk

Communities, when faced with natural disasters such as extreme weather events, overwhelmingly tend to band together to assist others (Drabek 1986; Drabek and Key 1984; Freudenburg and Jones 1991; Quarantelli and Dynes 1976). Many disaster researchers and officials conceptualize natural and human-made[4] disasters as analytically similar, but as insurance policies often dictate, there is a difference between "acts of God" and problems brought on through the actions of people. Who and/or what can be blamed in human-made disaster such as toxic waste and/or an oil spill becomes an issue that is fought in the legal realm, an issue that is mute in natural disasters, as God cannot currently face litigation (Freudenburg and Jones 1991)? This becomes an important distinction as it has the potential to create "corrosive communities" that result in a "disruptive struggle over affixing blame," where experts are seen as showing greater concern for "protecting bureaucratic prerogatives than with providing genuine assistance to victims," and where suspicion of others increases (Freudenburg and Jones 1991:1158). However, even in cases where communities tend to more or less agree, environmental toxicity not only shifts the normal set of behaviors that pattern the way we live our lives, which are at one level, personal and on another level, a reflection of a society's core values, but also challenges, "our fundamental understandings about what to expect from the world around us" (Edelstein 1988:11).

Problem arise in abstract systems all the time, and most are handled by experts and hidden from view. How people make sense of the world is not only anchored in cognition and emotion, but also routine and habit (Giddens 1991). In order to reduce anxiety, habits

[4] This is often still referred to as man-made, but since men are only half the planet, I use human-made instead.

and routines are formed that we rely on to make sense of our world and to add some level of predictability—a form of risk management (Giddens 1991). The predictability of life, or the sense of being-in-the-world, known as ontological security, is "the confidence that most human beings have in the continuity of their self-identity and in the constancy of the surrounding social and material environments of action" (Giddens 1991:92). In order to reduce anxiety and fear, it is important to not only anticipate a future but also be able to plan for it (Giddens, 1991). While the vast majority of problems remain hidden from view, some problems do reach a wider audience, likely because it makes people question their ontological security in some way. In times of environmental uncertainty, especially in cases in which the experts disagree, we can see how people are continuously questioning, negotiating, and assessing risk.

This is an important facet, as Douglas and Wildavsky (2010) found that people tend to use their values and beliefs to determine what risks are acceptable/unacceptable. Furthermore, they tend to draw upon their social networks, the media, and other sources when determining their perception of risk (Douglas and Wildavsky 2010; Short 1984). These can be powerful sources, as regardless of an individual's personal experience, events that happen or are perceived to happen more often, such as those frequently covered in the media, are more easily recalled and are perceived as having an increased risk (Slovic, Fischhoff, and Lichtenstein 1976; Tversky and Kahneman 1973). When the general public considers risk, they consider the potential for future generations to be impacted and/or harmed, the degree to which it evokes feelings of dread, the degree to which it is seen as a catastrophe, and personal impact (Slovic et al. 1976). These can take on different forms as people also consider threats to their chosen way of life and how their community may be impacted.

People's conceptualization of risk is further complicated by state-science-industry entanglements (Jasanoff 2007). At Doc Sud, Buenos Aries, many residents experienced a slew of negative health effects, which they attributed to the highly polluted soil, air, and water from the petrochemical industry (Auyero and Swistun 2009). In their ethnography, Auyero and Swistun (2009:49) discuss what they call the "material and symbolic entanglement" residents have with the corporation that they believe to be causing their illnesses. The corporation developed a very paternalistic relationship with the residents and adopted, what they call a "good neighbor policy," where they invest in community programs for the residents, such as schools and food programs, and they emphasize safe working conditions in the plants and offer tours, etc. (Auyero and Swistun 2009:50). This has resulted in a complicated relationship with residents, as the company acts as both the polluter and the savior, so much so, that some residents have begun to believe that the pollution is exclusively coming from other corporations in the area (Auyero and Swistun 2009). Many residents blame the local municipal government rather than the polluters, which ironically often put the polluters and citizen on the same side (Auyero and Swistun 2009).

In similar cases, ideas about risk are coded into narratives about jobs verses the environment (Hochschild 2016). In Arlie Hochschild's (2016:5) ethnography of what she refers to as "the great paradox," where the very people who rely on government aid often vote for limiting government, she found that many people believed that the government was over-regulating industries and limiting jobs, which made people more dependent on government aid. Similarly, in a town plagued by negative health effects due to the legacy of uranium mining for the Manhattan Project, residents have come out in support of the very industries that were the source of pollution in decades past (Malin 2015). Having been subject to many "boom and bust" cycles, market logic has become an important part of the town's social fabric (Malin 2015). This is happening so much that rather than viewing the town's extreme poverty, under-employment, and health issues as structural violence, many residents feel that the only way out of the current bust is market expansion (Malin 2015). Residents in these cases do worry about their health and safety and/or have the ability to use scientific information effectively; however, they are using a much more dynamic conceptualization of risk subjectivities within their own lives.

Contesting Knowledge, Public Understandings of Science, and Civic Epistemologies

A key facet under democratic governance is citizens' ability to freely make decisions about their lives. Somewhat ironically, reports continue to state that citizen and political engagement continues to decrease in the United States, with the most popular explanation being, simply, the lack of understanding of science among lay citizens (Irwin and Wynne 1996; Jasanoff 2005). This is often supported by general knowledge surveys, which test knowledge about basic scientific facts that experts feel the general population should know (Irwin and Wynne 1996; Jasanoff 2005). Unsurprisingly, these studies indicate that the problem lies in laypeople's deficiency in basic knowledge and leads many to believe that the solution is simply more education; if citizens were just educated enough, then they would be more likely to participate in more meaningful ways. As it is now, the scientific community continues to grow, producing more expert elites, and the gap between the people and the governing body continues to grow. Various scholars within the field of Science Studies have challenged the so-called expert-lay divide as overly privileging experts and failing to acknowledge the importance of lay knowledges (Epstein 1996; Irwin and Wynne 1996; Jasanoff 2005; Wynne 1996). As Brian Wynne's (1996) study of radiation experts and sheep farmers found, experts were not necessarily better informed, as differently informed, and publics don't actively reject nor passively accept what is told to them.

In *Designs of Nature*, Sheila Jasanoff moves away from a priori assumptions about what the public should or should not know about science and, instead, she asks how knowledge becomes "reliable in political settings, and how scientific claims, more specifically, pattern as authoritative" (Jasanoff 2005:250). If we are to think that "contests over policy-relevant ideas and facts are an essential element of democratic societies," then we must be able to think through the formal and informal ways in which the public makes sense of statements or claims of truth or fact, and have a clearer understanding of "knowledge-in-the-making" (Miller 2008:1897). Jasanoff has coined the concept "civic epistemology" to "refer to the institutionalized practices by which members of a given society test and deploy knowledge claims used as a basis for making collectives choices… these collective knowledge ways… are distinctive, systematic, often institutionalized, and articulated through practice rather than in formal rules" (Jasanoff 2005:255). When the lay public contests knowledge claims, then the ways in which knowledge shapes and is shaped by society becomes visible.

When scientists are asked to exit the lab and give advice on policy, they are often not asked to answer questions that are of a purely scientific nature but are asked questions with social implications. On their work of civic epistemologies and disasters, Amy Donovan and Clive Oppenheimer (2016) show how disasters produce what they call ruptures in civic epistemologies. Environmental disasters often contain a high-level of uncertainty and are time critical. As such, experts and laypeople must work together quickly. Donovan and Oppenheimer (2016:366) state:

> "We suggest that extreme events such as volcanic eruptions, large earthquakes and other high magnitude hazards can produce civic epistemological ruptures: they change the course of knowledge production at the science-society interface, through shared experience and learning. If this occurs efficiently, it will facilitate resilience as a part of adaptive capacity. If it fails and information is disputed, unclear, or unavailable, response to the hazard will be similarly delayed and confused as expertise is assembled *ad hoc*."

While this study offers a framework for large scale environmental hazards, its framework is not completely adequate for the situation at the landfills. The ways in which uncertainty factors into the civic epistemologies will be undoubtedly useful, but the situation at the landfill forces us to more carefully imagine how temporality bears upon not just epistemology but also ontology and politics. The landfill offers a unique opportunity because it has the potential to be both a slow-moving disaster (Nixon 2013), and yet, it can become time-critical at any moment. This is precisely the predicament residents are in as they navigate their everyday lives.

Methodology

The overarching question that guided my project was, "How do lay people make sense of risk in environments of high uncertainty when narratives of risk are being contested by experts and stakeholders?" The West Lake Landfill makes for a compelling place to explore that question and as such, my research design was as case study. Case studies involve

"…and individual, group, organization, or event – [that] rests implicitly on the existence of a micro-macro link in social behavior" (as cited in Gerring 2017:1). The boundaries of case studies have a tendency to be porous specifically in terms of temporality (Feagin et al. 1991; Gerring 2017). This was an important aspect in this case, as decisions over the last seventy years has impacted residents in the communities surrounding the landfill today.

Case studies have routinely been employed when studying issues of environmental toxicity, contamination, and/or uncertainty (Bullard 2000; Edelstein 1988; Tesh 2000) and is a method that the EPA utilizes in making sense of environmental problems (U.S. EPA 2020). Since no single methodological approach would be sufficient to address the above stated research problem, case studies draw on a variety of research methods. To understand past decision making, this project did content analysis on archival research and/or historical documents. This included reports and documents from the AEC, NRC, EPA, MDNR, Mallinckrodt Chemical Works, the Cotter Corporation, personal letters, documentaries, congressional hearings, newspaper articles, and social media posts.

To understand how current residents were making sense of risk, I did participant observations of the public West Lake Landfill Facebook group and other related social media, attended several in-person public townhall meetings hosted my Just Moms STL and/or the Missouri Coalition for the Environment, watched any meetings I missed on YouTube, attended in-person public meetings with the EPA, when to a letter writing event at a senators house, and attended a toxic tour given by performance artist Alana Ross for several local sites (Bauer and Kalz 2020). Additionally, I initially conducted several interviews with residents, but quickly realized this was not as fruitful as I had anticipated, which will be discussed below.

Content Analysis

For the first several decades after radioactive material made its way to St. Louis, it's connection with the Manhattan Project, meant that many of the early documents were classified under a top-secret security clearance. Over the years, many of these documents have become de-classified, but it is reasonable to assume that not all of them have been. The AEC, NRC, MDNR, and Mallinckrodt Chemical Works all have various reports and studies that they have conducted over the years. Since this project has ties to the Manhattan Project, many archival documents have been released and are publicly available. However, for the vast majority of historical books that have been written about the WWII, the Cold War, the Manhattan Project, and/or nuclear contamination, St. Louis is often not mentioned and/or if mentioned at all, is done so very little (Gosling 2010; Rhodes 1986; U.S. DOE 1996; Welsome 1999). But, the documents that do, tell important, albeit partial stories of how the waste has moved from site to site and was trucked through various neighborhoods in the area.

Many St. Louisans believe the West Lake Landfill is but the latest articulation of a greater problem of toxicity that has traveled around the area. A number of sources and historical documents have been scanned and shared due to the diligent work of local activists and investigative reporters. Denise Brock's parents both worked at Mallinckrodt Chemical Works when it partnered with the AEC to create and produce atomic weapons. She has worked tirelessly to collect documents from a variety of sources including interviewing and collecting boxes of information and old company documents from peoples' basements. Her hard work was even included in a Congressional hearing about early Mallinckrodt Workers (Subcommittee on Immigration, Border Security, and Claims 2006). Local activist, Kay Drey has been calling for the removal of radioactive waste in the St. Louis area since its discovery and has collected a massive collection of documents[5]. Both women have been very generous with their collections and have allowed many documents to be scanned. Any project that looks at toxicity and radioactive contamination in the St. Louis area, owes these women a great debt.

I gathered documents collected by residents in the "West Lake Landfill" Facebook group[6], "Humans of West Lake Landfill" community page on Facebook[7], Just Moms STL Facebook page[8] and the Just Moms STL website[9], along with "The Coldwater Creek- Just the Facts" Facebook Group[10] and website[11]. The NRC, MDNR, EPA and the responsible parties of the landfills also have webpages with collections of documents. Additionally, I pulled and reviewed newspaper articles on Lexis-Nexis. I searched "Bridgeton Landfill" and "West Lake Landfill." The vast majority of articles appear after 2007 and most are from local regional media sources. Many of these articles had been shared already within the Facebook Group, and/or on the above websites and places, but I cross-refenced these to collect any that I had missed.

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[5] Many of her papers have been donated to the Missouri State Historical Society. During data collection, the local branch at Mizzou was under construction. However, many documents have been scanned and were available in .pdf format and readily available online.
[6] "West Lake Landfill" Facebook Group, accessed December 2017, https://www.facebook.com/groups/508327822519437/
[7] "Humans of West Lake Landfill" community page on Facebook, accessed December 2017, https://www.facebook.com/HumansOfWestLakeLandfill
[8] "Just Moms STL" Nonprofit Facebook page, accessed December 2017, https://www.facebook.com/westlakelandfill
[9] The Just Moms STL website accessed December 2017, http://www.stlradwastelegacy.com/
[10] "The Coldwater Creek- Just the Facts" Facebook Group accessed December 2017, https://www.facebook.com/groups/217215444963933
[11] "The Coldwater Creek- Just the Facts" website accessed December 2017, http://www.coldwatercreekfacts.com/

Unlike Facebook, where two-way conversations are possible, the Environmental Protection Agency (EPA) and Missouri Department of Natural Resources (MDNR) tend to communicate through their websites and press releases. A few years ago, the EPA began sending out a newsletter about the West Lake landfill, which is posted on their website and/or available via email subscription, which I joined.

Additionally, in 2013 a "Community Advisory Group" (CAG) was formed (U.S. EPA 2018a). CAGs work in conjunction with the EPA and meet when there is community interest about a Superfund site (U.S. EPA 2018a). According to the EPA, "a CAG can assist EPA in making better decisions on how to clean up a site. It offers EPA a unique opportunity to hear-and seriously consider-community preferences for site cleanup and remediation" (EPA 2018a:1). The local CAG in this case also has an in-depth website, posts meeting video and minutes, and other documents relating to the site. This was an important point of contact between citizens and regulatory officials, but that does not mean the meetings were without conflict. These meetings can become quite contentious at times and it was often discussed within the townhall meetings and the Facebook group.

As documents were widely spread out in a number of locations and from a number of sources, attempts were made to get documents in a single location. In 2016, a free, non-commercial public online library and database emerged called "Environmental Archives," had many of the governmental documents that pertain to St. Louis's radioactive legacy and were made available to freely download on the site. I was able to download all of these reports, which totaled approximately 210 documents. The earliest report was from 1943 and the latest was from August of 2016.[12] As various researchers and reporters have conducted Freedom of Information act (FOIA) requests over the years, this site has produced a searchable database of documents. Many of these documents also appeared and were uploaded to the "West Lake Landfill" Facebook group, as members have conducted their own research over the years. I relied on a number of sources to cross-check to make sure I included as many historical documents as I could, but the site has amassed hundreds, if not thousands of documents.

Computer mediated communications (CMC), such as Facebook, are changing the way people interact with one another (Chambers 2013; Chayko 2017). The Facebook group itself has turned into a space for residents to unite amidst their own uncertainties and is a place where residents can challenge, contest, and create knowledge. What once was considered a place (cyberspace) or an activity (surfing the web), with expanded technologies, social media and the internet has allowed users to discuss topics and upload live videos in real time (Chayko 2017). As the sites themselves have generated a wealth of information, there are videos of meetings, each regulatory agency has a website about the landfill, there are four documentary films, and a large number of newspaper articles. Other risk researchers have found that people employ a variety of sources in determining their perception of risk and are influenced by their social networks and by the media (Douglas and Wildavsky 2010;

[12] Sometime in 2019, the archive was taken offline and it is unclear when and/or if it will again reappear. The documents vary considerably in terms of what they are. In most cases a single file contained a solitary report, but in quite a few, there were multiple files merged into one. Regardless, it was immensely helpful as I did not readily have access to some of the Historical Societies Archives in time for the writing of this project. I reached out, after noticing it was missing and offered my assistance to help manage the documents, site, etc., but was never able to get a reply.

Short 1984). Therefore, I paid considerable attention to the Facebook Groups and other social media pages.

To make sense of the Facebook group, I did a "data scrape" in November 2017 and again in 2018. This captures all of the threads and posts in the group since its inception. This was conducted as a way to provide ease of coding, and not as a stand-alone document, detached from the interactions of participants (Hine 2015). Unlike Twitter, metadata was not accessible, so the information collected is only what can be seen in the group, so geolocations and/or user information was not accessible. This is why getting demographic data for the over 21,000 group users was, sadly, not possible at this time.

Since users can go back in the timeline and comment on past posts, anything after the scrape would not be available. I have kept up with the page since then, but do not have copies of the more recent posts. With Dawn and Karen's blessing and relief,[13] the end result was thousands of pages of threads and posts. It became clear very quickly that it was unreasonable to adequately account for the entire Facebook Group. Therefore, I coded each post and sub-posts for the inception of the group in 2012 to end of 2015. The remaining posts will be analyzed for subsequent publications.

Just Moms STL also have a YouTube channel that records and posts all of the town hall meetings both hosted by themselves and ones hosted by the EPA. In following the date

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[13] I interviewed the administrators of the Facebook Group and was given permission to use the group and all its posts as data. The group is a public group on Facebook that is viewable to anyone. The administrators of the group stated that residents are aware that there are many researchers, reporters, and they suspected even members of regulatory agencies monitoring the posts. As the "West Lake Landfill" Facebook Groups administers, they stated that they were perpetually worried that something may happen to the group and were happy that even if something happened that a record would still be available, through my data scrape. Since the groups purpose was to get the word out about this issue, they and many group members highly encouraged me to continue my work and were very helpful in helping me track down documents and recordings.

restrictions above, while I attended many meetings over the years, this project focuses on meetings before 2015. I was given permission to use and download these videos as well. Additionally, Just Moms STL have a website and a Twitter feed, which was adopted in March 2014. In some cases, handouts and other artifacts like T-shirts and art prints with the landfill and/or St. Louis toxicity as the subject matter have been made available through fundraisers for the group. When possible, I have purchased these items. Figure 8 shows a sample of some of the materials that I have acquired from residents, and Figure 9 shows materials I received at or before meetings from the EPA and other unknown sources.

Figure 8. Landfill Artifacts- Made by Residents.
Data Source Author, 2014-2018

Figure 9. Landfill Artifacts- Given by the EPA (left) and unknown (right).
Data Source Author, date unknown

To date, there have been four documentaries about the landfill. The first, "The Safe Side of the Fence," was released in 2015 and premiered in the "St. Louis International Film Festival," which is where I first saw the documentary. It won at the fest that year in the categories of "Best Documentary" and "Best Director," and subsequently was shown at the "Rivers Edge International Film Fest" (2015) and "Berlin International Uranium Film Fest" (2018) (West 2015). I was able to attend its premier in St. Louis and many residents and activists were in attendance. While not explicitly about the landfills, the film is about the workers who were employed during WWII at nuclear facilities, including Mallinckrodt Chemical Works and its subsequent divisions and their families who have lived under this legacy (West 2015). Many of the workers experienced untimely deaths according to their families as the result of working within these industries. The dirt some of waste sat on would eventually illegally end up in the landfill. The filmmakers also interviewed the families of the men who were unknowingly hauling the waste and who have also experienced untimely deaths (West 2015).

The second film, "The First Secret City," also premiered at the "St. Louis International Film Fest" in 2015. It took home the "John Michael's Award" from Southern Illinois University Edwardsville's (SIUE) "Big Muddy Film Festival" in 2016 due to its ability to "advance awareness of critical social justice and environmental issues" (Carrick and Stelzer 2017:1). This film follows exposed workers through various sites on the Illinois and Missouri sides of the river, tracks and follows the waste, and highlights some of the ways this legacy has impacted people up to present day (Carrick and Stelzer 2017).

The third film, "Atomic Homefront," debuted on HBO in 2018 to much fanfare and focuses on the communities surrounding Coldwater Creek[14] and the West Lake Landfill (Cammisa 2018). The film itself came out just as the EPA opened up the public listening period for remediation at the site and drew thousands to the Facebook group somewhat overnight. For many people in the greater St. Louis area, this was their introduction to the situation, and since its release, it was the film most often suggested that curious visitors to the page watch first. The final film was called "Target St. Louis," and came out in 2018. It details a secret, Cold War era, radiation project that spayed an African American community in St. Louis (Slater 2018). As I have attended meetings over the years, it was not uncommon to see these film crews filming meetings, so it makes sense that their final product would also be included within this project.

[14] This local creek is spelled both as Coldwater Creek and Cold Water Creek. I tend to use Coldwater Creek throughout, except in places where it is directly quoted from another source.

Each of the above sources was analyzed through content analysis. While relationships between experts and lay people can be full of friction, this project sought to go beyond exclusively privileging expert opinion and does not make the assumption that experts and lay people are necessarily always at odds. Therefore, I was mindful of what feminist's call "privileged epistemologies," such as "those that do not require a defense" (Ackerly and True 2010:25). I made clear to residents and officials that I was not taking sides, but rather wanted to understand the issue and how residents made sense of living in uncertainty. While I use many historical documents from regulatory agencies, officials were not directly interviewed. I sometimes shared passing comments and chats with various officials, but these were fairly few and far between.

Participant Observation

Having been a Facebook user since 2007, I stumbled upon the West Lake Landfill Facebook group in the same way other users did, by either searching for information on it, or being added by someone already in my social network. In November of 2012, local resident Karen Nichols created a group page on Facebook titled simply, "West Lake Landfill" for the purposes of keeping information in one location. By this time, knowledge of the illegally dumped radioactive waste was well known by regulatory agencies, state officials, and anti-nuclear activists, but not widely known by the residents of the communities surrounding the landfill. Another Facebook page had been created approximately a year earlier that focused on what a group of McCluer North High School alumnx believed to be a cancer cluster caused by the radioactive contamination of a local creek. Having once lived near the creek and now near the landfill, Karen created a separate place for people to come for information.

The first post in the West Lake Landfill group states, "this group has been formed by concerned residents to inform and keep the public updated about the radioactive waste in the West Lake Landfill in Bridgeton, Mo."[15] By the time the page was created, the landfills had already amassed a great deal of data and according to official reports the "smoldering event" had already been detected, but many residents were unsure what has happening (Republic Services 2014a). As the landfill began omitting a strong odor, some concerned residents dialed 911 to report the issue, likely unsure of what else to do.

In any case, having heard stories over the years about the creek and the landfill from family, friends, and acquaintances, most of which seemed outlandish and nothing short of science fiction, I became a member of the Facebook group sometime in July of 2014. As my graduate studies progressed, and I officially chose to pursue the uncertainty of the landfill as a line of inquiry, the Facebook group began to take on an even greater role. While my motivation in joining the Facebook group originally was more curiosity than research, it was never my intention to use the Facebook group as a major site for my project, but qualitative researchers tend to go where the people are, and do what people do, and Facebook occupies an important place in the cultural milieu (Hine 2015). The Facebook group turned into *the* place that people turned too and connected with one another. It, therefore, went without saying that as more and more users logged on to Facebook and joined the publicly accessible

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[15] Administrator of West Lake Landfill's group page, accessed December 2017, https://www.facebook.com/groups/508327822519437/

group, that in addition to other types of data collection, the page occupied an important place within this project.

As our lives have continued to become tangled with technology, divisions between our everyday lives and our interactions online have turned porous and it has manifested into a version of Baudrillard's hyperreality (Baudrillard 1994). It is no wonder than that, "online activity can make more visible and amplify concerns, problems, and divisions that are part of social life in physical space, and it can raise concern about new issues, too" (Chayko 2017:2). My participation in the Facebook group has ranged from liking statuses; engaging with attachments, such as files, pictures, videos, following posted links; watching YouTube videos; watching Facebook Live videos; and occasionally commenting. The group has grown considerably over the years and, rather than being an intimate dialog between members the group, it has an ongoing chat as a whole. Since the group is and was so large, my posts, which were few and far between, likely was drowned out, with the ongoing pace of the group.

The Facebook group draws a large number of people. As of today (September 2018), the group has over 21,000 members and ranges from the people who currently live in the area, to people who used to live in the area, to supporters from other Superfund sites, to the simply curious. Group topics range from the real-time current conditions at the landfill, to personal narratives, live videos, and shared news articles. The group often is a great window into what residents are thinking in real time, as the groups discussions are ongoing and commented on rather constantly. The page also has an archival quality, as people in the group have taken it upon themselves to research and find archival data about the site and other toxic uncertain sites in the area. The page is managed by two of the four moms of

"Just Moms STL," a moniker they adopted not long after they created the group. They adopted this name because they see themselves as primarily mothers and reluctant activists. In an interview, one of the moms conveyed this when she said that they are often referred to as "landfill moms" or "the landfill moms." In our interview, she stated, the irony now is that no one ever asks her about her kids when they see her out and about, only the landfill. Throughout this dissertation then, I refer to these women as "mother-activists" as a way to acknowledge their role at the site.

While the page is public, allowing anyone to see anything that is posted, I formally asked permission to be in the group and to collect data from the group, as well as the Just Moms STL website, the separate Just Moms STL Facebook page, their YouTube Channel, and their twitter feed. A public Facebook group blurs the boundary between what is public and what is private and brings about ethical considerations (James and Busher 2012). As the administrators and creators of the Facebook group, I specifically asked how best to navigate this situation. In an interview with the group's administrators, Karen Nichols and Dawn Chapman, were adamant that the purpose of the group was for information and awareness, which includes everything posted. Unlike other groups, whose members may join to share about an illness or activity that they wish to keep apart from other aspects of their lives, this group and the people whose lives have been impacted have historically been ignored and aim to create greater awareness through the group. The group is public for this reason, and they both acknowledge and (wanted!) what goes on in the group to be seen by outsiders, regulatory officials, the various parties involved.

Nonetheless, I was mindful of what information I used throughout the chapters from Facebook. For example, when general comments about the landfills are spoken, such as the smell “its gross,” “it smells like rotten eggs,” I did not attribute them to particular individuals. I know that the use of pseudonyms within studies are common, but I did not think it added to the study and listing them without names was more in line with how the information was shared. As the comments are public, I still was mindful of omitting personal information such as the location of a person’s work, where they lived, their medical diagnoses, etc., even though they shared this information. When I told Karen and Dawn that I would be proceeding in this way, they stated that it was “not necessary” but understood and stated anything they personally have said, posted, etc. was available for my use and could be attributed to them. They additionally encouraged me to contact people in the group directly and stated that many of the main contributors to the group are quite familiar with being interviewed. This was indeed true, as I reached out directly to a number of different people within the group.

While the internet has no doubt become an important part of culture, inequalities still persist and there are still barriers to access (Hine 2015). Regardless, it was a great, linear, and unfiltered way to watch how conversations about the landfill and its influence in the lives of residents unfolded. The Facebook group linked people with connections to the area, both past and present, but for people who are currently living in the area and who engaged with the landfill on more of a personal level, there were also town hall meetings that could be attended.

Beginning in August of 2013, town hall meetings have been hosted on nearly a monthly basis, and, in some cases, more than once a month. These meetings draw a varying number of residents, sometimes groups around twenty or thirty and at other times hundreds. The meetings often last a few hours and contain stories from residents, guest speakers, and information sharing. Each of these meetings are recorded and uploaded on the Just Moms STL's YouTube channel and website. To date, there are roughly 64 videos and are each roughly two hours in length. The meeting tends to have an agenda made by the moms and PowerPoint is frequently used. In many ways, these meetings are invaluable as they not only address current issues within the community, but they also discuss strategy.

When available, I have attended these meetings, often came early to small talk with people before the meeting started, and I took ethnographic field notes during the meetings (Emerson, Fretz, and Shaw 2011). In many cases, I have come face-to-face with people I have seen online and in newsprint. The meetings where I was not in attendance are still part of my analysis because I was able to watch the meetings on YouTube. While YouTube had a comment feature, most of the videos are not widely viewed, with the exception of a few, and do not include comments. I also attended a letter writing party hosted at a senator's house, where residents wrote letters to the EPA that detailed residents preferred mode of remediation activities.

Finally, in early April 2018, with the help of a colleague who I convinced to tag along, we attended a "Toxic Tour" (Bauer and Kalz 2020). I saw it advertised in the Facebook group in March and reached out to the "tour guide" about attending the tour, taking pictures, and taking field notes. She gave permission, and this was added to my IRB proposal and deemed exempt. The tour was a piece of performance art and included a tour of seven sites around the greater St. Louis area that had been impacted by environmental toxicity. Mixing both past and present sites, the tour was an opportunity to see some of the sites firsthand and offered a glimpse as to how the former sites were re-imagined and repurposed, post-remediation. Since the tour involved a great deal of driving, the guide prepared a "toxic play list" for us to listen to in the car and between sites.

The tour itself, in many ways, brought these landscapes into focus in a way that I hadn't experienced before. Experiencing it with a small group of about sixteen was also interesting, as everyone on the tour knew, to varying degrees, about the toxicity in the area, and while some even lived or worked fairly close to the sites/landfills, they had not physically been to the sites (Bauer and Kalz 2020). I could say the same, while I had been researching the sites and frequently was close enough to smell the landfills, I had never had the opportunity to experience them in person. Of note, I experienced the same level of surprise in being in the presence of the landfills. Fully expecting a smell, we all were shocked that there wasn't one present, but were overcome with how the landfill sounded. One of the other tour participants noted that the landfills were roughly in the middle of the tour and we had been a pretty chatty bunch up until that point. But as he pointed out that we all whispered near the landfill, and while we spoke normally at the remaining stops, we were much more somber with all the subsequent sites. This experience was invaluable and provided much more insight than I had initially expected. Many of the photos taken were from that tour appear throughout the dissertation. Weeks after the tour, I was able to interview the guide and discuss many of the "experiences" of being in the presence of these sites.

Interviews and Ethnographic Field Notes

I conducted a few interviews with the various stakeholders and citizens who live around the landfill. Through my time in the Facebook group and attending meetings, I identified a number of people who regularly posted, attended meetings, or both. Most were citizens who live amongst uncertainty, but others were also members of outside committees and organizations within the community. After IRB approval, I conducted approximately ten interviews with residents and activists. As outlined by IRB guidelines, participants were given an informed consent form and the interviews were audio recorded. The interviews were semi-structured, and an interview guide is available in the Appendix. The semi-structured interviews allowed me to have some flexibility to explore topics that interviewees found important and allowed them to have more control of the interview process. I was able to adjust questions and topics based on previous interviews and things I saw in meetings and online.

Early on, it became exceedingly apparent that interviewing was not yielding significantly different results than what was happening in the Facebook group and at meetings. Many of the people who were very active at the site were also very active online and in the meetings. The in-person meetings often summarized what was happening online and I found that in interviews, it was often a summary of both. For example, I interviewed someone who spoke at a meeting a few days before our interview and I quickly noticed that the information was largely information I already knew, because they had shared the same stories and points a few days earlier. This was interesting in itself, but also an indication that the stories of how the landfill was impacting people did not often change significantly day-to-day. Additionally, residents freely shared information with one another online and what I was getting in the interviews was in many cases a neat, condensed version of what I had seen them already post online.

I also found that coming early, staying late, and simply conversing with the people around me at the townhall meetings was invaluable and yielded much better results than full length interviews. Initially, I dressed more formally, in what many would consider professional attire, but I was asked multiple times by curious residents, "Who are you? Where do you work? What are you writing down?" None of these inquiries were accusatory, but it became clear early on that my attire, my recorder, and my notebook gave people pause. Most notably when a resident said, "Hey, hey, you. Do you work for them? Are you one of the landfill people?" It became clear that some thought I was working for the company and/or one for the regulatory agencies. When I explained I was a writing a dissertation and interested in what was going on, they, like the gentleman at the meeting, visibly became much more comfortable and chatted freely with me. In another meeting, I chatted with an older woman who lived nearby before the meeting and I noticed that she was trying to read my notes during the meeting. Aware that I am an outsider, I shifted so it was easier for her to read them, so she felt more comfortable. I need not to have worried because she then began to point out places where I did not get the wording exact and wanted to be help me.

The irony was that when I dressed more "professionally," I seemed to not only confuse residents but also the other people who *were* there from the media, regulatory agencies, city officials, etc. After a presentation by someone representing a local utility, I approached him after the meeting ended and he seemed to focus on me immediately and asked me if I had any questions. I felt put on the spot because I did, but there were several residents who were there first and actively trying to get his attention. I politely told him that I did, and that I wasn't a resident and did not have any pressing concerns. I was happy to wait and once the questions by residents were over, he turned to me, and also visibly let out a sigh of relief. My status as not at resident must have made him feel comfortable enough to not feel as "on stage" as he let out his sigh of relief (Goffman 1990). Like the above, my non-resident status was met with ease. I attributed the similar responses to simply just how contentious this situation was at times between the experts and the residents. People were very interested in "which side" I was on. I tried my best to convey that I was not on a side, even though I was aware that the way I dressed often led to judgements about my position. After several of these encounters, I simply thought it best to dress how I normally do. But I spent my time mingling with the residents much more than with the experts. I did so because they were most likely to be available and stayed around at the end of meetings. Residents asked me often where I lived. I told them and also explained that I have family in the area, who believe they have been impacted by the same issues. I felt by answering this, residents were much more open to talking to me.

Positionality of the Researcher

Many residents in the area have strong familial ties and have lived in or around the St. Louis area for generations, me included. I first became aware of the situation while reading a local news story about an increase in odors surrounding the landfill. Reading the article, which was as factual as sensationalized, I did the mental math between where I was holding the magazine and the location of the landfills. Although not exactly close to me, I lived within the same county, I found myself picturing the worst. I wondered and echoed some of the same concerns residents who live in the communities closer would often state when I would later speak to them, "Can it explode? If it does, am I far enough away?" While worrisome, my wonderings paled in comparison to the people who lived within a few miles' radius of the site. However, I did have family much closer and recognized the names of many places because, at one time, my immediate family lived much closer before settling across the river.

Regardless, family events and celebrations often brought us back to those same areas again and again. While I am not an insider to the events surrounding the landfill, I am not a complete outsider either. When people spoke of the landfill, it was easy for me to picture the places in my mind, and not hard to understand why people found the contaminated space(s) so upsetting. Calling my parents and interrupting their dinner, I read parts of the article aloud, in-between bites and on speaker phone. My mom stated something along the lines of "oh yes, we know about that. Your dad's siblings used to play in the creek as kids, it was a few blocks from their house." My dad interjected, "we used to play baseball at the Berkley ballfields, we brought you there when you were tiny. It is crazy to think they found radioactive waste there." As more stories came out in the news about St. Louis' nuclear legacy, so too did the stories of local people who I somewhat regularly came into contact with. Various family members were also very eager to tell me about their experiences as well.

Many researchers often chose topics of study that are close to home, so to speak, and this case is no exception. As such, feminist methodologies remind researchers to be self-reflexive and to acknowledge their role within their research (Ackerly and True 2010). As a child, I was fascinated by the stories I heard from various family members and being blessed with having all four grandparents until my thirties, I often found them a wealth of information.

Marilyn and Bill Lesner were close friends of my maternal grandparents and often present at important holidays. I was initially fascinated and in awe that the grandmotherly woman, with the biting wit, was at one time a town mayor, a role I hadn't heard many women take on before. Later, I learned that Marilyn was the mayor of Times Beach during the dioxin spill and the subsequent evacuation of the town. While she no longer speaks publicly on the issue, and at times is somewhat guarded about that time in her life with outsiders, in between family meals and gift exchanges, she often graciously entertained all the questions I had about the topic, ad nauseum. My mom remembers fondly the times she spent at Times Beach, spending the night there and playing in the resort town. Additionally, the paternal side of my family is quite large, and it was not uncommon to see my relatives posting in the Facebook Group. I saw relatives and friends commenting and sharing stories about their experiences and health. At family events, hospital visits, and the untimely/sudden funerals of relatives, the topic of conversation always seemed to lead back to the landfills, the creek, or both. I often got calls when people remembered things about the landfill and/or the creek. Many relatives believe that the creek was a factor in the death of loved ones and these perspectives gave me a unique position as a researcher. While I do not think it biased my position as a researcher, as my family is not particularly close, it and my background in working in mental health, did make me much more careful and sensitive when talking to residents. Many residents felt as though they were not taken seriously and/or were believed, so I was careful to be sensitive to those issues. I think it also helped make me more relatable to residents, as members of my extended family are believed to have been impacted by the creek and/or landfill.

Data Analysis

I used the software program MAXQDA 2018/2020 to help analyze my data. This program was a helpful way to gather all of my data in one place. To make it easier, I sorted the documents and sources by year. I reviewed all of the historical documents to help set a timeline. Some of the documents themselves included a timeline, which was helpful, but none of these were sufficient. I used MAXQDA to take notes on the YouTube videos and on the interviews. MAXQDA allows researchers to time stamp and add code(s) to direct portions from the sources. I added all the notes I took during interviews, newspaper articles, and the town hall meetings and added them to the program. Finally, since I was able to put the Facebook Posts into pdf's, I was able to insert them in the program as well. Once all the documents, interviews, notes and videos were in the in the program. I used memo-ing as a way of developing themes and I searched for relevant themes found in previous research (Emerson et al. 2011). I grouped like topics and then further broke down what people were saying into meaningful categories (Corbin and Strauss 2015). I used both open codes and memo writing to make sense of the data (Corbin and Strauss 2015; Emerson et al. 2011). Through this process I found many themes and subthemes. The data was vast and for this dissertation I focused on a few particular themes.

Chapters 3 and 4 draws heavily on the archival research I found. The history of the site was of great importance to members in the Facebook Group and thus, it a large portion of the project. In many ways, residents wanted to understand the decisions that were made that have impacted them. Chapter 5 draws heavily on smell, health, and knowledge construction. Posts discussing the smell and how it correlated with health and safety were by far, the most prevalent posts in the Facebook Group, as were strategies on how to prevent and/or manage health and safety. As mentioned above, the data that was analyzed from the early 1940s up until the end of 2015. The Facebook group is still very active, as of this writing and is a wealth of information about how residents are feeling day to day, but because dissertations are time bound, that is where I drew the line. Cutting off a data for an ongoing problem though made it hard at times and can be evidenced throughout the dissertation in mixing past and present tenses. Many of the issues are still happening such as reports about the smell, health and illnesses, etc. remain ongoing. It is my hope that in the future I will be able to code, analyze, and interpret more of the data.

Chapter 3: How Radioactive Material Came to St. Louis: Creating a Legacy of Harm

Atomic Homefront (2018), an HBO documentary, puts it starkly: “For many residents of North St. Louis County, World War II has not ended.” The documentary refers to the Cold War era radioactive waste left over from the Manhattan Project that still exists in the West Lake landfill in St. Louis county. Many residents who live in the communities surrounding the West Lake Landfill Superfund site have expressed shock, dismay, and bewilderment upon discovering that a local landfill complex contains both, illegally dumped Cold War era radioactive waste and a “subsurface smoldering event” or underground fire (LaCapra 2014:6). Their shock is in part due to its very existence, as St. Louis has largely not been thought about as a nuclear space, and in response to what many believe to be the apathy of regulatory agencies in taking appropriate and preventative actions. Residents, who believe that they have already begun experiencing negative health effects, have grown worried about their health and safety should the smoldering event and the radioactive waste meet (Alvarez 2016; LaCapra 2015; Jeffery Tomich 2013). This chapter discusses how radioactive material made its way to the St. Louis area, how the radioactive material was thought about as it traveled around the area and how it has, and continues to impact places, people, and communities.

While not widely discussed, St. Louis’s connection to the nuclear industry during WWII and the long-time presence of radioactive waste has been intimately known by several communities that have been impacted over the years. Due to plant expansions and storage needs, radioactive material and later waste has traveled to multiple sites in the area and has impacted many communities along the way. The stories of workers, haulers, and residents have entered the public sphere from time to time through popular epidemiology, exposés in the media[16], and environmental activism (Bowers, Rose, and Tighe 1989b; Coldwater Creek Facts 2020; Hartmann 2013; Just Moms STL 2020a; LaCapra 2014; Jeffrey Tomich 2013b).

Today, many residents in the communities surrounding the West Lake landfill believe the landfill is but, the latest articulation of the radioactive waste issue in St. Louis and as such, their health and safety are being put at risk. Many residents state that they unknowingly purchased homes and now live and work near a Superfund site that also contains an underground fire (Cammisa 2018). Regulators and the potentially responsible parties (PRP) contend that all of the material is contained and that no one is experiencing negative health effects (Berfield 2017; Brooks 2014; Phillips and Marsh 2014). Residents point out that this has been a common refrain, echoed at some of the other sites where this same and/or similar waste was housed, only to find out years later, that the land had been contaminated and impacted human health (Hartmann 2013; Schuessler 2015a). Residents largely believe that regulators in the area are quicker to acknowledge the contamination of properties than concerns about the people and bodies who utilized those same spaces because of the tools and regulations in place that require employers to monitor employees are not used on communities and the general public. Therefore, these communities are left to suffer and shoulder all of the burden of this legacy without protections and/or any monitoring of how it is impacting their health.

As Anna Tsing (2015) has so eloquently pointed out in her work, we often don't pay enough attention to the stories within places, which is an important oversight in

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[16] See the *St. Louis Post-Dispatch* series: Legacy of the Bomb: St. Louis Nuclear Waste

environmental histories. She states, "We need to know the histories humans have made in these spaces *and* the histories of nonhuman participants" (Tsing 2015:160). This is indeed true in this case, as residents state that humans and nonhumans have occupied and utilized various areas in ways not mentioned, monitored, and/or realized in the official historical record, which was then further obscured through top-secret security clearances that prevented public input.

Drawing on Gabrielle Hecht's concept of nuclearity, which explains the often continuous nature in which "places, objects, or hazards get designated as 'nuclear'" (Hecht 2012:4), this chapter takes a step back to discuss how radioactive material came to St. Louis and how war time relationships between Mallinckrodt's Chemical Works, the Manhattan Engineering District (MED) and the Atomic Energy Commission (AEC), rendered some materials, places, and bodies nuclear in some regards, but not in others. Whether or not these spaces and the people who occupied them are considered nuclear, has impacted ideas about the sites, people, and illnesses in present day. This in turn, has rendered some sites and bodies visible, which has created opportunities for health monitoring, remediation, and legacy benefits, while still rendering others invisible.

Decades ago, military officials at the Manhattan Engineering District (MED), which oversaw early nuclear decisions, successfully argued that tensions with Germany and a world at war created justifiable economic, political, and national reasons to risk exposure(s), which were not only unavoidable but necessary. In St. Louis, this has coalesced not only in the bodies of early workers, but in the machines, materials used, and the in physical environments where they all interacted. Early reports and declassified documents indicated that the MED, and later the AEC, had fully anticipated that they would be held accountable for their actions one day (U.S. DOE 1996). But because ideas about nuclearity varied, and continue to do so, data has not always been readily available to back up claims when people believe they have been impacted.

Eighty years after these war time partnerships, people who live in the communities that surround the West Lake Landfill Superfund site continue to live under the ramifications of war time decision making, which created varying risk(s) and harm(s), which derived from a clash between early atomic scientists and military officials and their ideas about work/home spaces, public/private, and ideas about the environment. It is now widely known, that radioactive material can impact bodies in many ways and cause great damage, but the impact(s) are often imperceptible in real-time unless the exposures are great, but any exposure can still result in disease and damage, as radiogenic diseases often take years to emerge (Cram 2016; Hacker 1987; Zwicker 2005). If technologies are often used to render things visible (Murphy 2006), and these technologies are not readily available for citizens, how do they know they have been impacted, are experiencing negative health outcomes related to exposure and/or that they are safe? What can residents do the decrease their risk(s) and prevent harm(s)?

Residents near the landfill have found themselves in a situation where they believe they have already been impacted by negative health outcomes related to the site and that current remediation efforts have not been quick enough to render their health and environment safe. They are fearful that if the waste is not contained and moved, any impacts to health and safety will just continue to get worse (Berfield 2017; LaCapra 2015; Jeffery Tomich 2013). Residents argued that they are being held accountable to war time decision making, which continues to put their families at risk.

In St. Louis regulators are currently willing to admit that environmental contamination occurred because of war time activities, and that there are now over 100 contaminated sites in the area (U.S. Army Corp of Engineers n.d.). However, the Environmental Protection Agency (EPA) and Army Corp of Engineers (USACE) believe that since the radioactive material is low-level, no one in the area is currently experiencing any negative or immediate health impacts (Bouscaren 2015; Brooks 2014; Cammisa 2018). Residents do not want to have to wait for their bodies to show *more harm* before action is taken. Therefore, the purpose of this chapter is two-fold, the first focuses on how nuclearity emerged and/or failed to emerge in materials, spaces, and bodies in the area, and second, as nuclearity is not a stable category, discusses the implications for people and places as nuclear things are being made, remade, unmade.

This chapter relied on archival government documents and reports, as well as primary sources such as newspaper articles, interviews, and personal accounts. The historical record, preserved through various government documents that have since become declassified, presents a glimpse into how the materials were thought about by officials and what safety considerations they warranted. These documents play an important role in showing how decisions were made, as they reveal what uncertainties were planned for, how the material was thought about, and what the implications of those decisions are for people today. But, at best, these records are still incomplete, as many documents are still classified, and information is not always readily available nor easy to obtain.

Interviews and personal accounts shed light on what was, in many cases, left out of the official record and provided insight into how some of these properties, spaces, and bodies were actually utilized throughout the war era. For example, at various points guidelines were issued about how to handle material, track, use, and/or dispose of items, but workers themselves discussed how they actually navigated their jobs, which often included times when the guidelines were not followed and, as was often the case, how they operated when no guidelines existed. This is of key importance because when official records are absent, dose reconstruction(s) are used to estimate a person's exposure. In this case it has occurred decades after the fact and is used to help determine eligibility for benefits for workers, families, and properties. To that end, many of the early war time era workers, haulers, community members, and residents have since passed away, but some of their stories have been preserved through documentaries and preservation projects. These have been helpful in understanding the experiences of workers and how materials were thought about and used. The documentaries *Safe Side of the Fence (2015b)* and *First Secret City (2017)* discussed early war efforts and nuclear workers and includes workers from the St. Louis area. *Atomic Home Front (2018)* and *Target St. Louis (2018)* discussed how two specific communities in St. Louis were impacted due to war time activities. The U.S. Department of Energy (DOE) over the years has collected oral histories of various government officials and when appropriate these have been utilized, specifically in terms of decision making in St. Louis (U.S. DOE 1995b).

Nuclearity and Perceptibility

The St. Louis area makes for a compelling case to study Gabrielle Hecht's (2012) concept of nuclearity, in part, due to the environmental uncertainty and widespread disagreement about environmental health and safety (Barker and Bernhard 2014; Bouscaren 2015; Brooks 2014). Nuclear is not a technical category, it not only varies across time, place, and by degree, but it also is not easily transferred from one domain to another (Hecht 2007). Whether or not something counts as, or is thought about as nuclear, lies in part due to our inability to come to grips with something that must be managed for eternity (Hecht 2007). Therefore, nuclear things all too often fall prey to nuclear exceptionalism, in that, it is both treated as special and important, often necessitating various protections and security clearances in some spaces, while also being treated as banal and much like everyday things in others (Hecht 2012). In this way, we are both reminded that some nuclear things can be the "destroyer of worlds" (as quoted in Giovannitti and Freed 1965:197), but that it is also embedded in our everyday and naturally occurring, in the background of our lives (Frame 2009). Nevertheless, it troubles ideas about health and safety if you have lived, currently are living, and/or plan to live within these spaces that Shannon Cram (2015:90) calls "living breathing archives of atomic history."

Nuclearity "emerges from political and cultural phenomenon of technical and scientific things, from the social relations where knowledge is produced" and is not, nor has it ever been defined by, technical parameters; instead nuclear is a "highly contingent technopolitical product of historical circumstances" (Hecht 2009:898, 2012:15). Here it is important to bear in mind that, "*radiation* is a physical phenomenon that exists independently of how it is detected or politicized [emphasis the authors]" (Hecht 2012:15). Not all places that radiation is detected is thought about as "dangerous" and/or "nuclear." This is why African mines have often been the "othered" sites within the larger nuclear industrial process, and miners have often had to fight for the mines themselves to be considered nuclear workplaces, but this has been far from even. Whether or not a workplace has been thought about as nuclear has not been universal and instead, "has depended on time, place, purpose, and markets" and so too, has the consequences of these decisions (Hecht 2010:2).

Places seen as nuclear often have technologies in place that render them visible; are subjected to safety standards; are monitored, inspected, and regulated through regulatory bodies; and workers are able to challenge and make claims about their health and safety (Cram 2016). As all of this takes place largely invisible to workers, it has to be made both perceptible and imperceptible through social and technical assemblages (Hecht 2009; Murphy 2006). Michelle Murphy (2006:10) refers to this as a "regime of perceptibility," which is the "way a discipline or epistemological tradition perceives and does not perceive its world." But just because something evades perception does not mean that it is not present. Radioactivity cannot be detected through human senses; elements impact body parts differently, and radiogenic injury is not easily detected, often taking decades or generations to present (Cram 2016:524). In short, "domains of imperceptibility" are needed to even detect and make exposures "measurable, quantifiable, assessable, and knowable in some ways and not in others" (Murphy 2006:9). Even the various technologies that were created to help render radiation exposure levels visible, such as film badges, were far from perfect and produced only crude estimates (Pardue, Goldstein, and Wollan 1944).

This also speaks to the difficulties in estimating dose calculations after the fact, because in order to make reliable calculations, some data must have been collected in order to make estimates (Cram 2016). Since many of these spaces, places, and bodies were not thought about as nuclear and/or changed over time, very little data was collected, which has political, social, and economic consequences. Historically, the nuclear weapons and atomic technologies have relied upon certain othered bodies and geographies for testing purposes and/or as “sacrifice zones” (Schneider 1988:2).

Outside of the U.S., this has meant using colonial geographies, often places deemed remote, for weapons testing (Masco 2006; Solnit 2014). Both within and outside the U.S., marginalized communities of color have been most often the subjects of environmental contamination and uncertainty (Bullard 2000; Chavis and Lee 1987; Checker 2005; Krauss 1993; Martino-Taylor 2018; Masco 2006; Solnit 2014; Stein 2004). Discourses of wastelands, empty non-places, and backwardness are all often ways in which landscapes are socially, economically, and politically transformed into nuclear landscapes (Kuletz 1998; Masco 2006; Pitkanen and Farish 2017; Schneider 1988; Solnit 2014). In fact, race and hazardous waste are so intertwined that Mohai et al (2009:409) found that “the percentages of people of color in the zip code proved to be the best predictor of where commercial hazardous waste facilities were located.” But, many of the communities that have been impacted in St. Louis, do not follow this trend[17]. Instead, the situation at the West Lake Landfill has garnered more attention in some respects, as it does not fit the usual mold.

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[17] The notable exception is detailed in Lisa Martino-Taylor’s (2018) book *Behind the Fog: How the U.S. Cold War Radiological Weapons Program Exposed Innocent Americans*, where a predominately African American community in St. Louis was exposed to an intentional release of radiological material. While her book and a subsequent documentary called, *Target: St. Louis*, has come out to shed light on this issue, this case differs from the other cases of contamination in the area, as it was intentional rather than accidental. Unfortunately, that has further marginalized this community and its survivors.

The Metallurgical Laboratory (Met Lab) & its Connection to St. Louis

"The story of the supply of uranium is by itself a thrilling one, and the production of enough pure metallic uranium to do our task in time was a technological and industrial miracle." – Arthur Holly Compton (Compton 1956:90)

St. Louis's connection to nuclear things began in 1942, and yet, the St. Louis area is largely not thought about a particularly nuclear place, even among people who live here and know the history. Located in the center of the country, firmly in America's heartland, St. Louis's contribution and its subsequent contamination, has at times been rendered invisible. This was, in part, largely by design. Even by today's standards, the Manhattan Project was a massive undertaking, and the development and production of nuclear weapons created new relationships between science, industry, and the State (Jasanoff 2005).

The three cities that are now widely associated with the development of nuclear technologies, Oakridge, Tennessee; Harford/Richland, Washington; and Los Alamos, New Mexico, were created for that very purpose (Hurley 2018). Built with rapid speed in 1942, these cities were kept top-secret and since the project was seen as a high-risk endeavor, the areas in which the cities were to be built were chosen in part for their natural and topographical features (Clarfield and Wiecek 1984; Hurley 2018). "In all three cases, they were somewhat remote—in the case of Hanford and Los Alamos, very remote—which offered a more secure environment, of course. But also, in the event of a disaster, an explosion or a radiation leak, that would also minimize the potential exposure of people outside the project to any sort of radiation danger" (Hurley 2018:3). St. Louis was an already thriving city before a downtown company was asked to help with the war project, and rather than build from scratch, they modified what they already had.

In the spring of 1942, with greater funding and more urgency, a group of scientists at the University of Chicago established The Metallurgical Laboratory (Met Lab) and began working towards producing the first self-sustaining chain reaction of an atomic reactor (Gosling 2010; Jones 1985; Rhodes 1986). Many scientists and experts at the time believed that Germany, due to recent discoveries by German scientists, were developing nuclear technologies and was likely ahead in the process (Gosling 2010; Rhodes 1986).

As there was so much that needed to be done, the lab was divided into four divisions: Chemistry, Engineering, Physics, and Health (Hacker 1987). One promising avenue for the project involved uranium. Scientists quickly realized they needed large amounts of purified uranium, approximately 40 tons, for an experiment "that would prove self-sustaining nuclear reactions possible." Unfortunately, at the time, "no more than half a cup of uranium pure enough to sustain fission existed in the country" (Bowers, Rose, and Tighe 1989a:3).

Dr. Arthur Compton, a physicist on the project with ties to Washington University in St. Louis, Missouri, along with other scientists, believed a method of purification that involved Ether would be the best way to produce uranium of a pure enough quality to complete the project (Jones 1985; Rhodes 1986). However, Ether was known for its explosiveness and the process proved very dangerous even in laboratory settings (Jones 1985; Rhodes 1986). Dr. Compton began looking for companies willing to undertake this part of the task, and three separate companies turned the commission down due to other war time commitments and the dangerous nature of the work (Bowers et al. 1989a; Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). He then approached an old colleague, Edward Mallinckrodt Jr., the owner of Mallinckrodt Chemical Works in downtown St. Louis, Missouri (Fleishman-Hillard, Inc. 1967; Jones 1985).

During a lunch meeting in April 1942, Edward Mallinckrodt Jr. was told, in no uncertain terms, that the Germans were years ahead of the Allied forces on working on a device capable of an extremely powerful explosion and the best chance of winning the war, was to create it first (Fleishman-Hillard, Inc. 1967; Jones 1985). While these statements would not stand the test of time, as Germany at the end of the war was no closer to an atomic weapon than at the beginning, presenting their case as a matter of national security likely appealed to his sense of patriotism and duty (Fleishman-Hillard, Inc. 1967; Gosling 2010). His company had a reputation of safety, prior experience working with Ether, and producing "high-quality and high-purity products" (Fleishman-Hillard, Inc. 1967:5). By the end of lunch, Mallinckrodt agreed to work with researchers in Chicago by helping with uranium production at his St. Louis plant (Fleishman-Hillard, Inc. 1967). They shook hands and agreed on the terms of the project, which would not be finalized until after much of the product had already been produced and shipped (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). A report made in conjunction with the company would later state that, within this oral agreement, provisions were made regarding consulting with the Washington University School of Medicine on matters of health hazards (Fleishman-Hillard, Inc. 1967). Still under research and development, the company's role and its product were to be kept "top-secret," even amongst the employees of the company who would be working with the material(s) (Fleishman-Hillard, Inc. 1967). As is often the case with war, the needs of the nation took precedence over individuals/civilians working with dangerous materials.

Edward Mallinckrodt Jr., not bothering to wait for a contract, went to work almost immediately. Within a week of his meeting with Dr. Compton, Mallinckrodt Chemical Works began translating the laboratory process into a large commercial scale. To maintain secrecy, the project was given a code name "to imply that the uranium compound was simply another of Mallinckrodt's line of standard luminescent chemicals," but the name was quickly changed to omit the word "uranium" due to government security regulations (Fleishman-Hillard, Inc. 1967:20). Anaïs & Walby (2016:951) found that "secrecy plays out not as a project aimed at ensuring the total invisibility of secret projects but as a feat of organizational management directed at the spaces between the visible and invisible." Therefore, the vast majority of the employees working on the project were unaware of exactly what they were working on.

Mallinckrodt's engineers and scientists worked quickly to construct a plant under wartime shortages, by using existing facilities, materials, and equipment they already had on hand (Fleishman-Hillard, Inc. 1967). Machinery and equipment went from rough paper sketches to working equipment within days (Fleishman-Hillard, Inc. 1967). As the original intention for the project was short-term and under emergency-basis, the machinery and plants were built in haste, and long-term safety considerations were not viewed at critical at the time (Fleishman-Hillard, Inc. 1967).

Documents later provided by the company stated that, under the assumed temporary nature of the project, no "formal" health program was specified for employees working with uranium and it was treated in the same manner as other hazardous materials (Fleishman-Hillard, Inc. 1967). While prior to the war, uranium was known as a poisonous heavy metal, "It was felt that the radioactivity level of uranium was low enough so that small scale, short-term operations would not present a radiation problem" (Fleishman-Hillard, Inc. 1967:144). This was to say that they were cautious, but not overly concerned, about human and environmental health. Workers have since reported that a great deal of the work was initially done manually. For example, one employee reported they completed their work by "hand-scooping powdery uranium ore" (Bowers, Rose, and Tighe 1989d:5).

According to Mallinckrodt, "the materials were handled mainly according to standard industry procedures for health and safety protection against the hazards of ordinary toxic chemicals" (Fleishman-Hillard, Inc. 1967:144). Uranium is the heaviest naturally occurring element on earth and largely consists of two isotopes, uranium-238 (^{238}U or U-238) and uranium-235 (^{235}U or U-235). Uranium-238 (^{238}U or U-238) represents 99.3% of all-natural uranium and contains less than 0.7% of uranium-235 (^{235}U or U-235), which is often referred to as "enriched uranium"" (Gosling 2010). However, the uranium ore that Mallinckrodt processed was Belgian Congo pitchblende[18] and was unlike typical uranium ore. The Belgian Congo pitchblende was unique in character compared with other ores, as it was known to contain "as much as 60 percent uranium, both U-238 and Uranium 235, which is very rare and highly toxic" (Dreiling 2003:3) and it also contained high concentrations of other elements like thorium, radium, nickel, copper, cobalt, etc. (U.S. AEC 1964).

It was clear the Mallinckrodt Chemical Works had taken the urgency of the situation to heart, as it was deemed a success in an almost unbelievably short amount of time. Within, "only fifty days from the start of the project, the necessary data were gathered, the plant

[18] The material that made its way to St. Louis was important enough to be specifically mentioned in the Leo Szilard and Albert Einstein letter to President Roosevelt. It was stated that, "…the most important source of uranium is the Belgian Congo" (as reprinted in Jones 1985:609). The Belgian Congo pitchblende was unique enough that residents today are able to link samples collected recently to this specific source and material.

equipment designed and assembled, the plant built, and the product produced at a rate of more than one ton a day to serve as the sole source of purified uranium for the Manhattan Project well into 1943" (Fleishman-Hillard, Inc. 1967:24). In short, Mallinckrodt had pulled off the unthinkable and production at this level enabled the MED engineers and scientists the 40 tons of uranium dioxide (UO_2) needed to produce the first self-sustaining chain-reaction on December 2, 1942, beneath the west stands of Stagg Field at the University of Chicago (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). In just eight months from their original meeting, the company's part in the project would later be hailed as "a technological and industrial miracle" (Bowers et al. 1989a:3). While the ore itself was thought about as special and exceptional due to it being some of the high concentrations of radioactive elements found anywhere in the world, in the workplace itself it was business as usual and the material was treated much like other materials produced.

That is to say, the material was not treated as nuclear, in the same way we might today, because working with the material was in its infancy, but more importantly the security clearance impeded the spread of information, as it was deemed pertinent only at the managerial level, and did not translate to the level of the workers on the floor. As the quote above suggests, perhaps it was met with some ambivalence because it was only supposed to be a very short-term project and Mallinckrodt Chemical Works had envisioned soon returning back to the production of their own products and believed they were not entirely responsible for worker health in terms of radioactive exposures due to uranium. These decisions greatly impacted the employees who actually worked with the materials but who were left in the dark about what they were working with and subsequently would go on to bear the health consequences of doing so.

MED: Managing Risk, Health, and Safety through Secrecy

It is important to remember that Mallinckrodt's involvement with the Met Lab was so early on that while Mallinckrodt Chemical Works got to work in St. Louis, the lab itself had just begun recruiting scientists and took some time to be established. When the project began, scientists knew there was insufficient knowledge about the health, safety, and environmental impacts of the work that was being conducted (Hacker 1987). Scientists knew they did not have sufficient knowledge of the harmful effects of some of the materials they were using and, as such, created a Health Division as part of the Met lab (Hacker 1987).

However, while they may have thought there was much more to learn, they were not completely in the dark either. The tragic and painful deaths of the dial painters or "radium girls" of World War I was a testament of the harmful effects of ingesting radium, another radioactive element (Hacker 1987; Moore 2018). Having been told the radium paint was harmless, the young female employees used a technique called "tipping", which consisted of placing the brush in their mouths to create a fine point, which helped them paint the small numbers on the dials (Hacker 1987; Moore 2018). As the body mistakes radium for calcium, the young women contracted radiation poisoning and later died painful deaths as their teeth, jaw bones, hips, and skin became brittle[19]. Investigations later revealed that male lab technicians who also worked with radium, at the same company, took precautions when using it, which made this injustice particularly gendered (Moore 2018). In short, scientists would not have had to look very hard to find cases about the impacts of working with radioactive materials.

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[19] For more information see Kate Moore's (2018), *The Radium Girls: The Dark Story of America's Shining Women.*

Because of the dangerous potential impact of radioactive materials, prior to the second world war, scientists had already begun looking for what they called "tolerant doses" among some of these elements and some standards were created (Hacker 1987). In 1941, the year before the lab was established, the American Advisory Committee met to discuss tolerance as a concept and determined a "tolerance dose" to mean:

> "…[what]can be tolerated without any damage whatever, which, of course is not the case if we consider genetic damage. It was recommended therefore that in the future we use the terms "permissible dose." This does not in any way imply that no injury will follow. It merely says that the Committee recommends its use even though it is not necessarily safe but is adopted only as a practical and expedient value" (as cited in Hacker 1987:26).

Members of the Health Division knew that calculating tolerance or permissible doses in living systems was difficult, as it depended on exposure intensity, frequency, duration, and other factors. To make matters worse, very little information about the materials they were using was available at the time (Hacker 1987). The Health Divisions focused its efforts on two main aims: to set safety standards for workers and those in the field, and to conduct further research on health (Hacker 1987; Zwicker 2005).

Their approach reflected an age-old paradox. "…some level of exposure is unavoidable when working with nuclear materials and that any level comes with an associated biological risk" (Cram 2016:522). While there is much talk today about acceptable risk, this is largely a social issue, meaning if any exposure comes with risk, then it is up to individuals to decide what is acceptable for them (Cram 2016). However, in this case, individuals were uninformed, and scientist and military officials had differing ideas about what was acceptable and if/when conditions warranted different responses.

In August of 1942, the military entered the lab with the establishment of the Manhattan Engineering District (MED). Its sole purpose was to create an atomic bomb (Gosling 2010; Hacker 1987; Jones 1985; Rhodes 1986). Brigadier General Leslie Groves of the Army Corps of Engineers was placed in charge of the operation, code named the Manhattan Project (Gosling 2010; Hacker 1987; Jones 1985; Rhodes 1986).

As the military's goals and values were different than the scientist's, tensions rose between the two groups. The academic side were much more risk adverse and cautious and saw a much greater need to gain more knowledge about the basic science involved so that they could better advise other scientists and their contractors about possible risks to employees and the public (Hacker 1987; Zwicker 2005).

Robert S. Stone ran The Met labs health and safety division and believed, "the university, in any event, had a 'moral obligation to the personnel and the community' that must "extend far beyond the war project" (Hacker 1987:51). He was very concerned about low-level exposures and was aware that exposures may take years to observe, as even the acute impacts are hard to see (Hacker 1987; Zwicker 2005). Many scientists struggled with the ethics of human experiments, and as such, opted instead to experiment on themselves. There is evidence that some "…adapted their concept of safety to the situation at hand," which meant stopping at the point to which the physical harm was visible to them, even though many knew that the harm can be severe even without producing an immediate physical reaction (Zwicker 2005:47).

However, things came to a head when the military recruited their own medical experts. On the military side, their primary goal was to produce a weapon as quickly as possible and saw war as an inherently risky endeavor and loss an unfortunate but legitimate and anticipated outcome (Hacker 1987). Warren Stafford was recruited to be a medical advisor and to oversee the MED's medical section, and as an example of regulatory capture, was commissioned to be in the Army (Dal Bó 2006; Hacker 1987). In this role, Stafford and Warren disagreed often, as Stafford believed that basic research was something that could be done later and safety standards that were too constraining slowed down the process and, in some cases, impeded work (Hacker 1987; Zwicker 2005). Stafford felt that current industrial standards were good enough and felt that "special standards should apply only upon proof of prompt, clear-cut biological changes or health threats" (Hacker 1987:51).

While there seemed to be differing aims, the Health Division was able to make recommendations and military personnel was able to see the value in its work, especially as it pertained to protecting soldiers from potential biological, chemical, and/or radiological elements (Hacker 1987). Although much of the tension between military and academics would last for the duration of the war, Mallinckrodt Chemical Works was already readying its first shipments to Chicago as the MED entered the scene and they company shipped the rest not long after.

With an atomic weapon as its primary goal, the Manhattan Project saw its risk not in terms of employee health and safety, but in terms of intellectual theft. Propelled by fear that German atomic research was more advanced, speed and secrecy were the great driving forces of the project (Zwicker 2005). To safeguard various aspects of the project, work was compartmentalized, and workers were restricted from knowing what others were doing

(Zwicker 2005). Preventing open communication had a profound impact on health and safety and greatly worried the academics working on the project as they saw it as antithetical to knowledge construction (Hacker 1987). It also increased risk among workers who were not sufficiently informed about what they were working with and how that may be a detriment to their health (Zwicker 2005).

Occupational health and safety policies were in its infancy and largely a matter left up to individual states (Eisenbud 1990; Hacker 1987). Even so, "…the laws were drafted in such a way that protection was provided for injuries for accidents in the workplace, but not for occupational disease…occupational disease usually result from the gradual and insidious action of a physical, chemical, or biological agent to which the employee is exposed in the course of his work" (Eisenbud 1990:16–17). This left many workers, such as those in companies like Mallinckrodt's, with very little long-term health protection since it could take years before a worker experienced its effects. Even among activities that were thought about as relatively safe, speed and secrecy likely created more harm(s).

This also extended in many ways to the general public, who were often not informed when hazards were released into the environment both intentionally and unintentionally. For example, when scientists began preparing for the first self-sustaining chain reaction, on the University of Chicago's squash court no less, neither the university president nor the communities surrounding the university were informed it was happening (Zwicker 2005).

While there seemed to be awareness that the various materials used in the project could be dangerous, and the long-term impacts were unknown, the material was treated differently in the research lab and in the plants, as mentioned above. In the lab, and under the Met scientists, it seems that material was treated much more cautiously; this may have been based on what the scientist knew and/or suspected and in keeping with occupational laws. As stated above, these laws were woefully inadequate when considering the long-term impacts of these new materials to workers health. In terms of the environment, environmental laws protecting the general public were virtually nonexistent and allowed for environmental contamination through practices like on site burial and it seems very little additional consideration was given. Waste was routinely thought about as something that could be attended to at a later date.

Atomic Energy Commission (AEC) & Cold War Expansion

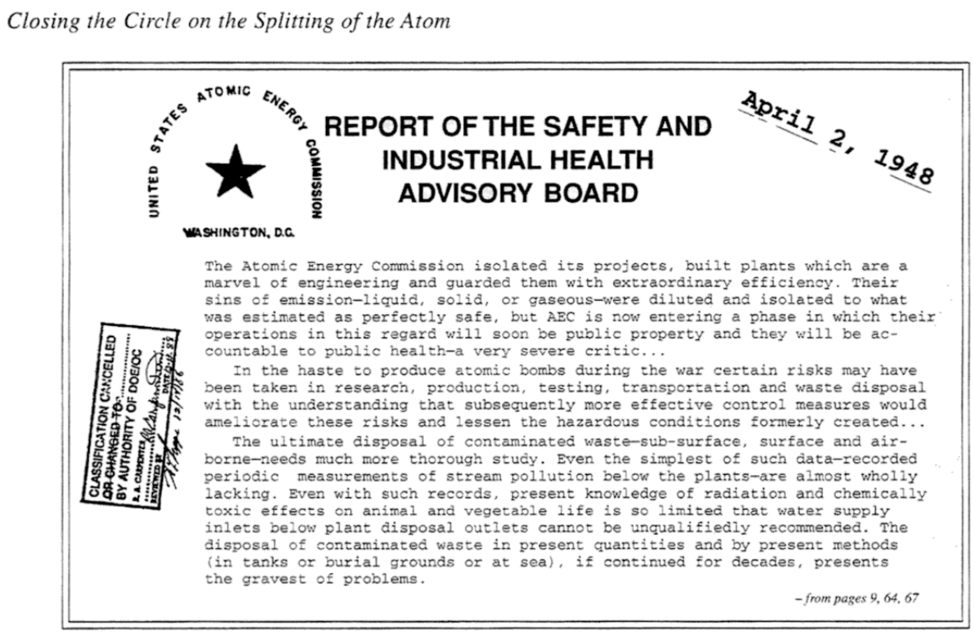
Not long after, the world's first atomic weapons were used on Hiroshima and Nagasaki, Japan, which violated all international laws at the time and is largely thought about as bringing about the end of World War II (Jones 1985; Rhodes 1986). The U.S. saw great potential in atomic science and was further interested in exploring new avenues of science and technology. In August of 1946, Harry S. Truman signed the McMahon/Atomic Energy Act, which created the five-member Atomic Energy Commission (AEC). The purpose of the AEC was to improve "the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace" (U.S. AEC 1946:1). With the newly created AEC, the Manhattan Engineering District was dissolved, and the newly created AEC resumed many of the MED's responsibilities. In the end, the scientists on the project were later removed from the project and, "in short, neither the public nor their elected leaders nor the scientific community was in control of the weapon; control had largely passed into the hands of the military" (Nye 2007). Thus, making it truly a weapon of the State.

Having created atomic weapons and generating techno-scientific knowledge about nuclear weapons and their impacts also challenged the existing world order. The U.S. rather quickly took the lead, solidifying its position as a superpower. The ability to use atomic weapons then, and the possibility of continuing to use them as a threatening and coercive tool used by the U.S., the U.S. was able to dominate and secure favorable terms within international negotiations (Kauzlarich and Kramer 2010; Kramer and Kauzlarich 2011). While atomic energy brought about the close of one war, it also created an arms-race between the United States and the Soviet Union.

The Atomic Energy Act of 1946 gave the commission broad authority of nuclear weapons production and unlike other commissions which "were limited to one or two special powers," the AEC acted as a "government within a government" (Makhijani 1995:3). However, a significant portion of its work remained in conjunction and partnership with the military. The AEC was in charge of both regulating and promoting nuclear energy and these competing goals continued to be fostered by secrecy in the name of national security. Much like the prewar era, there continued to be "little sustained congressional oversight of health and environmental issues…[and]… a distinct lack of interest in nuclear waste and environmental management within the AEC itself," and the AEC was never charged with creating policies or monitoring its environmental impact (Kauzlarich and Kramer 2010; Kramer and Kauzlarich 2011; Makhijani, Schwartz, and Weida 1998:357).

As nuclear production peaked under the AEC in the 1950s-1960s, the former general manager of the AEC stated, "Nobody got brownie points for caring about nuclear waste. The Atomic Energy Commission neglected the problem" (Steele 1989:18). Disposal practices during the WWII and into the Cold War consisted primarily of storage of high-level waste, such as that was produced as reactor fuel, and the dilution of low-level wastes (Walker 2009). It was assumed that, through the process of dilution, the waste could be returned to the environment (Walker 2009). While the general practice was that "soil absorbs radioactive and hazardous elements in waste, and harmlessly extinguishes all potentially dangerous chemicals," this was completely untrue and not backed by scientific evidence (as cited in Kramer and Kauzlarich 2011:107). Little thought was given to how the progeny of decay chains may one day impact the environment, which is indeed what current residents in the St. Louis area are concerned about.

However as early as 1948 the AEC had anticipated that one day their actions would "be accountable to public health- a very severe critic." They admitted that "in the haste to produce atomic bombs during the war certain risks may have been taken in research, production, testing, transportation, and waste disposal with the understanding that subsequently more effective control measures would ameliorate these risks and lessen the hazardous conditions formerly created." They also admitted that there was a complete lack of testing on the impact of these materials in the environment (U.S. DOE 1996:8). Figure 10 shows an excerpt from 1948, which outlined many of these sentiments (1996).



Closing the Circle on the Splitting of the Atom

UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C.

REPORT OF THE SAFETY AND INDUSTRIAL HEALTH ADVISORY BOARD

April 2, 1948

CLASSIFICATION CANCELLED OR CHANGED TO ... BY AUTHORITY OF DOE/OC

The Atomic Energy Commission isolated its projects, built plants which are a marvel of engineering and guarded them with extraordinary efficiency. Their sins of emission—liquid, solid, or gaseous—were diluted and isolated to what was estimated as perfectly safe, but AEC is now entering a phase in which their operations in this regard will soon be public property and they will be accountable to public health—a very severe critic...

In the haste to produce atomic bombs during the war certain risks may have been taken in research, production, testing, transportation and waste disposal with the understanding that subsequently more effective control measures would ameliorate these risks and lessen the hazardous conditions formerly created...

The ultimate disposal of contaminated waste—sub-surface, surface and air-borne—needs much more thorough study. Even the simplest of such data—recorded periodic measurements of stream pollution below the plants—are almost wholly lacking. Even with such records, present knowledge of radiation and chemically toxic effects on animal and vegetable life is so limited that water supply inlets below plant disposal outlets cannot be unqualifiedly recommended. The disposal of contaminated waste in present quantities and by present methods (in tanks or burial grounds or at sea), if continued for decades, presents the gravest of problems.

– from pages 9, 64, 67

Figure 10. From *Closing the Circle on Splitting the Atom.*
Data Source U.S. DOE (1996)

While the AEC was less interested in the environmental impacts from weapons *production*, it did begin monitoring radiation fall out from its various nuclear *tests* (Eisenbud 1990). In the 1940s and 1950s, the AEC secretly used the Marshall Islands and a site outside of Las Vegas, Nevada, as nuclear weapons testing grounds (Eisenbud 1990). They quickly found out that nuclear fallout could travel much farther than they had anticipated. There was evidence that radioactive dust had impacted film at the Eastman Kodak Company in Rochester, NY, and radioactive fallout from the western states had ended up in snowfall in the northeastern United States (Eisenbud 1990). In regard to that 1951 snowstorm, "…there was little appreciation of the fact that some of the nuclides present in the bomb debris were capable of being absorbed by plants and animals and the human body. Such information was available from studies that had been conducted at Hanford and other nuclear centers, but the information was still secret in 1951…" (Eisenbud 1990:66). As the promoters of nuclear technologies, the AEC benefited from the extreme secrecy that impeded the flow of information, and also prevented outside scrutiny.

For the duration of WWII, the health and safety of both workers, the general public, and the environment were largely viewed as something that would potentially slow workflow, and after the creation of nuclear weapons, this attitude continued to prevail. However, contractors, many of whom had worked with the MED in the war, were concerned about the potential of human and environmental harm, specifically their liability (Makhijani et al. 1998). To successfully go into nuclear weapons production, the AEC would still need the assistance of various contactors and corporations. In this new relationship, "before corporations agreed to do the job, they insisted that they be completely free of liability for their actions, even when these actions were negligent" (Makhijani et al. 1998:357). While this was led by some of the larger corporations, such as General Electric (GE) and DuPont, this also, to varying degrees, made its way into many other agreements with contractors including Mallinckrodt Chemical Works (Makhijani et al. 1998).

As the MED, and later the AEC, had previously normalized production goals over human and environmental health and safety, and largely saw waste management as something to be accomplished at a later date, it normalized a certain level of deviance (Kramer and Kauzlarich 2011). While the AEC required licensure for source materials and created guidelines for protections against environmental and human health, "…virtually every weapons production facility is or has operated in violation of one or more environmental laws, the organization as a whole could be viewed as a "culture" of non-compliance" (Kramer and Kauzlarich 2011:117). Given these activities were largely carried out in conjunction with a state sponsored regulatory agency, these actions have created enormous social harm.

Mallinckrodt Workers Health and Safety

Due to Mallinckrodt's early work and success, they continued to work with the MED for the duration of the war, by quickly shifting from research to the production of uranium ore and also produced uranium metals (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). Again, while security clearances impeded information flow and employees were uninformed about what they were working with from roughly 1942 to 1945, it seems that the question of whether or not the workplace was seen as nuclear was put to rest by 1945. A contract from May of that year between Mallinckrodt and the U.S. government stated, "The United States of America will make all tests and do all things necessary to measure the intensity of radiation throughout the plant at various stages of the process, and determine and measure all resulting hazards in order to reduce to a minimum possible risks in connection with the operation of said plant" (War Department, United States Engineer Office 1945:1). As the United States entered the Cold War, stockpiling nuclear weapons became a new priority, and since Mallinckrodt had been a major producer of weapons grade uranium in WWII, they continued and expanded production (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996).

In 1946, the new Destrehan Street plant was constructed in downtown St. Louis for the processing of Belgian Congo pitchblende, which continued until 1957 (Fleishman-Hillard, Inc. 1967). Somewhat similar as before, in this partnership, Mallinckrodt provided the labor and facilities, most of the equipment and machinery, and the government supplied

Mallinckrodt with materials and took responsibility for safety measures (Fleishman-Hillard, Inc. 1967).

Within this new relationship with the AEC, and still working under a security clearance, Mallinckrodt took on responsibility for screening all personnel. In addition, rules and regulations were established for around-the-clock security and security checks (Fleishman-Hillard, Inc. 1967). As was the case elsewhere, film badges were used in an attempt to measure exposure, which gave a rather crude estimate of a person's exposure to x-rays or gamma radiation (Pardue et al. 1944).

A formal health program started in 1947, and in 1948, an in-house health department was established, as the AEC had "submitted to Mallinckrodt a comprehensive outline of recommendations for the initiation of an extensive program to protect personnel from radiation hazards at the project plants" (Fleishman-Hillard, Inc. 1967:146). According to records, Mallinckrodt's main focus in the new plant was on ventilation and the reduction of contamination, and the AEC would ultimately spend $300,000 on ventilation and safety. As had been the case earlier, worker health was being monitored by local hospitals and Washington University in St. Louis. It was recommended that employees needed more education on precautions, but "employees who had worked on the uranium project for several years with few formal health regulations found it difficult to understand the new emphasis on physical exams, dust control, radiation shielding, and other health and safety measures" (Fleishman-Hillard, Inc. 1967:149). In short, many employees had been working with the materials for years and were told it was similar to the other materials in the plant, and largely did not see why all the new regulations were necessary.

For all their efforts to educate, control dust, and monitor health and safety, it was perhaps the pace of work that put employees at most risk. The operations were extensive and, "all of Mallinckrodt's plants were producing more than three times their designed capacity" and most would do so until their eventual closure in 1968 (Bowers et al. 1989d:6). The first AEC industrial hygienist, Merril Eisenbud, who would go on to set up the AEC's Health and Safety Laboratory, would later describe the plant as one of the two worst plants in terms of health and safety (U.S. DOE 1995b). He states:

> "Well they were- these were plants that were designed to operate for, perhaps, 60 days, just to make enough uranium for a couple of bombs. They went on for five years, six years, something like that, and the exposures were very high. Against the standards of- I don't remember exactly, but I think the maximum amount of uranium in air was supposed to be 50 micrograms per cubic meter; we were measuring milligrams per cubic meter, and they were excreting as much as a milligram a day in their urine… It was obvious that they either had to be fixed or closed, and, for the most part, they were closed…" (U.S. DOE 1995b:16).

It was later estimated that "exposure levels may have been nearly 200 times the contemporary maximum permissible concentration" (as cited in Dreiling 2003:4). Additionally, in testimony from a hearing of the Subcommittee on Immigration, Border Security, and Claims, a former employee stated,

> "The early Plant 4 was very dirty. At Plant 4 they did everything by hand and by guess and by gosh" (Subcommittee on Immigration, Border Security, and Claims 2006:30).

> An employee with long experience stated, “At Plant 4 nothing was done about nothing: live it, breathe it, eat it.” (Subcommittee on Immigration, Border Security, and Claims 2006:30).

In terms of worker health, much of what we know is from reports produced by Mallinckrodt and the AEC, and subsequently remains contested by the families of many, now deceased workers (Dreiling 2003; West 2015).

Interviews and de-classified documents would later reveal that the AEC and some of its contractors were concerned about, and collecting data on, employee and the general public’s health and safety. While the AEC agreed to do all things necessary to protect the plant (War Department, United States Engineer Office 1945:1), it also saw a unique opportunity with Mallinckrodt’s employees to understand how bodies reacted to exposures. To this end, Eisenbud stated that apart from their recommendations, “It was recognized that pending the elimination of excessive exposures, here was a unique opportunity to conduct clinical studies on a fairly large size population whose radiation exposure for several years had been in excess of any group for which data are available” (Subcommittee on Immigration, Border Security, and Claims 2006:29).

In their quest for knowledge, workers bodies were examined both before and after death. Some workers were already showing signs of kidney failure (Subcommittee on Immigration, Border Security, and Claims 2006). In a 1951 memo, Eisenbud found that, “17 workers had dose rates of 1,000 rem or more to the lung” at a time when the “AEC set the allowable annual dose limit to 15 rem to the lung” (Subcommittee on Immigration, Border Security, and Claims 2006:30). There was evidence that Mallinckrodt’s management was concerned about their future liability. For example, documents indicated that after consulting their attorney, no formal report was ever prepared for a 1949 dust study that led to the transfer of overexposed workers and those with knowledge of the study and/or transferred to other areas in the plant were coached on what to say (Subcommittee on Immigration, Border Security, and Claims 2006).

Decades later, in seeking dose reconstruction, the National Institute of Occupational Safety and Health (NIOSH) granted plant workers from 1942-1948, Special Exposure Cohort status due to the lack of radiation monitoring from 1942-1945 and the limited amount of monitoring from 1945-1948. Special Exposure Cohort status "may be applied for and received by sick workers whose radiation dose exposures cannot be estimated adequately with existing records and who worked in an area where it is reasonably likely that they were exposed to enough dose to endanger their health" (Subcommittee on Immigration, Border Security, and Claims 2006:8). After the tireless searching for documents and the advocacy of Denise Brock, the daughter of two workers exposed, the same status was given to workers from 1949-1957. To garner this status, she "…provided documents which questioned the reliability of exposure records, and it demonstrated that there was no individual employee monitoring for some of the most toxic radiotoxic isotopes which were contained in the so called "raffinates" (thorium -230, cctinium-227, protactinium-231)" (Subcommittee on Immigration, Border Security, and Claims 2006:31). In short, treating the material at the downtown plant as if it were the same as other toxic and/or hazardous material created undue harms for worker and their families. Many of the workers died from cancers attributed to their time spent working at the plants.

It wasn't until the Clinton Administration that the harm(s) of Cold War era workers was recognized (U.S. DOE 1995a). In speaking of the workers, the chairman of this congressional committee stated, "In this case we as a government did the harm, knew we were doing the harm and intentionally deceiving people working to protect this nation from harm…We as a government are to blame. And unlike some involved in this program, we should step up and take responsibility for what has happened with integrity and purpose" (Subcommittee on Immigration, Border Security, and Claims 2006:3–4). While Mallinckrodt Chemical Works was originally not seen as a nuclear workplace, the government finally acknowledged that it was, and as such it only became nuclear after WWII. Although some protections were put in place, but due to the long latency period of radiogenic effects, nuclearity was not extended to the bodies of workers until many had already long passed away.

Creating the St. Louis Airport Site (SLAPS)

As the current controversy surrounding the landfill indicates, Mallinckrodt and the AEC's Cold War era activities were not limited to its operations downtown. Towards the end of WWII, production at the downtown site began to increase and space became even more limited. It became clear, almost immediately, that the continued production both used/needed a great deal of material and also generated quite a bit of waste. Since space was in short supply, one of the last things the outgoing Manhattan Engineering District did was to secure a plot of land large enough to store what it referred to as "residues" (U.S. AEC 1959). In 1946, the Manhattan Engineering District was granted consent to use a 21.74-acre tract of land north of the St. Louis Municipal Airport (SLAPS)[20] to store material (U.S. AEC 1959). The site was approximately 15 miles northwest of downtown in Robertson, Missouri, and "is bounded by Brown Road to the North and East, the Wabash Railroad main line to the South and Cold Water Creek on the West, which is also the property line of McDonnell Aircraft Corporation" (Airport Committee 1965:1).

The property was very uneven and contained an area of low drainage and possibly once contained a lake or pond (Airport Committee 1965:3). Due to the slope of the property, "all of the surface drainage directed to the Cold Water Creek at the western edge of the property" and the property itself was in the creek's flood plain (Airport Committee 1965:3). While it remains unclear specifically why this site was chosen, it was likely the ease of acquisition that made the land appealing. As part of the municipal airport, the land was within the airport's flight line and was likely little use to the airport, as it was near other land used by corporations. After the MED dissolved, the AEC took on the oversight of the property.

As the material started to make its way to SLAPS, the vast majority of it was sorted in outdoor piles, as shown in Figure 11, and stored for two reasons. First, when the U.S. acquired the ore, it actually *only acquired the uranium content* and not the other elements included, such as thorium, radium, copper, nickel, and cobalt (U.S. AEC 1959). Essentially, "African Metals retained ownership of all material except the uranium content" and African Metals was able to enter into contracts with the commission and other companies for parts

[20] In some instances, this site is referred to as "the Airport Site at Robertson Missouri," "the Robertson Airport Residue Storage Site," "the St. Louis Airport Site" or "SLAPS," and/or "SLAPPS." For the purposes of this papers it will be referred to as SLAPS.

of the materials (U.S. AEC 1959:1–2). The second reason the material was stored was because most of the material at the site could be reprocessed and some of the material *was* reprocessed and then brought back to the downtown facility (U.S. AEC 1959).

It is likely because of the temporal use of the materials that the material at the site becomes hard to define. Within the archival documents before the 1970s, the contents of the site are referred to as simply "material" or most often "residues."[21] There is plenty to suggest that the site was thought about as nuclear in some circumstances as tools were used to measure radiation, as evidenced by employees wearing film badges (Bowers et al. 1989b). But, workers at the site reported driving their cars on the piles, re-selling barrels that contained uranium, and watching material blow around the site (Bowers et al. 1989b). When they asked questions, they were told to keep quiet, including when machinery and other items were buried on site (Bowers et al. 1989b). The growing mountain of material did not go unnoticed by local residents and the local newspaper that inquired about the material. When asked, they were told, "officials said the residue was not radioactive nor dangerous" (Bowers et al. 1989b:7).

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[21] It is worth noting that the word "residue" is not defined, nor does it appear anywhere in the "Atomic Energy Act of 1946." In the "Atomic Energy Act of 1946," "source material" was defined as, "uranium, thorium or any other material which is determined by the Commission, with the approval of the President, to be peculiarly essential to the production of fissionable materials; but includes ores only if they contain one or more of the foregoing materials in such concentration as the Commission may by regulation determine from time to time" (U.S. AEC 1946:11). By contrast, "byproduct materials," "means any radioactive material (except fissionable materials) yielded in or made radioactive by exposure to the process of producing or utilizing fissionable material" (U.S. AEC 1946:13). Most of the material at the site could be re-processed and some of the material *was* reprocessed and then brought back (U.S. AEC 1959). Additionally, words like "waste" and/or "disposal" are also missing, which likely indicates how little consideration was given.

Figure 11. A Mountain of at Latty Ave Waste.
Data Source (photo by Larry Williams as cited in Cammisa 2020).

By the close of the 1950s, in under two decades, the residues had grown to over 100,000 tons, with the vast majority in open-air "mountainous piles" and in steel drums (Alvarez 2016:2; Rock Road Industries 2013; Schneider 1990). Workers at the sites reportedly used trucks and bulldozers to make more room for the growing pile of waste, as shown in Figures 12, and 13, below (Bowers et al. 1989b). In a summary report (1959:2) prepared in April of 1959, the AEC estimates that the site contains the following:

47,000 tons	Pitchblende Raffinate, Am-7
32,500 tons	Raffinate, Am-10
7,800 tons	Slag, C-Liner
7 ,000 tons	Interim Residue Plant Tailings, C-701
10,200 tons	Barium Cake, AJ-4
290 tons	Vitro Residues
60 tons	Captured Japanese U, Precipitates
55,000	30-gallon & 50-gallon Drums of Steel and Alloy Scrap

The material took on a precarious nature, as it not only could be reprocessed but also contained other valuable elements. At one point the material was under contract to be sold for the recovery of nickel, cobalt, copper, and uranium content (U.S. AEC 1959). However, due to the falling prices of nickel, cobalt, and copper, and a surplus of uranium, these contacts became less lucrative and they eventually fell through (Malin 2015; U.S. AEC 1959).

Not all of the material at the site was deemed sellable or valuable according to the AEC. The report notes that only 10,000 of the 55,000 drums stored at the site was slated for sale, while "the remainder are unsaleable and will probably have to be baled and sold as scrap metal, together with the 3,500 tons of other contaminated steel and alloy scrap metal also stored at the site" (U.S. AEC 1959:2).

Figure 12. A View of SLAPS.
Data Source U.S. Army Corps of Engineers (2020)

Photograph 1. Barrels filled with radioactive waste were piled end-on-end over most of the SLAPSS, this photograph possibly represents a later period evidence indicates that the first wastes were simply "dumped" in open piles. Photograph courtesy USDOE.

Figure 13. Barrels at SLAPS.
Data Source U.S. DOE as cited (2020b)

Contamination Along the Way

As material made its way between SLAPS and downtown, independent truck drivers were used (Bowers et al. 1989b). Unlike the workers at the plant who had some, albeit woefully lacking protections, the truck drivers reportedly were never fully aware of what they were hauling (Bowers et al. 1989b). Since the drivers were not company employees and did not see the material as dangerous, they were not exactly careful with the material they hauled and were not given tools to monitor their exposure. The drivers hauled thousands of tons yearly and often came home with the material still stuck on their shoes (Bowers et al. 1989b). When the truck drivers routinely cleaned out their trucks after hauling and they recalled that most of the runoff overflowed into Coldwater Creek (Bowers et al. 1989b).

Some of the employees at SLAPS had grown concerned about the safety of the material, especially after a foreman recalled that they were ordered by the AEC to dig a hole at SLAPS and bury a pickup truck because it was "too hot" [indicating it was radioactive] (Bowers et al. 1989b:8). Former employees also noted that material routinely would blow around and likely settled on the nearby corn fields that would later become the Berkley ballfields. For years, the ballfields hosted countless baseball and little league games until it was closed in the late 1980s due to radioactive contamination (Bowers et al. 1989b). A few local children reportedly played in the yellow dirt that fell from the trucks and later were tested by the AEC (Bowers et al. 1989b).

Both the SLAPS, and later the Latty Ave site[22], were in close proximity to nearby Coldwater Creek, which was prone to flooding, and snakes through the neighborhood backyards that countless local residents reported playing in, unaware of any risks of harm (Bowers et al. 1989b). Even though some workers had suspected decades ago that the residue could be hazardous and were concerned about it contaminating the creek, it appears from interviews that they were repeatedly told it was safe and/or that they shouldn't worry about it and official record suggested that they largely believed the creek was not used, when in fact, it was a favorite spot for neighborhood children to plan in (Bowers et al. 1989b). Employees largely, assumed that those in positions hire than them knew best, which is consistent with other studies in the social sciences, that found that when people are faced with a knowledgeable authority figure, they tend to be somewhat trusting and yield feelings of personal responsibility (Asch 1951; Milgram 1974). It seemed to be a well-known occurrence for officials that material was making its way into the creek as far back as the late

[22] A portion of this site is also referred to as the "Hazelwood Interim Storage Site" (HISS).

1940s, as de-classified documents revealed the creek and nearby properties were tested (Kelvin 1948).

At SLAPS, it seems their concern was less about whether the residue/materials were migrating off site, and more whether the mitigated material was within the "limits of tolerance" for the time period (Kelvin 1948:1). In a study conducted in 1948, but not declassified until 1959, mud and water samples were taken from the adjacent properties and Coldwater Creek (Kelvin 1948). The study found that radioactive material/waste had indeed moved off site, and the highest concentrations of mud were from samples collected farthest away, as "mud samples adjacent to the area ranged in value from nil to 190 times that of normal uranium content in soil," (Kelvin 1948:1). The highest concentrations found in water were the ones closest to the site (Kelvin 1948:1). In spite of this, the study officially concludes that water samples "were well within their limits of tolerance" and that "no final conclusions could be drawn from these samples… additional samples under both under normal and adverse weather conditions need to be taken o that the evaluation of hazards presented by erosion and drainage both into the Creek and adjacent area can be more soundly determined" (Kelvin 1948:1). Nearby property owners and local residents were not informed of these findings, nor were ever given any indication that the creek should be avoided.

Residents in the area have been exposed in general and specific ways. As the AEC conducted weapons testing in the decades following WWII, some scientists grew concerned about what impact years of testing may have for the country (Blumenthal 1964; Early 2013). In the early 1960s, children in St. Louis were asked to donate their baby teeth to science and almost 160,000 children in the area did so (Blumenthal 1964; Early 2013). Figure, 14 shows the card that kids got once they participated (Early 2013). In this landmark study that has been replicated time and time again, the level of strontium 90, which behaves like calcium in the body, was measured in children. In one analysis, when compared to bottle fed infants in 1951, bottle fed children in 1964 had over thirty times as much strontium 90 levels (Blumenthal 1964; Early 2013). Scientists and activists were able to use this data to link it to weapons testing and the impact of fallouts on the general population in the St. Louis area and across the country (Blumenthal 1964; Early 2013). These sorts of studies show how bodies in St. Louis have been used time and time again to show how radioactive exposure has made its way into bodies, but also indicates that for the most part, very little was put in place at the time to prevented this from happening in the first place.

Figure 14. The Tooth Club for Children in St. Louis.
Data Source as cited by Early (2013)

The families of the truck drivers who hauled waste and children who grew up in the area have also come forward to report the ways in which their bodies were harmed. An article called, “The Poisoned Children of Coldwater,” details how local illnesses were originally detected through popular epidemiology (Hartmann 2013). A few alumnx from the McCluer North class of 1988 were shocked to find out that many of their classmates had life threatening cancers and illness and/or had already succumbed to them (Hartmann 2013). Many of the alumnx grew up in neighborhoods were Coldwater Creek regularly flooded into their backyards (Hartmann 2013), suggesting that there may be a connection between the creek and life threatening illnesses.

Current and former residents of homes near the creek have started a Facebook group and have tracked illnesses for years (Hartmann 2013). While they have been fighting for their harm(s) to be recognized, in some cases for decades, it wasn't until April, 2019, that it was finally reported that "Radiological contamination in and around Coldwater Creek, prior to remediation activities, could have increased the risk of some types of cancer in people who played or lived there" in the 1960s-1990s (U.S. Department of Health and Human Services 2019:iii). But they note that since the likelihood of cancer is low and, "no method exists to link a particular cancer with this exposure," that "ATSDR does not recommend additional general disease screening for past or present residents around Coldwater Creek" (U.S. Department of Health and Human Services 2019:iii). Essentially, residents are left to wonder if their illnesses were a result of exposures or not and are not entitled to any health benefits as a result.

Selling the SLAPS Material & Creating the Latty/HISS Site

By the end of the 1950s, SLAPS had become crowded, and rather than slowing production, Mallinckrodt was expanding. In 1957, the AEC built a new 220-acre facility about 30 miles away from downtown St. Louis in Weldon Springs, located in St. Charles, Missouri (Fleishman-Hillard, Inc. 1967; St. Louis Remediation Task Force 1996). Mallinckrodt operated the plant, and from 1957 to 1966, production was moved to this new facility. The property, an expansive 17,000 acres, had originally been acquired through the condemnation process and used by the US Army from 1941 - 1946 as a TNT and DNT production facility (St. Louis Remediation Task Force 1996).

Through testing, it became clear that some of the old buildings, machinery, and other debris at the downtown plant were contaminated and the AEC began inquiring about what to do with it and the growing mountain of material/residues at the SLAPS. As the material had been exposed to the elements for quite some time, some of the barrels had already begun to deteriorate. In April of 1960, the AEC requested that a U.S. Geological Survey be conducted to see if one such area, referred to as "the Weldon Springs Quarry," would be a suitable place to dispose of "uranium contaminated building debris and rubble and residues containing thorium and uranium" (Richardson 1960:8). It noted that the quarry's floor was lower than the streams, so when the water in the quarry was greater than the streams, then the water would flow towards the creeks, which then flows to the river. This became a concern because less than 12 miles downstream was the public water supply for both St. Louis and St. Charles County (Richardson 1960:8). Reports would later indicate that some contaminated material ended up being stored there nonetheless (Bowers, Rose, and Tighe 1989c). Former high school students have since reported that the quarries were a somewhat common spot that they would sneak out to and swim in, and while it was trespassing, they unaware of any harm(s).

In March of 1962, rather than store the materials, the AEC instead decided to put some of the residues at SLAPS up for sale. While the market for these materials had suffered, they still had some commercial value. A sale ad drawn up to advertise the material included the following: The Pitchblende Raffinate (the Belgian Congo pitchblende plus other uranium concentrates), the Colorado Raffinate (primarily from domestic sources), Barium Sulfate Cake (unleached), Barium Cake (leached), and miscellaneous residues (in deteriorated drums, content/info unknown) (U.S. AEC 1964). It is notable that while they were selling the residues in their entirety, they were advertising particular elements within them, specifically its cobalt, nickel, and copper content. For example, within the 74,000 tons of Pitchblende Raffinate, it is estimated to contain (1964:8): 1,775,000 lbs., of Cobalt; 1,085,000 lbs. of Nickel; 1,098,000 lbs., of Copper; and 113 tons of Uranium.

The way that this was listed was particularly telling. On the second page of the advertisement, under "instructions and information to bidders," read as follows: "THE BIDDER IS ADVISED THAT THE ATOMIC ENERGY COMMISION WILL <u>NOT</u> PURCHASE THE URANIUM RECOVERED FROM PROCESSING OF RESIDUES TO BE PURCHASED UNDER THIS INVITATION" [re-printed, directly as it appears in the ad] (U.S. AEC 1964:2). By this time, the uranium boom was ostensibly over, and the U.S. had created a surplus of uranium (Malin 2015). It appeared then, that since uranium was no longer a rarity, that the residues were again treated as relatively banal, in spite of the fact that they were still radioactive and contained substantial amounts of radium and thorium, among other elements. By thinking of the residues in parts, it ignores the radioactivity of the whole, and the cross contamination that occurred due to the way it was stored more or less directly next to each other.

The ad stated that they could not guarantee the "fitness for any use or purpose; or that it would not cause injury or damage to persons or property…its contamination…and the Government shall not be held responsible for any such injury or damage. The purchaser assumes all responsibility and liability for the property purchased thereunder" and a buyer must take all of the material (U.S. AEC 1964:12). The waste did not immediately sell, and the ad was listed a total of three times before finally being sold in 1966 to Continental Mining and Milling Company for $126,000, which amounted to roughly a dollar a ton (Foster 1966:3; Marcott 1972). The residue/material was transported less than 5 miles away to the company's site "… located at 9200 Latty Avenue, Hazelwood, Missouri, where Latty Avenue dead ends into Coldwater Creek" (Foster 1966:5).

While the AEC relinquished most its responsibility with the sale, it was still required to oversee the material, as the agency in charged with regulating radioactive material. Once purchased, it appears that significant problems with hauling, storage, containment, and safety began almost immediately. In a report titled, "Health Physics Analysis," the first inspection of the sites happened almost two weeks after the material began to leave SLAPS for Latty Ave. A follow up inspection happened in August of that same year (Foster 1966). To haul the estimated 125,000 tons of waste, Continental Mining subcontracted with 4 small independent trucking firms, who hauled approximately 2500 to 3000 tons of waste per day.

Trucks were frequently entering and leaving the area, dropping large amount of material along the roadsides during transport. During the first visit, Continental "was trying to correct this condition by [possibly] keeping trucks loaded to three-fourth the allowable height," using canvas covers, and hiring an employee to follow in a truck to pick up what spilled off (Foster 1966:1). However, at the August visit, none of these strategies had been implemented, because they were "wanting to finish the job as soon as possible." They instead explained the reason there was so much spillage on the road was "that they had just had a heavy rain, and it was mud that was falling from the sides of the vehicles where it hit and stick during loading operations" (Foster 1966:10).

The inspector twice tested some of the trucks and "spillage" and noted, while the materials and trucks were radioactive, they did not test high enough to warrant major concern (Foster 1966:1 & 11). Additionally, the inspection noted at both times the following issues: lack of proper signage indicating radioactive material was being stored there; the gates were being left unlocked; radioactive barrels were being stored in the incorrect area; and that surveys and tests monitoring radiation levels were either not done and/or disbelieved (Foster 1966). "Film badges" were placed on all personnel working in restricted areas and "some film badges showed exposures as high as 40 mrem for a single week. The licensee indicated to this inspector that they had some doubts about the Nuclear Consultant Corporation film badge service since [illegible word] based on the radiation level shown from the surveys, they did not see how people could be getting that much exposure." Shortly after, they moved to monthly checks (Foster 1966:9).

Archival documents and later reports show that in addition to issues of related to transport and safe handling, the company itself faced financial problems almost immediately. They eventually foreclosed on their loan and not long after, the material was acquired by the Cotter Corporation of Colorado (Boughton 2009; Marcott 1972). After sorting the residues, the Cotter Corporation made arrangements to ship what residues were left and valuable to Colorado (Boughton 2009; Marcott 1972).

Throughout spring and summer of 1971, the Cotter Corporation communicated with the AEC about what to do with the material that they deemed had no value and/or for which "no utilization then existed or now exists" (Henderson 1971:29). In particular, they mentioned in letters there was no known use for the spent barium sulfate, and they were unsure of what to do with approximately a thousand drums, "contaminated with trash, that is items such as bricks, clothes, boots, gloves, and the like"" (Henderson 1971:29). This was the first instance where the materials or subsets of the residues are referred to specifically as "waste."

Having sold everything, the AEC no longer saw this as their responsibility, even though they were in ultimately in charge of regulating it. After the Cotter Corporation sorted through what they deemed usable material, they hired another company to remediate the site and dispose of the remaining material (Cotter Corporation 1972). The outside company then illegally dumped the unwanted radioactive material in the West Lake Landfill (Alvarez 2016; Bowers et al. 1989b), where it currently remains, and residents have begun to question their own health as they believe they are experiencing negative health effects.

Waiting for Harm

After a decade and half of research and data collection, the National Regulatory Commission (NRC) prepared a summary report of the West Lake Landfill in 1988. The report concludes that there were two areas (operational unit 1 area 1 & operational unit 1 area 2 in Figure 15), in the landfill that, in total, contained roughly 150,000 cubic yards of soil contaminated by uranium and thorium's decay chains (U.S. NRC 1988). The material in some places was just three feet below the surface, which would need long term stabilization (U.S. NRC 1988).

In 1990, the West Lake Landfill was added to the National Priorities List (NPL) and designated it a Superfund site, which identifies some of the country's most toxic sites

(MDNR n.d.). Under Superfund program, also known as Comprehensive Environmental Response, Compensation, and Liability Act (CERLA), the potentially responsible parties (PRP)[23] were identified and asked to conduct further investigations, studies, hold public meetings, and gather public comments regarding final clean-up plans.

In 2008, these plans were shared with the public. They recommended leaving the material in place and putting a cap on the site, but this was met with heavy backlash from the public, who had been calling for its removal for decades (U.S. EPA 2008a). Not long after the PRPs were asked to explore alternatives, a subsurface smoldering event was detected in a nearby area known as the Bridgeton landfill[24] (LaCapra 2014). Figure 15, shows the section of the landfill, including the Bridgeton Landfill which is identified in the figure by the neon yellow-green color and Figure 16, shows where the underground fire is, in relation to the nuclear waste. Soon after, local residents began smelling a chemical-type odor in air and grew increasingly concerned about their health and safety (Bernhard 2014; Bissell 2015; Jeffery Tomich 2013).

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[23] Under CERLA the EPA identifies and works with potentially responsible parties (PRP) to clean up site. At the landfill, the U.S. Department of Energy, the Cotter Corporation, Republic Services subsidiaries Bridgeton Landfill, and Rock Road Industries.

[24] While often called the "Bridgeton Landfill," it is a portion of the West Lake landfill Superfund site. Referring to it in this way, as if it was not a subset of the larger complex, is often confusing. This is further bolstered by the fact that the "Bridgeton Landfill" and the "West Lake Landfill" have separate websites and there is another landfill close by, which is also a Bridgeton landfill. Here the use of language and naming conventions likely help convey that the sites are managed and separate, but residents often do not make this distinction.

Figure 15. View of West Lake Landfill.
Data Source MDNR (2010)

Figure 16. Photo of SSE & RIM.
Data Source MDNR (2015)

While officials have called the smell inconvenient, they have maintained that "Scientific evidence shows no one living or working around West Lake is experiencing harmful exposures to its hazardous contaminants, including the radiologically contaminated materials, because the EPA has securely contained them" (Brooks 2014:1). However, residents are quick to note that the air and the smell that carries from the landfill does regularly escape the site. One frustrated resident wrote, "[Person at the landfill] told me the fact that… [I have] Asthma does not change anything. I have explained to them that the smell is not just an inconvenience but is a serious health issue..."[25] and another resident stated:

> "… I walked my dog every day thru the winter. I had not been aware of any of these land fill problems when I was doing that. After months of my family telling me I should go get my throat checked out because my voice was changing… They didn't find anything internally wrong. I was experiencing choking issues with a feeling my throat was closing up and difficulty breathing... I can tell you that tightness in my throat occurs on days the stench is worse than others… I think we can't underestimate the power of this stench. I used to just think it was regular trash dump stink when I smelled it and not this burning concoction. I limit my outdoor activity now when I smell this."[26]

Regulators largely see the smoldering event and the radioactive material as separate and distinct issues, but residents are concerned about both, and the possibility of an overlap between them. Radiogenic exposures often have long latency periods and may not show up for decades or generations and since the site has not been thought of a particularly dangerous, resident believe it has not been monitored as closely as they feel it should have.

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[25] The public West Lake Landfill Facebook group, May 2013.
[26] Ibid

Many of the residents around the West Lake Landfill have been in the area their entire lives and are worried not only about the West Lake Landfill and the smoldering event, but also about compound exposures.

Today, residents largely see these sites and their current circumstances as all interconnected. Prior to and during WWII, production and handing of nuclear materials happened largely before standards were set in place and workers did not have protection from employers as occupational disease was not fully considered. During these times, the materials nuclearity was low, as calling something nuclear/atomic was a new concept and they were not informed about the materials danger. As production increased the military's view on war time risk and safety won out, much to the dismay of some of the early scientists. The MED and later the AEC assumed there would be time to clean up sites and make provisions about materials after the WWII, but then the Cold War began, and production was increased and what to do about waste and issues related to workplace health was places even further down the line.

While it seems that Mallinckrodt Chemical Works became a nuclear workplace after WWII ended, it took until the Clinton administration for the workers to gain a level of nuclearity that acknowledged their harm and sacrifice. Yet, this acknowledgement mainly benefited the families the workers left behind due to their illnesses and untimely deaths. AS the material moved away from the downtown site, SLAPS and Latty Ave. used some tools and technologies like Geiger counters and film badges to monitor exposures of workers at the area but these seemed to be pretty lax, and employees report that managers were not particularly forthcoming with employees, about their interactions with the materials. If nuclearity can be understood in degrees, the truck drivers who hauled the material both to and from locations and after its subsequent sales were offered even less protection from harm. Finally, the general public was largely not monitored at all during the time period because of (false) assumptions about dilution and assumptions that certain areas, like the creek and quarries were not used by local residents. It seems the farther the material was from the lab and from the plants, the less monitoring and nuclear the material was considered.

Although workers may have generally been both exposed to, and somewhat (albeit largely inadequately) protected from, radioactive materials, many others along the way came into contact with the material, such as truck drivers and/or those who played in the creek. Neither were ever informed of its presence or potential risk. Because these places were not initially considered nuclear, data is not available which has left residents frustrated as this not only makes any possible exposure estimations difficult, but also does not provide them proof of their safety. They are, in turn, left to wonder and residents are hesitant to trust regulators who assure them of their safety as, residents point out, there has been a long history of deceit related to this material. Residents fear that, just as before, they may come back years or decades later and state that harm was done. Regulators largely believe the radioactive material at the West Lake Landfill is contained on site and in their minds, there is little need and/or obligation to do off site testing. Resident frustration about this is perhaps best captured in the exchange[27] below on the public Facebook group:

> <u>Person #1</u>: "SIGH!!! Okay… just got off the phone [person at MDNR] ... he confirmed that they are NOT testing for radioactive particles (alpha and beta) in the

[27] Ibid

air!! I asked him why and his response was that DNR along with St. Louis Health and Senior Services did not feel like it needed to be done. My response was very simple and blunt "you have a landfill fire burning that is turning the leachate and the contaminated ground water into steam and releasing it into the air!! You ABSOLUTELY need to be testing for these particles!! He said as of right now there is no testing, but it is possible in the near future...I asked if "near future" could be next couple of hours? No, was the response, but we will see what can be done in the "near future"!!"

Person #2: "I often wonder what they base their *feelings* on, [when] they do not feel it needs to be done? My feelings are it NEEDS to be done. They should be on top of anything being released into the air. I wish we had hourly air quality reports as well. Waiting until evening is still after the fact. I am glad they have listened to us to some degree, perhaps a bit more listening would change their *feelings*."

Residents have gone on to report the smell for several years and it wasn't until 2018 that there was some indication that residents' fears have come to pass. After years of being told, that everything was fine and safe, a report found that residents were breathing "sulfur-based compounds" (Missouri Department of Health and Senior Services 2018:6). While the report admits that it was worse in the past, "odors of low concentrations of sulfur-based compounds may occasionally affect the health or quality of life of people living or working near the landfill"; however, it is "unlikely to harm people's health" (Missouri Department of Health and Senior Services 2018:6). To residents, these reports are quite damning and after proof that the West Lake Landfill has the potential to harm health presently and in the future. Residents have continued to fight to have their harms recognized and often the small amount of recognition they receive comes years later. This is often of little consolation to them, because the days of missed work and school and/or doctor's appointments are in the past and they have grown even more distrustful of assurances of regulators and landfill officials. In a memorandum from the EPA, residents were told that even if the radioactive waste and the underground fire meet that "…Areas 1 and 2 will not become more or less radioactive in the presence of heat. Likewise, the RIM[28] is not explosive and will not become explosive in the presence of heat" (U.S. Environmental Protection Agency 2014:1). But residents are intimately aware of the radioactive legacy in St. Louis and continue to question their safety and their trust in these claims.

Discussion/Conclusion

Since the West Lake Landfill is known to contain Cold War era radioactive material and uses technologies to monitor the radioactivity of the site, the nuclearity of the site has finally been made a bit more visible, even if it is often being downplayed. However, like other sites in St. Louis, regulators are much more ready to admit that properties have some degree of nuclearity but stops short in terms of the bodies that may have lived, worked, and/or frequented those properties years ago. However, what nuclearity regulators and officials are willing to grant it, is delimited to its own property lines. Monitoring the general public who live near the site, is conducted much within the standards for the state that are in place elsewhere.

[28] RIM stands for "radiologically impacted materials."

Residents believe they are being impacted by the landfill, because they are already experiencing negative health effects. The landfill owners and regulatory officials do not see the burning eyes, nose, and throats of residents as *enough* proof that they are being impacted. Technologies that may help render some of these impacts visible are not clearly defined, and/or easily accessed by residents. And even if they are defined, it is hard to determine causality (Murphy 2006), leaving residents feeling vulnerable and concerned. They do not want to wait until the impact is more pronounced, because by then, the damage to health may be too great.

Residents argue that the federal government, through relationships with companies, created this entire problem, and then, even when the war was over, did not do enough to ensure that citizens would not be impacted. Instead, individual citizens must try and manage something that is difficult to detect, prevent, and/or attend to, on their own and in real time. While Beck (Beck 1992, 2006) and Giddens (1997) contend that we are all now living in a risk society, these risks are far from equitable and in some cases very difficult to detect. Furthermore, St. Louis's contribution to the nuclear industry has been made even less visible, in part, because other cities are more easily recognized and have experienced greater levels of contamination.

The landfill has gained greater visibility recently, in part due to the growing Facebook community that has emerged as a result of resident's frustration and through four documentaries (Cammisa 2018; Carrick and Stelzer 2017; Slater 2018; West 2015). The most recent, *Atomic Homefront (2018)*, which aired in 2018 on HBO, has sensationalized the story and experiences of local residents. This is largely in part because the communities surrounding the West Lake Landfill are predominately white, which is unlike other cases of contamination and toxicity, which tends to plague the neighborhoods of people of color and low-income residents. Yet, while this has created greater visibility of the issue, residents who live in the area do not believe that this has necessarily brought them closer in knowing how best to protect themselves.

CHAPTER 4: CREATING SEPARATE TRAJECTORIES OF REMEDIATION

"Salus Populi Suprema Lex Esto,"

which means "Let the welfare of the people be the supreme law."

- *Missouri's official state moto*

"It's a really horrible situation just with the smell, and then you take into consideration … the radioactive waste part of it. We're scared to death. Every time we turn around there's a new report coming out saying they've found something new. And it's very difficult for anybody who lives around the site to feel like anybody has this situation, anybody is in control." --Dawn Chapman (as quoted in Phillips and Marsh 2014:4)

The West Lake landfill has been an important site for how federal, state, and local issues coalesce and impact one another. The last chapter discussed how radioactive material/waste ended up in the greater St. Louis area at the dawn of the nuclear age and covered the decades between the 1940s to the beginning of the 1970s. Throughout that time period issues of waste, storage, clean ups, and remediation were thought to be activities that could wait until after WWII, but the early 1970s, ushered in a time when the general public not only had learned about nuclear programs and the ways that materials were (mis)handled, but also a growing concern about issues of environment, conservation, and pollution. These concerns translated into the dissolution, reorganization, and creation of various government agencies, both at the federal and state level, who were tasked with the oversight of human and environmental health and safety. Places like the West Lake Landfill created a conundrum for some of these newly created federal and state agencies, as the illegal dumping of nuclear waste happened before regulation and oversite.

The focus of this chapter, then, is on how tensions between federal and state regulatory agencies led to placing the West Lake Landfill on a different trajectory than other radiologically contaminated properties in the area, and the impact that has had on local government, residents' feelings of risk, civic participation, and their ability to make decisions in the community. These tensions, which have continued to present day, are almost as old as the creation of many of the regulatory agencies themselves, and laws and policies regarding the disposal of waste and landfills. While residents and activists near the West Lake Landfill have attempted to challenge decisions made by federal agencies over the years, they made very little progress. As the last chapter discussed many properties in the area were contaminated due to Cold War era activities and have over time, undergone remediation and clean-up efforts. However, unlike the other properties, the West Lake Landfill has largely been the exception.

Regulatory agencies evaluate each contaminated site separately and evaluate and develop individualized plans based on a number of factors including level of contamination and future land use. Nevertheless, residents tend to see the 100+ Cold War era contaminated sites as overlapping with one another and often believe that if one property warranted the complete removal of contaminated soil, waste, or materials, why others wouldn't as well. The West Lake Landfill presents a complicated case which was further complicated with the discover of the subsurface smoldering event or as the locals refer to is as simply, an underground fire. Landfills, such as this one, are often under state and local oversight and independently owned, which often leads to various tensions when federal agencies make decisions about how best to manage sites that are also under their oversight. This creates multiple stakeholders and with this complexity often comes the silo-ing of responsibilities. While the purpose of the division of tasks is supposed to increase clarity, residents fear that because of this compartmentalized, no one is looking at and/or in charge of thinking about this issue as a whole. In short, residents do not live by a landfill, a smoldering event, and radioactive waste; they live by a radioactive and on fire landfill.

Residents argue that it is not just that physical and biological aspects that are putting them at risk, but also the ways in which these organizations are organized and make decisions that greatly impact their lives that puts them in harm's way and creates risk(s). As the quotes at the start of this chapter highlights, residents feel as though no one is thinking about the West Lake Landfill in its entirety, which greatly impacts their lives. However, while the security clearances and secrecy in the 1940s to late 1960s stifled and prevented public participation and civic engagement, the late 1970s and 1980s created space for it. Even with this newfound avenue for public participation and civic engagement, their suggestions, needs, and wants, have often not been taken under consideration.

The biggest determining factor as to why the West Lake Landfill has awaited remediation and has largely been set on a different trajectory than other contaminated sites is due to its status as a landfill. Before jumping into the more specific details about the West Lake landfill, I begin this chapter with an overview of environmental federalism and waste management. State and local governments initially had a difficult time both managing pollution and regulating nuclear things. As the federal government initially created regulations for clean air and water, regulations on all waste, including hazardous and nuclear waste, were much slower to roll out. As a result, the newly created regulatory agencies, the

Environmental Protection Agency (EPA) and Nuclear Regulatory Commission (NRC), were put in charge of monitoring the environment and the country's nuclear energy interests, respectively. But, they often, as this chapter will show, clashed with the state regulatory agencies and local governments.

Data from this chapter was gathered through a number of sources including archival documents of the Atomic Energy Commission (AEC), Nuclear Regulatory Commission (NRC), Environmental Protection Agency (EPA), Missouri Department of Natural Resources (MDNR/DNR); as well as newspaper articles, interviews with residents, and the public Facebook Group about the West Lake landfill. These sources pick up the story of what happened after the radioactive waste was illegally dumped in the West Lake Landfill. The waste sat for several years before it was discovery by a local newspaper journalist. The article not only informed the general public, but also the newly created regulatory agencies as well. Long before the smoldering event was discovered, state and local agencies, local government, and residents were at odds about who was responsible for monitoring the waste, remediation, and ultimately deciding what should be done. This has not been an easy nor smooth process, which is why this chapter addresses decision making from the middle 1970s up until the early 2000s.

Environmental Federalism

Up until the middle to late 1960s, the disposal of waste(s) was largely thought to be outside the purview of the federal government until there was mounting concern regarding pollution (Andrews 2010). Prior to the creation of regulatory agencies, individual states and local governments were charged with managing issues of pollution, but often lacked the institutional capacity to address issues of interstate pollution spillovers and were hesitant to impose sanctions on industry, which could result in economic disadvantages (Andrews 2010; Konisky 2015). Traditionally under local control, laws and regulations in individual states varied considerably and the federal government stepped in at this time to create national standards. To decrease environmental pollution, a series of federal acts were enacted, such as the Clean Air Act (CAA) of 1963 and Clean Water Act (CWA) of 1972 (CAA 1963; CWA 1972). While federalism has been conceptualized in a variety of ways, in this chapter, it refers primarily to the relationship between the national government and the states[29]. With shared governance, often came great tensions.

Negotiating shared governance has been largely a matter of the Supreme Court, which has been tasked with reconciling the conflicts between the national government and its constitutive parts (Merritt 1998; Rechtchaffen and Markell 2002). The tenth amendment grants states power and authority over matters not explicitly granted to the national government. However, what is often referred to as the supremacy clause, located in Article VI, Section 2 of the U.S. Constitution, "favor[s] national supremacy over the rights of states," in which federal power can outweigh that of the states (Kearney and Garey 1982b:15). For a time, this arrangement was viewed as "layer-cake" federalism (as cited in Kearney and Garey 1982b:15), due to its hierarchical nature, but some scholars rejected this characterization in favor of a model that reflected the collaboration and cooperation of the

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[29] While I refer to federalism as shared governance between the states and the national government, I do acknowledge that these relationships ebb and flow and are unequal. Additionally, in this relationship local governments are often collapsed within the category of state and in some cases, such as this paper, the local government tensions exist between local, state, and national governments. For other conceptualizations on Federalism see Daniel Elazar, *American Federalism: A View from the States* (2nd ed; New York: Thomas Y. Crowell, 1984); Daniel Etsy, *Revitalizing Environmental Federalism* (Michigan Law Review 95, 570, (1996); Deil S, Wright, *Understanding Governmental Relations*, (3rd ed; Pacific Grove, CA: Brooks/Cole Pub. Co, (1988).

various level of government and referred to as "marble cake" federalism (Elazar 1984; Grodzins 1960). Both terms refer to the strengths and difficulties of navigating the often-tense relationship between federal initiates and individual states. Regardless, with the passing of the CAA and CWA, the federal government provided a framework to states for the reduction in pollution (CAA 1963; CWA 1972).

In April of 1970, the first Earth Day was held and was "the largest nationwide public demonstrations that had occurred since the victory celebrations at the end of World War II" (Andrews 2010:226). Prompted by public pressure from citizens, the federal government began to address concerns about pollution (Andrews 2010). To manage the heightened awareness of environmental concerns at both the federal and state level, the early 1970s ushered in a new era marked with the establishment, dissolution, and re-organization of various government agencies, including the Environmental Protection Agency (EPA) (Andrews 2010; Percival et al. 2013; Rechtchaffen and Markell 2002; U.S. EPA 2014). In response to the mounting pressure and a desire to divert attention away from other more contentious debates about the Vietnam War and civil rights, the federal government created the EPA (Andrews 2006, 2010). The EPA was formed in December of 1970, as a federal agency focused on "research, monitoring, and standard-setting and enforcement activities to ensure environmental protection" (U.S. EPA 2014:1). Created through a presidential initiative by a conservative president, at its formation the EPA had solid bipartisan majority support and was given the power to regulate and impose federal mandates at the state level (Andrews 2006, 2010).

While the EPA was formed to set national guidelines and was ultimately responsible for carrying out federal pollution initiatives, state governments are able to play a role through passing their own laws using the federal policy as a baseline (Rechtchaffen and Markell 2002). This is widely known as "cooperative federalism" (Elazar 1984) and "collaborative federalism" (Agranoff 2001; Kraft and Scheberle 1998; Scheberle 2005). Consistent with this form of federalism, states gained authorization from the EPA to administer programs within their state (Percival et al. 2013). Individual states also created environmental organizations. For example, the state of Missouri created the Missouri Department of Natural Resources (MDNR) in 1974 to oversee the air, land, water, and mineral resources in the state and oversee landfills under their Solid Waste Management program (MDNR n.d.).

Federal/state relationships have, by all accounts, not been easy and clashes between individual states and the federal government are not uncommon. Throughout the 1970s, individual states have varied on the degree to which they sought primacy, better known as their level of commitment, to take the lead on the implementation of programs (Woods 2006). However, issues of radioactive waste management has been an area of particular tension (Bowman 1985; Kearney and Garey 1982a). At the close of the 1970s, some scholars described the situation as "dysfunctional federalism," (Walker 1981) and "contentious federalism" (Kearney and Garey 1982b). However, tensions are not always negative. Scholars have noted that in some cases where agencies were adversaries, it served to increase democratic governance as these conflicts were worked through (Farber and O'Connell 2017).

It is worth noting though, that the EPA is unlike other regulatory agencies which are independent commissions. It, instead, is much more suspectable to White House politics, in part because the EPA's senior officers and administrators change with each presidential regime (Andrews 2010). Therefore, since the 1980s, environmental concerns have served as a stand in for partisan conflicts about the degree of government regulation (Andrews 2010). As a result, "it has been chronically underfunded and subjected to increasing burdens of proof, oversight, and litigation; and with changes in presidential administrations, its priorities have repeatedly been subjected to radical swings and even attempts at fundamental reversal" (Andrews 2010:224).

Since it was not creation as an independent commission, there has been substantial differences in how the EPA operates, its budget, and agenda items when compared to other regulatory agencies and therefore has been subjected to a tug-of-war between federal, state, and local governments (Konisky 2011). While in the 1970s, the federal government has a great deal of control, in the 1980s, the Reagan Administration sought to shift even greater responsibility back to state and local governments and many federal programs faced significant cuts in federal funding, including the EPA (Andrews 2010). Tensions did not just begin and end with issues of federal and state power but were also present within and between the agencies themselves. For example, in 1989, the Federal Bureau of Investigation (FBI) and the EPA raided the Rocky Flats facility near Denver Colorado in an investigation of the Department of Energy (DOE) and its contractor (Abas 1989; Kauzlarich and Kramer 2010).

Throughout the 1990s, the EPA remained underfunded, and individual states argued that they were in a better place to regulate their own programs. Denise Scheberle (2005:73) writes:

> "Whereas state politicians resented the national government encroaching on state activities with little federal financial assistance, state agency officials resented the EPA and other federal officials prescribing what they should do in the field.

> Increasingly during the 1990s, state officials pointed out that they had increased capacity to run environmental programs, with more staff, greater expertise and technical understanding, and significantly increased state sources of funding."

Due to legislative gridlock, the George W. Bush and Obama Administrations have both used the tools of the administrative presidency to advance environmental goals (Klyza and Sousa 2007; Konisky and Woods 2016; Rabe 2007). Additionally, the relationship between some states and the EPA has been largely characterized as antagonistic and some states have accused the EPA over the years, of failing to take action and failing to carry out its duties (Konisky and Woods 2016; Scheberle 2005). While there is no way to tell what legacy the Donald Trump Administration will leave, it has thus far, been marked by the roll back of environmental regulations (Konisky and Woods 2018).

Waste Management: From Municipal to Radioactive

The last section discussed the creation of federal regulatory agencies, this section addresses more broadly issues of waste. While federal regulations on clean air and water began to take shape in the 1970s, the management of waste took much longer to roll out, with the management of hazardous and radioactive waste taking even longer. Prior to 1965, very little national attention was given to waste management. Up to the beginning of the 20th century, households created most of what they consumed; items were used until they were worn out and then often transformed into something else, rather than discarded because they were no longer *wanted* (Strasser 2000). However, "industrialization broke the cycle. In an industrial system, the flow is one-way: materials and energy are extracted from the earth and converted by labor and capital into industrial products and byproducts, which are sold, and into waste, which is returned to the ecosystem but does not nourish it" (Strasser 2000:14–15). As "there is no waste in nature," the concept and construction of waste is of human design (Shukin 2009:71). Once waste left the control of households and the purview of the domestic sphere, it became something that needed to be managed. In short, "For the first time in human history, disposal became separated from production, consumption, and use"[30] (Strasser 2000:109).

Before attempts at state or federal policy, environmental regulation, including dumping waste and landfills, was under the responsibility of state and local governments (Percival et al. 2013). As regulation was minimal, discarded materials were often dumped directly in rivers and waterways and/or were dumped in unlined and unregulated landfills (Horinko and Courtin 2016). With few protections, areas thought of as "commons" became contaminated and resulted in a whole host of unsanitary conditions like odors, rodents, and fires (Horinko and Courtin 2016). The first attempts at solid waste management in Missouri did not occur until 1955, but was largely ineffective at overall pollution reduction, because it was left up to each individual county to adopt the law, (Hull 1999).

The first attempt at a national policy regarding waste was passed by Congress was the Solid Waste Disposal Act (SWDA) of 1965 (SWDA 1965). The Act acknowledged economic growth and increases in manufacturing that created an increase in discarded material. It was a federal attempt to improve waste technology (SWDA 1965). The Solid

[30] In addition to a social process of sorting what is useful and what is not, trash was also viewed as an important facet of class distinction and a civic concern. While early sanitation reformers were concerned about sanitation, health, and hygiene, they were faced with resistance and out-right refusal of friends and neighbors who saw trash collection as a violation of their civil rights and as part of an important social contract between their households and the people who came calling at their doors for unwanted items (Civic Improvement League of St Louis 1906; Strasser 2000).

Waste Disposal Act provided a framework for landfills (SWDA 1965) and funded a survey aimed at taking stock of current practices of waste management.

In the state of Missouri, the survey concluded that "solid waste management in Missouri was largely unplanned and was causing serious threats to public health and the environment" (Hull 1999:2). This gave way to the Missouri Solid Waste Management Law of 1972, which required local governments to create a plan to manage solid waste and outlawed open dumping (Hull 1999). These plans were somewhat slow to roll out, and open or "midnight dumping," had been a relatively common industrial practice with very little consequences (Szasz 1994).

The management of hazardous and radioactive wastes proved to be much more difficult to manage. Until the mid 1970s, hazardous waste was largely unregulated and industries who generated hazardous waste(s) tended to use land disposal methods such as burial, and/or on-site in ponds or pits (Bowman 1985; Szasz 1994). The creation of hazardous chemical and radioactive waste(s) largely took a turn during World War II, as the federal government partnered with industries in an effort to win the war. When then president Harry S. Truman signed the McMahon/Atomic Energy Act of 1946, which was later renewed in 1954, creating a civilian controlled federal agency tasked with overseeing the development, control, and use of atomic energy (U.S. AEC 1946), Congress never tasked the AEC with creating policies or monitoring its environmental impact (Kramer and Kauzlarich 2011). Therefore, nuclear waste and its management continued to be an area of great tension between the competing aims to make nuclear weapons quickly and attending to its public health and environmental impact. This was evident both within the culture of the AEC, and in its guidelines, as a former general manager of the AEC stated, "Nobody got brownie points for caring about nuclear waste" (Steele 1989:18).

The AEC did, however, dispose of waste in a number of ways including burial in the ocean, dilution and dispersion, and shallow land burial (SLB) (Ryan, Lee, and Larson 2007). The use of ocean burial was sought for low-level wastes, "Because most radionuclides have short half-lives, many believed that dilution in ocean water plus decay would result in innocuous levels of radiation and pose minimal hazards to man [sic.]" (Ryan et al. 2007:7). While ocean disposal continued until 1970, land disposal was cheaper, and "disposal generally involved clearing and grading the land and excavating shallow unlined trenches - generally less than 50-feet (15-m) deep - that would be used to receive the waste" (Ryan et al. 2007:9). Neither land nor ocean burial, was seen as long term solutions, as the ocean burial of steel drums were estimated to last 10 years, and by the 1970s, many of the shallow land burial (SLB) sites were leaking into nearby ground water (Ryan et al. 2007).

For the decades that followed the second world war, industry continued on without a long-term plan, and continued to put off regulations under the assumption that it was only a matter of time before a technological fix would present itself and a, "practical, safe ultimate disposal systems will be developed" (as cited in Walker 2009:1). Therefore, nuclear waste was thought about as something that could be attended to at a later date, and most scientists and state and local governments were not in a position to challenge such claims not only because the nuclear weapons production was a relatively new industry, but also due to the cost of clean ups (Kearney and Garey 1982a:16). Richard Kearney and Robert Carey (1982a:16) stated:

> "Moreover, since the federal government alone could afford the costs of nuclear technology development, and had, since the 1940s, employed (along with corporations such as Union Carbide which did its research) most of the non-university nuclear scientists, state or local governments had little of the capital or human resources necessary to challenge the AEC's optimistic predictions that nuclear waste problems would be solved."

Therefore, by the early 1970s when the federal government began to pass legislation regarding pollution and waste, there was already a significant hazardous waste problem.

When Congress was tasked with creating new policy to regulate the previously unregulated waste, it gave way to fierce debates. Having been unreported for so long, no one knew how much waste was present, where it was located, and how it was impacting the environment (Szasz 1994). In designing policy, much came down to the fundamental question of whether to regulate production and products, or its eventual disposal (Szasz 1994). While a strong case could be made for intervening in the production process to limit substances from becoming hazardous, to do so would no doubt limit production and hinder the free market (Szasz 1994). The chemical industry itself was one of the most vocal critics of production regulation and wanted to limit their liability and responsibility for environmental impacts (Szasz 1994). Waste generators lobbied congress on the grounds that they did not want production regulated and also did not want to be liable for where their waste ended up (Szasz 1994). In short, "liability, they argued, should then pass to the party in physical possession of the wastes" (Szasz 1994:20).

While many of the regulatory agencies were created in the early 1970s, most of the governing policies regarding the reporting and disposal of materials did not occur until later.

The first national program to "regulate the treatment and disposal of hazardous waste" passed in 1976 and replaced the "Solid Waste Disposal Act of 1965," was known as the "Resource Conservation and Recovery Act" (RCRA) (Szasz 1994:11). In the end, the RCRA tasked the EPA with identifying toxic hazards and creating standards in terms of tracking hazardous waste "from cradle to grave" and regulating how waste was transported (Szasz 1994). Rather that bearing the burden of finding more sustainable practices, the RCRA limited the responsibilities of the waste generator to maintaining records; packaging and labeling toxic substances; following federal and state regulations; and when required, disposing of material/waste in a proper manner (Szasz 1994).

The other important facet of the management of waste then, was the regulation of sites and manner of disposal. Since open dumping was relatively common prior to the mid 1970s, companies now had to factor into their production and budgets the management of their own by-products and waste, often referred to now as "externalities" (Commoner 1977). After all, open dumping and on-site disposal was much cheaper than having to pay to transport waste, elsewhere. In terms of creating and maintaining waste facilities, the federal government did not want to get into the management of waste but rather opted to "create a demand for, but would not take an active role in providing, the network of facilities that would be essential to make the system work" (Szasz 1994:23). The lack of infrastructure early on created some difficulties, but nationally "hazardous waste" would not emerge as a mainstream public issue until the 1980s. Sadly, in anticipation of the RCRA passing, reports surfaced that this actually spurred waste generators to move quickly to dump hazardous waste before doing so became illegal (Szasz 1994).

That is not to say that the federal government did not attempt to address the areas in which they created radioactive and hazardous waste(s). The federal government did create two government programs to clean up hazardous waste. The first, initiated in 1974, was the Formerly Utilized Sites Remedial Action Program (FUSRAP). Its purpose was "to identify, investigate and clean up or control sites throughout the United States that became contaminated as a result of the Nation's early atomic energy program during the 1940s, 1950s, and 1960s" (U.S. Army Corp of Engineers n.d.). The program was initiated under the AEC but was later transferred to the Department of Energy (DOE) and officially began cleaning up sites in 1979 (Navarro Research and Engineering, Inc 2018). Many contaminated sites in St. Louis were or have been slated for cleaned up under FUSRAP.

The second program aimed at cleaning hazardous waste sites passed in 1980. The Comprehensive Environmental Response, Compensation, and Liability Act (CERLA), most commonly referred to as the Superfund, was created for sites contaminated with hazardous material due to industry. Both programs have very detailed guidelines. For example, in order to qualify as a site, research is conducted to determine eligibility. For sites to be cleaned up under FUSRAP, it must not be eligible for Superfund status, but it must also warrant the likelihood of a CERLA response (Navarro Research and Engineering, Inc 2018).

Risk, Decision Making, & Civic Engagement

The creation of environmental regulatory agencies did not just usher in a new era of oversight, it also created tools and differing ideas about how to make sense of environmental problems. The birth or the nuclear age and unregulated industries had created enormous amounts of pollution and the EPA and state agencies were tasked with evaluating and creating various plans to clean up sites. However, residents themselves wanted to weigh in on how these sites were addressed within their own communities. This section provides an overview of how both agencies and lay people understand and conceptualize risk and how that impacts civic participation, trust, and decision making.

Beginning in 1984, EPA administrator, William Ruckelshaus, suggested the term "risk assessment" as a tool to reduce variables into a probability, where each variable is reduced to a numerical value and weighed using a population (Andrews 2006:266). By the end of the 1980s, this became the dominant language to justify EPA decision making (Andrews 2006). Decisions stem from what are considered objective calculations, but most often decisions are not based on the alternative that reduces risk to zero, but rather it weighs possible damages against economic prosperity (Andrews 2006). As variables are understood as being objective proxies, which includes accounting for the general public itself, there is often very little room for lay people's voices within this system. In short, it is likened that decisions are made using risk calculations and the answers are based on mathematical equations. Therefore, input from the lay public is seen as having little to add to the scientific process (Andrews 2006; Fischer 2000; Mehta 2005; Szasz 1994).

What often goes unacknowledged is in times of uncertainty, where little information about variables are known, experts make judgement calls and/or symbolic links, namely what Lee Clark (1999:71) calls "apparent affinities" as a way to estimate variables[31]. In this way, science and society are said to be coproduced which, "…suggests that the state's

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[31] Within nuclear and chemical studies this often means using animal testing to stand in for people. For more information see: Lee Clark's Book *Mission Improbable: Using Fantasy Documents to Tame Disaster* (University of Chicago Press, 1999); and Donna Haraway's book *When Species Meet* (University of Minnesota Press, 2008) which discusses ideas of human supremacy in the human use of lab animals.

instrumental goals, the knowledge's and practices adopted for achieving them, and the applicable standards of credibility and legitimacy are all constructed together through a unitary process of ordering the world" (Jasanoff 2005:23). When executed in this fashion, science and its eventual decision making is often regarded as objective, but studies in science and technology have shown that experts often do not acknowledge their own embeddedness, and that science itself is socially constructed. In addition, knowledge cannot easily be divorced from the institutions, systems, and disciplines that create it (Irwin and Wynne 1996; Jasanoff 2005).

Nor does it acknowledge how lay people draw on science in their own claims. Studies focusing on the public understanding of science and technology (PUS/PUST) often counter claims that lay citizens are simply not educated enough to make decisions about complex problems, by instead showing how lay people can present a much more nuanced analysis of the situation (Irwin and Wynne 1996). While lay people are often not privy to the same type or sources of information as that of experts (Fischer 2000), they sometimes have a much more sophisticated understanding of how processes and systems interact and work within the contexts of their lives, than that of outside experts (Irwin and Wynne 1996; Sharp 1952; Wynne 1996). In some cases, where experts have not acknowledged this, it has led to disastrous results (Irwin and Wynne 1996; Sharp 1952; Wynne 1996).

Additionally, lay people often lobby for the importance of considering subjective understandings that also account for their lived experiences and how environmental circumstances impact life chances (Brown 1992; Epstein 1996; Gibbs 2011). Mary Douglas and Aaron Wildavsky (2010:73) consider this as they take a much more socially constructed and culturally embedded idea of risk when they suggest, "Thinking about how to choose between risks, subjective values must take priority. It is a travesty of rational thought to pretend that it is best to take value-free decisions in matters of life and death." This highlights the tension between risk as an objective calculation and those who have to live with its subjective impacts.

For a signification portion of the nuclear and hazardous waste industry, their practices and decisions were often black boxed from public scrutiny. For example, top-secret security clearances and executive orders shielded the nuclear industry (Gusterson 1996; Zwicker 2005), while industry benefited from a lack of policy, promises of economic development or lack thereof, and property rights. But, by the late 1960s and early 1970s, a tide had changed, and with it, a series of events brought issues of science, trust, and credibility into the mainstream. Rachel Carson's book, *Silent Spring* (2002), questioned and challenged the chemical industry to consider its long term effects and impacts to the environment and those that depend on it for survival. Carson's book has continued to be a poignant reminder that, while science and technology have brought about many advancements, it has often done so at the determent of the environment (Carson 2002).

The late 1970s and 1980s, led to organizing and activism among civilians of both the nuclear industry and environmental pollution and protections. Anti-nuclear protests gained significant momentum both domestically and abroad by not only challenging the ideas about scientific safety, but also by focusing on the social parameters of risk (Jasper 2016; Joppke 1993). In particular the sitting of nuclear reactors, landfills, and the continued difficulties in finding long term solutions in radioactive waste, led to the widespread distrust and issues of scientific credibility in general, but also brought about the 1975 dissolution of the Atomic Energy Commission (AEC), in particular (Hoos 1978; Zinberg 1979). In Missouri, Leo and his wife, Kay Drey, along with some other notable people including Lewis Green, Barry Commoner, and Alfred Kahn, formed the Missouri Coalition for the Environment (MCE) in 1969. This became the "first citizen-based action group in the state," which is still active today. The coalition's main purpose is the conservation of Missouri's natural resources by educating Missourians about environmental policy and its effects (MCE n.d.:1).

Nationally other high-profile cases slowly began to emerge, beginning and throughout the 1980s, that focused on the environmental and human impacts of hazardous waste dumping. Perhaps the most famous cases are Guilford, Connecticut, Alsea, Oregon, and Love Canal, NY (Brown 1992; Edelstein 1988; Gibbs 2011; Tesh 2000). The media was quick to pick up these stories both nationally and internationally, and the impact that toxic waste could have on the health and safety of communities was pushed to the forefront (Brown 1992; Bullard 2000; Edelstein 1988; Jasanoff 2008). These stories often highlighted the clash between regulatory agencies and the citizens these agencies were tasked to serve (Brown 1992; Edelstein 1988; Tesh 2000). Studies show that communities who are experiencing negative environmental and/or health outcomes are often pitted against experts in search of an objective scientific truth or certainty, which most often evades them, have become somewhat common place (Brown 1992; Edelstein 1988; Tesh 2000).

What these controversies reveal is not only differing conceptions of risk, but controversies have a way of blurring the line between what is recognized as "unquestionably technical" and "unquestionably social" (Callon et al. 2009:25). Most issues of regulatory decision making are viewed as simply a technical issue. As such, they are largely removed from public influence and debate (Callon et al. 2009). Recognizing the social dimensions of the problem, and who may or may not be affected, increases the discussion in the political arena and often the people involved (Callon et al. 2009). Socio-technical controversies often result in unexpected problems with unforeseen effects. As more information is revealed, more actors may come forward. Uncertainty may increase as the number of actors do, which makes closure that much more complicated.

St. Louis: Selling the Residues and Negotiating the Waste

As discussed in the last chapter, toward the end of the 1960s, the Atomic Energy Commission had undergone intense public scrutiny and mounting distrust. Much of their activities and the way that they operated created countless hazardous and toxic sites because they were never directly charged with protecting the environment. In the end, "…virtually every weapons production facility is or has operated in violation of one or more environmental laws, the organization as a whole could be viewed as a "culture" of non-compliance" (Kramer and Kauzlarich 2011:117).

By the middle 1960s the U.S. had substantial reserves of uranium and had accumulated a sizeable arsenal of weapons and was no longer interested in purchasing the uranium or further production (Malin 2015; Schwartz 1998). In St. Louis, the Weldon Springs plant, where after WWII the AEC production had expanded to, was shut down in 1966 (St. Louis Remediation Task Force 1996). Much of the production waste accumulated at Weldon Springs, a property owned by the federal government, was stored in quarries and pits on site (Davis and Puro 1999; Henderson 1971). The Weldon Springs location was an expansive 17,000 acres and largely away from residentially populated areas (St. Louis Remediation Task Force 1996). However, the AEC also had acquired the 21-acre SLAPS site, which had grown tremendously over the decades to over 100,000 tons of material

(Alvarez 2016; Schneider 1990; U.S. AEC 1964). As discussed above, hazardous and radioactive waste had just been accumulating in hopes that a solution would eventually be found.

As the weapons production boom was winding down, the AEC decided that it would put the material at SLAPS up for sale (U.S. AEC 1964). After shipping the most of the on-site material, by rail, to Colorado, the Cotter Corporation in the spring and summer of 1971, the Cotter Corporation communicated with the AEC about what to do with the material in which they deemed had no value and/or for which "no utilization then existed or now exists" (Henderson 1971:29). When the AEC originally listed the material for sale, it did so under the agreement that a buyer must take *all* the material at the site, this included spent barium sulfate and approximately a thousand drums, "contaminated with trash, that is items such as bricks, clothes, boots, gloves, and the like" (Henderson 1971:29). But, while the AEC was still in charge of regulating the material, it no longer saw itself as responsible for it, nor did it see the problem of what to do with the waste as something they should solve.

As stated above, this was before the creation of the regulatory agencies and oversight, at during a time when open dumping was common. With only a few hazardous waste storage facilities across the country, rather than transport the waste hundreds and/or thousands of miles away, the Cotter Corporation made attempts at negotiating adding their waste to the already sizeable amount of similar waste at nearby Weldon Springs (Henderson 1971; Marcott 1972). Further, they alleged that in the original sale ad, the AEC stated that after processing the purchaser of the residues could dispose of what they no longer could use in the Weldon Springs Quarry[32]. But, the AEC rejected this plan on the grounds that operations at Weldon Springs had ceased production in 1966 and that they, "would be uninterested, therefore, in adding to our limited existing surveillance responsibility at the site…we would be happy to reconsider and evaluate any mutually beneficial proposal you might wish to offer" (Sapirie 1969:1). In short, the AEC was might have been willing to consider it, if Cotter agreed to share the cost of the long-term maintenance of the waste[33].

It appears then that Cotter proposed burial of the material on the Latty site itself, but was met with a different set of road blocks, and were told that any burial of radioactive waste must be owned by federal or state government and that, 'Cotter Corporation might be required to provide for perpetual maintenance of such a burial site" (Henderson 1971:1). This is somewhat ironic since based on documents waste was already buried at SLAPS, presumably put there by the AEC (Airport Committee 1965). Therefore, having just sold the waste, AEC did not want to responsible for it again.

Still trying to make a case, now that they were unable to bury it onsite, Cotter told the AEC that they looked for alternatives, but the nearest place to dispose of the material was quite a distance away, and outside of their budget (Henderson 1971). They stated, "The

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[32] Namely, while Cotter Corporation purchased the materials to processes, they argued that the AEC should be responsible for the long-term material agency of the waste and that they should be allowed to dump the waste into the Weldon Springs site "as per the original 1960 proposal" (Marcott 1972:13). It should be noted that while Cotter based this on a document prepared by Walter J. Haubach, this wording does not appear in the ad (Marcott 1972). It is possible that this appeared on earlier sale ads, but not subsequent ads, but this could not be substantiated through the archival data I found (Marcott 1972; U.S. AEC 1964). It is possible, though unconfirmed, that they were refereeing to the "Interim Radioactive Waste Burial Program," that was briefly set up by the AEC from September of 1962-August of 1963 which was set up as a temporary measure until commercial disposal became available (Ryan, Lee, and Larson 2007). However, land burial of low-level wastes was available at, at least six land burial sites, including the Sheffield, IL site which was over 200 miles away and is likely the site they referred too.

[33] While the Cotter Corporation was seeking storage of thousands of tons of waste and was ultimately refused, the Weldon Springs site was eventually remediated by the DOE in the late 1980s and its disposal cell encases 1.48 million cubic yards of radioactive waste (Kirby, Smith, and Wilkins n.d.)

$150,000 they had allowed for on-sight disposal is to be compared with an estimate of $2 million they have received from the Nuclear Engineering for commercial disposal at a site about 200 miles away" (Henderson 1971:25). Bearing in mind that the residues were purchased for around a dollar a ton. The AEC then counters by asking for a breakdown of the 2-million-dollar estimate, as they state this seems uncharacteristically high (Henderson 1971; Marcott 1972). Behind the scenes it seemed that directors at the AEC struggled with what to do with Cotters proposal (Henderson 1971). On one hand, they stated that due to the nature of the waste, that the quarry was out of the question, but that "there is a much more acceptable alternative in the Weldon Springs area… the AEC-controlled raffinate pits," and that "it would cost substantially less and be considerably safer to truck the residues to Weldon, where they can be direct dumped in pit 4, than to transport them across country. AEC could conceivably negotiate a charge to Cotter for disposal in the pits…[and] some crudely estimated cost for later stabilizing the residues" (Henderson 1971:22). In the end, they struck to their agreement and their contract, which was for the removal of *all* the wastes (Henderson 1971; Marcott 1972). This was all no doubt further complicated by the AEC's and Cotter Corporations, history together with one another, which often was tumultuous.[34]

Illegal Dumping & A Federal Investigation

In articles published in the *St. Louis Post-Dispatch* in May and June of 1976 reporter Mary Freivogel questioned the validity of a federal investigation regarding the dumping of

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[34] According to the book *Yellowcake Road: Cotter Corporation's Unfortunate Journey from Nuclear Waste Production to Nuclear Waste Recycle*, (Boughton 2009), David Marcott, "testified before the Subcommittee on Raw Materials on June 19, 1962 imply improper conduct on the part of the AEC" because he felt his mill was not getting equitable treatment.

radioactive waste (Freivogel 1976a, 1976b). As discussed above, throughout the decade of the 1970s, the federal government had taken on the task of managing environmental pollution and had created the EPA to help carry out its aims (Andrews 2006, 2010). For half of the decade the AEC, was in charge of the nuclear industrial complex, but by 1975 public opinion of the agency had soured (Hoos 1978; Zinberg 1979). The Energy Reorganization Act of 1974 dissolved the AEC and the former responsibilities of the AEC was divvied up and a new agency called the Nuclear Regulatory Commission (NRC) was placed in charge of managing nuclear energy (Energy Reorgination Act of 1974 1974).

While greatly needed and initially welcomed by states who often found themselves ill equipped to manage pollution and nuclear energy; but not all felt this way, and many were eager to re-gain regulatory control (U.S. NRC 2018). Under the Atomic Energy Act of 1956, individual states could enter into an agreement with the NRC to regain regulatory authority over nuclear energy (U.S. NRC 2018). States that do so are considered, "Agreement States" (U.S. NRC 2018). Missouri has never been an agreement state and as such, the AEC and later the NRC assumed regulatory control over the state nuclear waste and activities. In Freivogel's article she alleged that in 1973 under AEC oversight that radioactive waste was illegally dumped in a local landfill (Freivogel 1976a).

Her report claimed that the AEC first became aware of the dumping of radioactive waste in April of 1974, six months after it had taken place (Allen 1974). In 1972, as Cotter attempted to negotiate with the AEC about where to place the waste, they also began working with a local Missouri company called B&K Construction Company Inc., to both load and ship by rail the remaining "mineral residues" to Colorado and later to, restore the site and haul radioactive mineral residue to the Weldon Springs disposal area (Cotter

Corporation 1972). What transpires from here, remains to this day very contested, but, what is more-or-less know is, on July, 16, 1973, haulers were hired to transport, what the landfill facility claims they were told was clean fill dirt, from Latty Ave to the West Lake Landfill (Alvarez 2016; Bowers et al. 1989b). Over the next few months, several hundred trunksful were dumped, totaling approximately 38-39 thousand tons (Allen 1974).

In April of the following year, the AEC discovered during an inspection that the company dumped waste in the local landfill. It was determined that a mixture of surface soil and., "…approximately 8700 tons of leached barium sulfate (Ba SO_4) which contained about 7 tons of natural uranium (0.05 to 0.10%) [was taken] to a land fill area near St. Louis, Missouri, as part of their decommissioning of the Hazelwood site" (Allen 1974:1). B&K Construction claimed that it spread the barium sulfate, "which is a whitish, easily distinguishable heavy compound, over a considerable part of the 7-acre Hazelwood Site and then remove[d] it along with approximately 12 to 18 inches of the surface soil. The purpose was twofold, to disperse and dilute the uranium Ba SO_4 and to decontaminate the entire top surface of the site which had been used for storage of uranium ore residues since 1966" (Allen 1974:1).

There was likely another reason the material was mixed with soil which had to do with regulations at the time. Mixing soil with the radioactive material was one way to dilute it enough, as to not need any special consideration. In short, it created a loophole where regulations could be circumvented. According to the commission's regulations (10 CFR 40.13), there were some conditions in which source material is deemed "unimportant" namely if the, "…source material is by weight less than one-twentieth of 1 percent (0.05) … (U.S. AEC 1967). Through mixing, they surmised that they *made* the source material unimportant and as such, they could dump it where they pleased. It was then taken to, "St. Louis County sanitary land fill area No. 1 on Old Bridge Road" (Allen 1974:5). During the inspection, it is noted that Cotter had violated regulations because they had dumped licensed material in an unauthorized manner. In fact, "the licensee disposed of 3.5 times the quantity allowed by regulation" (Allen 1974:1). The inspectors were told by B&K Construction, the subcontractor that dumped the waste, that the waste was unrecoverable as, "the site received on the average of two to three hundred truckloads of refuse and garbage each week…. B&K Construction Company, the licensee's contractor, estimates that the material is probably buried under 100 feet of garbage at this time" (Allen 1974:1). While it is unclear exactly who made the decision, both Cotter Corporation and B&K Construction Company appear to be the ones who benefited from it the most.

Perhaps the most interesting aspects of Freivogels' investigative journalism and newspaper articles was the glaring inconsistencies she found within the federal inspection report (Freivogel 1976a, 1976b). First, she notes that, AEC records show the waste was dumped in "St. Louis County Landfill No. 1," but she highlights that no such place actually exists (Freivogel 1976a:1). Through interviewing B&K Construction, she confirms that the waste was taken to the West Lake Landfill (Freivogel 1976a). She noted, this was of particular concern because the West Lake Landfill was briefly closed in 1974 because it was found to be leaking into nearby soil (Freivogel 1976a). Second, during her reporting, while the official record stated that the leached barium sulfate was mixed with about 5 times as much soil, B&K Construction stated that it dumped less than 9,000 tons, which the newspaper said they confirmed through a second source (Freivogel 1976a). Cotter Corporation when asked, was both adamant that they dumped 40,000 tons because they had records to prove it, and also accused B&K Corporation for swindling them out of money if they hadn't (Freivogel 1976a). Third, she questioned the report's conclusions regarding the safety of local citizens if federal regulators have incorrect records of the "strength, volume, and location" of the dumped waste (Freivogel 1976a:1). In the end, all parties pointed fingers at each other. B&K Construction would later claim that it was told to dump the material by the Cotter Corporation (Freivogel 1976a). Cotter Corporation will later claim that they had no idea what was taking place and simultaneously claim that the AEC was aware of what was happening (Barker 2015). And it was difficult to forget, that the AEC, while also accused, was not only the ultimate overseer of the radioactive material but also in charge of the investigation and subsequent reporting. Within a year of the investigation and report, however the Atomic Energy Commission was dissolved.

Tensions Between Federal-State Relationship & Local Government (1970s & early 1980s)

For all the inaccuracies and false records, all parties involved stated that the waste was low-level and not immediately harmful to citizens (Freivogel 1976a, 1976b). The articles got the attention of local citizens and the newly created Missouri Department of Natural Resources (MDNR). While the waste was illegally dumped under AEC oversight in 1973, the state of Missouri didn't create MDNR until 1974 (MDNR n.d.). Now, just two years old, and as the state overseers of Missouri's solid waste management program, MDNR learned about the presence of radioactive waste in one of its landfills in the newspapers, much like everyone else. The day after the June article was published, Kenneth Karch, director of the Division of Environmental Quality, sent a letter to the U.S. Nuclear Regulatory Commission, and questioned the validity of the investigation into the waste (Karch 1976). He questioned the inaccuracies mentioned, but also stated that he was alarmed by other issues, beyond not having the correct physical location of the landfill and/or questioning the exactly the amount dumped.

The West Lake landfill is located in Bridgeton, Missouri and is an unlined landfill that resides in the floodplain of the Missouri River (Leiser 2006a). In the 1950s an old rock quarry was converted into a landfill complex and collected waste from the greater St. Louis area until the final section of the complex, stopped collecting waste in 2004 (Republic Services 2014a). Like the article, Karch pointed out that the area in which they state the waste was dumped was closed in 1974 and "may be in direct contact with groundwater. It has no monitoring wells to permit evaluation of groundwater" (Karch 1976:1). He then further questioned the investigation by pointing out that the report claimed that the waste was buried under 100 feet of fill, which he states was impossible since, 'The depth cited must be incorrect since no landfills in the St. Louis area contain 100 feet of fill" (Karch 1976:1). These falsehoods might have been easier to slip by federal investigators who were not familiar with the area, its locations and geology, but he questions how exactly can the health and safety of the area can be confirmed when such important details about where it was and the depth of burial had been wrong and when that particular area of the landfill was not being monitored, (Karch 1976)? He also requested that he be given records and locations of other burial sites in Missouri (Karch 1976).

With the AEC dissolved, it could no longer address the report, and its subsequent responsibilities were divided among several agencies. The newly minted Nuclear Regulatory Commission (NRC) responded that since the Cotter Corporation was a former licensee of the AEC, it would re-investigate the site, but that the "Energy Research and Development

Administration has no responsibility with regard to this material" (Keppler 1976:1). The letter went on to note that AEC and NRC regulation 20.304 does not require the reporting of burial sites of low-level wastes and therefore cannot provide MDNR other possible locations (Keppler 1976). Conducted in June and August of 1976, the report was delivered to MDNR a year later in June of 1977 (Keppler 1977). After interviewing the various stakeholders including Cotter Corporation, B&K Construction, superintendent of the landfill and visiting and testing both Latty Ave and the West Lake Landfill, the report concluded Cotter Corporation and B&K Construction did dispose of waste in an unauthorized manner (Keppler 1977; U.S. NRC 1977).

The report also indicated some unexpected findings. First, rather than being 100 feet underground, the waste in the West Lake Landfill was close to the surface and buried about 3 feet deep and this discrepancy was the "offhand opinion' of the licensee (U.S. NRC 1977:3). Second, readings at the Latty site indicated, "radiation levels exceeding NRC criterial for…unrestricted use" and at the West Lake Landfill, "one environmental sample showed a slightly elevated natural uranium concentration," but that "neither site presents an immediate radiological health hazard." (U.S. NRC 1977:3). Finally, using conservative estimates the report notes that due to the concentration of uranium, there was a concern for, "increased airborne concentration of radon 222 and its progeny, directly over buried materials," but the report estimated that this "would be indistinguishable from background within a few hundred feet from the landfill" (U.S. NRC 1977:4 & 11). Groundwater at the site was not tested (U.S. NRC 1977).

The report seemed to acknowledge that the company violated policy by dumping licensed material in an unlicensed manner. They also stated that the attempt to make it an unimportant or unlicensed was not in accordance with regulations. The NRC stated, "the disposal did not appear to be within the intent of the Commission's 10 CFR 40 regulations…concerning alteration of source material to obtain a mixture no longer subject to licensing" (U.S. NRC 1977:9). Regulation 10 CFR 20 states that, "…a licensee may bury up to two tons of natural uranium per year (in twelve increments) …concerning depth (4 feet) and spacing (6 foot spacing between locations) Thus, in four years, eight tons could be disposed of in a forty-eight one-sixth ton batches buried in a grid with six foot centers. Such a grid would compromise an area significantly smaller than that found in this case, while containing about the same quantity of disposed uranium" (U.S. NRC 1977:12).

Meaning, the company could have used a grid like pattern to dispose of the material, which based on Cotters records contained, "0.05% to 0.1% or approximately 7 tons of uranium U_3O_8," over the four year time period that it was in their possession (U.S. NRC 1977:2). However, this is isn't at all what they did. Instead they tried to circumvent the policy that forbade the dumping of licensed material by mixed the material with soil in an attempt to make it diluted enough to not need regulation, as shown in Figure 17. Then, dumped it over a series of months in an area that was three feet deep, instead of four, and over a much larger area than it would have been if they used the grid like pattern outlined in regulation. Not to mention the landfill was told it was clean fill dirt and it was dumped in an area that had been closed due to possible groundwater contamination and lack of monitoring. The report makes the rather odd conclusion that the company did dump the waste illegally but could have legally dumped and buried it under other circumstances. The investigation concluded that since they could not identify a "radiological hazard by any pathway," that it did not present an immediate threat, but they recommended more testing. (U.S. NRC 1977:12).

§ 20.304 *Disposal by burial in soil.* No licensee shall dispose of licensed material by burial in soil unless:

(a) The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed, at the time of burial, 1,000 times the amount specified in Appendix C of this part; and

(b) Burial is at a minimum depth of four feet; and

(c) Successive burials are separated by distances of at least six feet and not more than 12 burials are made in any year.

§ 20.305 *Treatment or disposal by incineration.* No licensee shall treat or dispose of licensed material by incineration except as specifically approved by the Commission, pursuant to §§ 20.106(a) and 20.302.

Figure17. Regulation CFR 20.304.
Data Source: U.S. Atomic Energy Commission (1967:33)

It's impossible to know the exact motivations as to why the waste was allowed to remain in the landfill in spite of the violations and/or why an exception was made based on what could have been done. It was likely that some of these decisions were related to the national concerns about the storage of low-level wastes. During the late 1960s and 1970s, there were six facilities across the United States that accepted low-level wastes, but by the early 1970s, contamination had emerged as a problem of serious concern (Ryan et al. 2007). At the time specific packaging requirements did not exist so radioactive waste often was put into a container and dumped in trenches on a first come first served basis (Ryan et al. 2007). After several years of operation, a few of the facilities suspended their operations due to a variety of issues related to the faulty containers leaking, which were so concerning that governors in two states suspended operations due to packaging and transportation issues (Ryan et al. 2007). For a time, virtually all of the countries low-level waste (LLW) was shipped to the sole facility accepting waste, in Bamwell, South Carolina (Ryan et al. 2007). Fearing it would continue to be the nation's dumping ground the state's governor requested in 1979 that operations be scaled back and it is worth noting, that out of all the facilities, this one had the highest disposal fees (Ryan et al. 2007).

Therefore, it was possible that the waste in the West Lake Landfill remained because it wasn't viewed as an immediate risk, and by the middle and late 1970s, storage facilities were few and far between[35] and had become quite costly. It also aligns with the ideology that unless there was proof of a clear and present danger, the state should not intrude on the rights of private property owners (Markowitz and Rosner 2002). Instead, the NRC called for further review of the site, likely to see if the site would or could became a risk, of significance, to the surrounding public. This served to delay action at the site and was a decision with its own set of consequences. As Markowitz and Rosner (2002:10) note, "the call for more scientific evidence is often a stalling tactic," and more information does not necessarily produce clearer results. More investigations not only take a significant amount of time to execute, sometimes years, but also more investigations bring about more uncertainties. As is often the case, "more uncertainty demands more knowledge, more knowledge increases the complexity, more complexity demands more abstraction, more abstraction increases uncertainty" (Van Loon 2002:41).

This was indeed the case as through later on-sight investigations of the landfill other wastes were discovered including paint sludge, and substantial amount of chemical waste

[35] The Sheffield, Illinois location, that Cotter was most likely referring to years earlier when they indicated it was 200 miles away, was in operation between 1968-1978 (Ryan et al. 2007:10). The next nearest location was Maxey Flats in Kentucky, which was over 400 miles away and in operation from 1963-1977 (Ryan et al. 2007:10).

(McCullough 1980a). Any type of clean up, removal, or remediation would now have to be mindful of chemical contaminates while also recognizing that landfills can contain a whole host of items that are both dangerous and/or difficult to plan for. Unlike many non-landfill dump sites, the landfill was used by industries to dump hazardous materials before it was regulated and as such, in addition to the nuclear waste, the landfill is known to contain, "waste ink, esters, halogenated intermediaries, oils, heavy metals, pigments, alcohols, waste water sludges, asbestos, oily sludges, insecticides, aromatics, herbicides" (McCullough 1980a:1). Perhaps most troublesome was that because the landfill is in a floodplain, when the landfill was in operation, "the fill area was often actually beneath the level of the water table" (McCullough 1980a:1).

In October of 1977, the NRC conducted an aerial survey and discovered that, "there are two areas within the landfill which are emitting abnormally high-levels of radiation" (McCullough 1980b:1). While MDNR requested these reports, the NRC was not particularly forthcoming and only delivered them years later. This was of particular interest as only the southernmost area was known at the time. They stated, "The Southernmost area is the result of the burial of contaminated Barium Sulfate Slags from the Mallinkrodt [sic] area of Destrelen Street Uranium processing plant. The Northernmost area of contamination borders onto neighboring farmland" (McCullough 1980b:1). Later reports indicated that the northernmost area was roughly ten years older than the southernmost (Radiation Management Corporation 1981). According to file materials from Missouri Geological Survey, it is "highly probable that leachate from the landfill is entering the waters of the Missouri River…"" (as cited in McCullough 1980a:1).

The issues at the West Lake Landfill, mirrored what was happening nationally as other high-profile cases slowly began to emerge beginning and throughout the 1980s, that focused on the environmental and human impacts of hazardous waste dumping. These stories often highlighted the clash between regulatory agencies and the citizens these agencies were tasked to serve (Edelstein 1988; Tesh 2000). The growing tensions between the agencies made the problem more complex because it involved clashes between the state and federal government and clashes between state and federal regulatory agencies, namely that of the Missouri Department of Natural Resources (MDNR), Nuclear Regulatory Commission (NRC) and later the Environmental Protection Agency (EPA). Having been shut out of decision making in the previous decades, local government officials and residents began calling for the removal of the waste and in the years following the articles petitioned the MDNR.

In 1979, the City of Bridgeton, Missouri passed a resolution that called for the removal of the radioactive waste in the landfill (MDNR 1979). Recognizing and acknowledging this desire, the state agency, the Missouri Department of Natural Resources (MDNR) found itself unable to do so since they were unable to enforce regulations. In a letter from MDNR to the mayor of Bridgeton, MDNR explained:

> You are probably aware that the Federal Nuclear Regulatory Commission has the primary responsibility for controlling the disposal of radioactive waste materials. The State of Missouri is not an agreement state and has no arrangements with the Nuclear Regulatory Commission to enforce the regulations within the State of Missouri. (MDNR 1979:1).

In short, as both regulation and enforcement were not only out of local control but being contested by the vary agencies meant to regulate it, MDNR had little authority over the material outside of an advisory role. Local residents also called for the removal of the waste through citizen activist groups. Environmental activist Kay Drey and her late husband Leo Drey, in conjunction with the organization they founded, the Missouri Coalition for the Environment, argued that the waste needed to be removed from the landfill to protect future generations (Emshwiller and Fields 2016). Kay Drey, presently in her 80s, has continued to fight for this over the decades and has written countless op-eds, protested, funded studies, written countless letters, organized meetings, etc. all calling for the removal of this waste (Emshwiller and Fields 2016). By the close of the 1970s, there was very little room for residents, activist groups, local governments, and the state agency, as the federal governments needs superseded any local or state wishes.

Federal Remediation Programs & Separate Trajectories (late 1980s & 1990s)

The NRC further conducted a series of surveys throughout the 1980s to characterize the radioactive material within the landfill. In June of 1988, the Nuclear Regulatory Commission released a report summarizing what they measured which included: external gamma, groundwater, surface and subsurface soil analysis, and airborne radioactivity among others (U.S. NRC 1988). All the readings and samples were collected at various times, and as expected showed fluctuations between each measurement. Their findings discussed the two areas, referred to Operable Unit 1 (OU1) Area 1, which was about 3 acres and contained roughly 20,000 cubic yards of contaminated soil and Operable Unit 1 (OU1) Area 2, which was about 13 acres and contained approximately 130,000 cubic yards of contaminated soil

(U.S. NRC 1988). In Area 1, the contaminated soil was about 3 to 5 feet deep, but in Area 2 there were places where there was evidence that the waste had already reached the surface (U.S. NRC 1988). The report stated that in total, the landfill contained rough 150,000 cubic yards of soil contaminated by uranium and thorium's decay chains (U.S. NRC 1988). This report noted, much like Gille's (2007) work on waste shows, because the radioactive waste has mixed with soil and is in the landfill, it has likely contaminated areas around it and in doing so, it has likely generated more waste. This makes measurements uncertain. Given the composition of the landfill, it was possible that chemical and radioactive waste had mixed at some point, but this report noted that it was something that they could not confirm (U.S. NRC 1988).

The report went on to say that external gamma readings fluctuated in both areas and was observed to be as high as 3,000 to 4,000 μR per hour, which was alarmingly higher than the no more than 10 μR per hour that the NRC strives for and surface soil sampling indicated uranium, thorium, and K-40 decay chains (U.S. NRC 1988:8). But, perhaps more importantly when estimating the radioactive inventory at the site it was determined that due to the high-level of thorium and its decay chains, that the site would likely become more radioactive over time (U.S. NRC 1988). The report stated:

> "However, because of the large ratio of Th-230 radioactivity to that of Ra-226, the radioactive decay of the Th-230 will increase the concentration of its decay product Ra-226 until these two radionuclides are again in equilibrium. Assuming the ratio of activities of 100:1 used above, the Ra-226 activity will increase by a factor of five over the next 100 years, by a factor of nine 200 years from now, and by a factor of thirty five1000 years from now. All radionuclides in the decay chain after Ra-226

(and thus the Rn-222 gas flux) will also be increased by similar multiples…. Under these conditions, onsite disposal, if possible, will likely require moving the material to a carefully designed and constructed "disposal cell"" (U.S. NRC 1988:11).

Therefore, the report represents the first call for action and presents a list of options and price estimates for each ranging from $370,000 to $5,500,000 in 1984 dollars. The report notes that, even if the waste were to stay on-site, it would still require the material to be stabilized. In terms of human health, reports noted that an, "analysis of the rates of fetal death, low birth weight, and malformations for 1972-1982 showed no rate for the area significantly higher than the state average" and that there is no evidence of off-site exposure (U.S. NRC 1988:5). Nevertheless, they concluded that the site is still a health threat because of the amount of uncertainty at the site. Based on these conclusions, as appears in Figure 18, the NRC began looking into what legal recourse they might have in remediating the site.

(1) There is a large quantity (on the order of 150,000 tons) of soil contaminated with long-lived radioactive material in the West Lake Landfill. Almost all the radioactivity consists of natural uranium and its radioactive decay products.[3]

(2) Based on the radiological surveys, the radioactive wastes as presently stored at the West Lake Landfill do not satisfy the conditions for Options 1-4 of the NRC's Branch Technical Position (BTP) regarding the disposal of radioactive wastes containing uranium or thorium residues.[8]

(3) A dominant factor for the future is that the average activity concentration of Th-230 is much larger than that of its decay product Ra-226, indicating a significant increase in the radiological hazards in the years and centuries to come.

(4) Some of the radioactive material on the northwestern face of the berm has no protective cover of soil to prevent the spread of contamination and attenuate radiation.

(5) Slightly more than 8 acres of the site exceed 20 μR per hour; the highest reading of 1600 μR per hour occurs near the Butler-type building.

(6) Radon and daughters were measured at 0.031 WL in and around the Butler-type building. This exceeds the BTP value of 0.02 WL.

(7) Based on monitoring-well sample analyses, some low-level contamination of the groundwater is occurring, indicating that the groundwater in the vicinity is not adequately protected by the present disposition of the wastes.

(8) Although these radiological conditions indicate that remedial action is needed, it is unlikely that anyone has received significant radiation exposures from the existing situation.

(9) Sampling results show that chemically hazardous materials have been disposed of adjacent to or possibly mixed with the radioactive material.[3] It is possible that part of the radioactive material has become "mixed" waste.

From these findings and the information developed to date, the NRC staff concludes: (1) measures must be taken to establish adequate permanent control of the radioactive waste and to mitigate the potential long-term adverse impacts from its existing temporary storage conditions and (2) the information developed to date is inadequate for a technological determination of several important issues, i.e., whether mixed wastes are involved, and whether onsite disposal is practical technologically, and, if so, under what alternative methods.

As indicated by the estimates developed by UMC, remedial action will be costly. Further, the investigations to develop the necessary information to resolve major questions and to provide a sound basis for evaluation of the feasibility of disposal alternatives may also be costly. Therefore, it is necessary to determine the way to accomplish the further studies and remedial actions that are needed.

Figure 18. Conclusions of 1988 NRC Report.
Data Source U.S. Nuclear Regulatory Commission (1988:15)

By the late 1970s and early 1980s, there was a great number of contaminated properties across the U.S. and two federal programs were created to address hazardous sites. The first, initiated in 1974, was the Formerly Utilized Sites Remedial Action Program (FUSRAP) and was tasked, "to identify, investigate and clean up or control sites throughout the United States that became contaminated as a result of the Nation's early atomic energy program during the 1940s, 1950s, and 1960s" (U.S. Army Corp of Engineers n.d.). FUSRAP was initiated under the AEC just prior to its dissolution and was later transferred to the Department of Energy (DOE) (Navarro Research and Engineering, Inc 2018). FUSRAP officially began cleaning up sites in 1979 but had rather specific guidelines to qualify as a site and research was conducted to determine site eligibility. While there were a lot of factors, the main qualifiers was that the site was *directedly* tied to Manhattan Project and AEC activities, likelihood of harm, and that the site was not eligible for other clean-up programs (Navarro Research and Engineering, Inc 2018). Under FUSRAP, low-level radioactive material has been detected at over a hundred sites and vicinity properties (VPs) in the St. Louis Metro area.[36] In 1996, Coldwater Creek, where run off from the SLAPS and the Latty Ave sites ended up, alone was estimated to contain 195,000 cubic yards of contaminated soil. (U.S. Army Corp of Engineers n.d.). Much like the other vicinity properties (VP) which were not original sites, but rather were properties near other sites that *became* contaminated. The USACE states, "over time, residues migrated from other sites or were deposited as the residues were hauled along transportation routes, contaminating the soils and sediments of the vicinity properties" (U.S. Army Corp of Engineers n.d.). Unlike the other sites, the West Lake Landfill was deemed ineligible for FUSRAP.

According to federal regulatory agencies, the landfill wasn't considered a site because they do not consider it directly contaminated due to the atomic energy program. SLAPS was a site because it was acquired by the AEC for the use of storing materials, whereas the

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[36] At the St. Louis Downtown Site (SLDS) where Mallinckrodt Chemical Works (now Mallinckrodt Inc) was/is located 210 acres of land has been identified (U.S. Army Corp of Engineers n.d.). This included the downtown site and 38 vicinity properties. The Latty/HISS site contains that site and eight vicinity properties. The St. Louis Airport Site (SLAPS) contains the original 21-acre property and includes 148 vicinity properties (U.S. Army Corp of Engineers n.d.). Additionally, a site just outside St. Louis, in Madison, Illinois has also been identified as well.

landfill became contaminated due to a sale rather than direct Cold War era activities. In short, the dumping occurred by a private company and as a result, the company should be liable. They seem to stress that fact, while ignoring that the AEC was in charge of regulating the material and the enforcement of its regulations and had failed to do so. In the end, it has been widely reported that the Cotter Corporation and B&K Construction did not even face a fine for their wrongdoing.

Regardless the sheer number of the vicinity properties, over 180, indicates how insufficiently contained, managed, and regulated their activities were. If their aim was to monitor, regulate, and contain radioactive material, then the AEC failed miserably at even its own sites. While radioactive material was not dumped directly in accordance with the AEC, it was a partnership between the AEC and local companies that created the material in the first place. Once more, Congress does have the ability to add sites to FUSRAP, but these decisions, whether to include or not include and the degree to which they are cleaned are profoundly political and not merely technical and/or scientific. In many cases the level of clean up matches imaginaries of the land's future use (Navarro Research and Engineering, Inc 2018; U.S. Army Corp of Engineers n.d.). The guidelines also precluded the landfill from being deemed a vicinity property, in part because of the sale, and because the properties status as being privately owned would made it eligible for a different federal program, called the Comprehensive Environmental Response, Compensation, and Liability Act (CERLA).

CERLA was established in December of 1980 to clean up industrial hazardous waste sites (U.S. EPA 2015a). The act created a tax on the chemical and petroleum industry which created a "Superfund," was then used to rectify the toxic and hazardous legacy of sites (U.S. EPA 2015a). Charging the EPA with federal authority to respond, CERLA was divided into either short-term removal or long-term remediation. Rather than paying for clean ups out of the fund, the act took on a position that polluters should pay for the clean-up of their sites. It was decided that, "contrary to most environmental laws, which usually deal only with current owners, Superfund casts a wider net for its responsible parties. These parties include past or present generators and transporters of hazardous materials to the site, as well as current—and with some exceptions, past—owners of the site in order to find enough responsible parties to pay for the cleanups" (Voltaggio and Adams 2016:4).

"Potentially responsible parties" (PRPs) are determined thorough complex investigations that are often long and costly (Voltaggio and Adams 2016). Even after being identified, PRPs typically undergo litigation to challenge findings as a way of reducing their liability (Voltaggio and Adams 2016). Additionally, since early polluters were not initially required to report or keep record (s)of where hazardous products were dumped or buried, there are many abandoned sites across the country, where a responsible party could not be identified, are cleaned up using the "Superfund." Within the first 5 years the fund had grown to $1.6 billion dollars (U.S. EPA 2015a). Sites requiring long-term remediation are added to the National Priorities List (NPL), whose primary function was notifying the public of sites that might warrant remediation (U.S. EPA 1990). Currently, there are over a thousand sites listed on the NPL and remediating sites is often a long and costly process (U.S. EPA 1990). Unfortunately, sites can, and often do, remain on the NPL list for decades, awaiting their turn (U.S. EPA 1990).

Ineligible to be a FUSRAP site, the NRC, began seeking advice on what their legal recourse would be in terms of charging the Cotter Corporation with the cost of remediation (Cunningham 1988). However, the NRC immediately ran into a problem. In a letter discussing possible recourse, Stuart Treby (1988), Assistant General Counsel for Rulemaking and Fuel Cycle in the Office of General Counsel, noted that the NRC and AEC were both made aware of the dumping back in 1974, and yet chose to not to issue a violation (Treby 1988). He went on to note, that as was typical, litigation should have occurred within five years of its discovery/dumping, but at the time of the letter, almost a full decade had already passed (Treby 1988). In short, because federal decision making was delayed, the window to legally hold the violator's accountable may have already expired.

This left them with only two options. First, they could try judicial action under the "Atomic Energy Act of 1954," but counsel noted that it would call into question whether or not what they did was unlawful to begin with because the violation itself would be open to interpretation (Treby 1988). Specifically, since the company took licensed material and then diluted it enough to be considered unlicensed, can they be held responsible for actually dumping licensed material in an unlicensed manner? Additionally, "the fact that 14 years has elapsed since the AEC/NRC had evidence of the disposal, and had considered it a possible violation, argues against the need for immediate vigorous enforcement through a judicial injunction… One could argue that the responsible regulatory agency, in terminating the license without further enforcement action, had determined that the alleged violations were without merit" (Treby 1988:2). In short, the regulatory agencies had allowed the material to stay in the landfill in spite of the ways that it had violated its own regulations and then chose to not act. Counsel was of the opinion that it would be difficult to make a case that action was now needed, when inaction had been the norm. That left the NRC with only one option, to seek remediation under CERCLA.

They again ran into roadblocks with their remaining option because of the superfund program itself. The Superfund program had come under heavy criticism in the years since its inception and was accused of mishandling cleanups (Shabeccoff 1983). Specifically, in terms of in terms of cost, length of time to remediation, and the legitimacy of the clean ups (Shabeccoff 1983). An article in the *New York Times* stated, "Half a dozen Congressional committees, the Federal Bureau of Investigation and the White House are all looking into charges of mismanagement, politicization, favoritism to business and corruption" (Shabeccoff 1983:2). While the program had significant failings, it was later amended in 1986 under "The Superfund Amendments and Reauthorization Act" (SARA) (U.S. EPA 2015b).

The West Lake Landfill was added to the National Priorities List (NPL) in 1990 and has remained there since (MDNR n.d.). In 1995, Congress chose not to renew the Superfund taxes on industry and clean ups across the nation stalled (Voltaggio and Adams 2016). The polluters, or PRPs accused the program, of being unfair as the cost for clean ups could be uncertain and frequently rose into the hundreds of millions of dollars (Shabeccoff 1983). When the tax was not renewed, "significant limits were put on EPA's ability to perform cleanup work itself, and an increasing percentage of cleanups was being performed by PRPs. EPA focused activity during this period and onward on ensuring that PRPs perform most of the cleanups, thus saving dwindling public funding for government oversight of private actions" (Voltaggio and Adams 2016:6). Rather than remediating the sites and then pursuing repayment from the PRPs, the EPA now tends to work with the PRPs on the front end, which often delays the start of projects. While this is characteristic of the polluters pay method, it also means that the polluters have much more say in remediation activities (Voltaggio and Adams 2016). By 2004, the so-called Superfund was completely empty and now, "the appropriation from the general fund was the only source of funds for the program," meaning taxpayers now shoulder a great deal of the burden in clean ups (U.S. General Accounting Office 2003:1).

However, even local clean ups under CERCLA have been controversial. In St. Charles, the Weldon Springs facility was remediated as a DOE CERCLA site in the late 1980s (Davis and Puro 1999). There were various tensions between local citizens, MDNR, EPA, and DOE. The DOE was given the lead on the clean-up and one of the larger disagreements between the DOE and MDNR centered around levels of exposure, often referred to as maximally exposed individual doses (Davis and Puro 1999). Davis and Puro (1999:43) found that, "The DOE argues that the reasonably maximally exposed individual is a recreational visitor because the contaminated ground water is under Missouri Department of Conservation land. MDNR argues that the reasonably maximally exposed individual is a future resident because the current rate of growth in St. Charles County may extend to residential use of property." In using risk assessments, the cleanup for a recreational visitor indicated a low or nonexistent risk, because it was assumed people will not be exposed to anything harmful because recreational visitors would not remain on the site long enough to experience harm(s), whereas a much more extensive and costly clean up would be needed for it to be suitable as residential space (Davis and Puro 1999). While the DOE provided documents for MDNR to review and comment on, the DOE was under no obligation to take them under serious consideration and MDNR could not exercise authority or require them to do so (Davis and Puro 1999).

"In a fall of 1997 meeting, the EPA Region VII supported less stringent cleanup standards for the uranium/TNT processing plant site [Weldon Springs] because DOE could not identify a viable methods to treat the water, although MDNR noted several alternatives and suggested pilot tests to determine their feasibility during the meeting" (Davis and Puro 1999:43). In the end local citizen response was also no match and the DOE eventually won out. As it was not remediated to the residential level, this has limited the expanse and potential economic development of the county. Today, part of the site has been made into a tourist attraction called, the "Nuclear Waste Adventure Trail," where residents are free to hike to top of the mound, where 1.48 million cubic yards of waste is encased in a disposal cell (Kirby, Smith, and Wilkins n.d.). It is difficult to adequately capture the enormity of the site, but Figures 19-21 below try, nonetheless. Radioactive waste buried below, visitors are encouraged to hike to the top of the mound, which one cannot even see the peak of, when at the bottom. Figure 19 was taken at the bottom on the mound and shows the author halfway to the top. The halfway point is roughly the last time someone from the ground can see someone walking towards the top. Figure 20 shows from that same halfway point to the peak and Figure 21 shows the view from the top. In the upper right-hand corner several dots are visible, which was the authors and friends' cars, which was fairly near the bottom of the site.

Figure 19. Taken at Ground level looking up, Halfway Point.
Data Source Author

Figure 20. Taken at Halfway Point to Peak.
Data Source Author

Figure 21. A View from the Top.
Data Source Author

A New Controversy & How it Impacts Old Problems (2000 & beyond)

The West Lake Landfill was not deemed suitable for a FUSRAP clean up because it was argued that the radioactive waste was dumped by an independent company and its subcontractor, even though the material was created because of, and for, Cold War era activities and in conjunction with the federal government. Instead, it was placed on the National Priorities List (NPL) to await its turn for possible remediation (U.S. EPA 1990). Much like at the Weldon Springs site, the MDNR was given an advisory role, and within this role, they could request documents and submit questions and comments, but ultimately the state was not given final decision-making power (Davis and Puro 1999; U.S. EPA 2008a). In many ways this puts MDNR in a tough spot, because as a state agency, they were reliant on the federal government to do the costly clean up, but largely unable to completely shape what that may look like. This had profound implications for local governments and residents, as the DOE remediated the site, but not enough for residential use, making the 17,000 acres in the county unsuitable for future residential development (Davis and Puro

1999). Local residents were largely shut out of the process, even though they much like MDNR wanted further remediation because they felt as though their health was at stake. By the middle 2000s, it had appeared, the West Lake Landfill was on track to follow suit, in terms of public participation, but much less so in terms of level of clean up. While residents near Weldon Springs would have liked the DOE to remediate to the level of residential, the West Lake Landfill was slated for a plan that would leave the property indefinitely restricted.

In 2006, the EPA released a plan for remediation of the West Lake Landfill (Leiser 2006b). The proposed plan was to leave the waste in place, as regulators stated that excavation would be difficult as the contamination had spread over the decades throughout various parts of the landfill (Leiser 2006a). Daniel Wall, remedial project manager for the EPA's Superfund division in Kansas City stated, "It is just that its current cover system and various monitoring and maintenance plans that go along with it need to be upgraded" (Leiser 2006a:1). The operations manager of the landfill, owned by Allied Waste of Scottsdale, AZ at the time, said ultimately, while he supported the EPA's decision, "It's not our decision," and "We will follow their decision whatever it is" (Leiser 2006b:2). The EPA hosted a public meeting to discuss the proposed plan, which tipped off months of debate and protests.

Later that year, Kay Drey along with 100 people, and armed with hundreds of signatures collected by Missouri Coalition for the Environment, met to protest the EPA's decision to leave the waste where it was (Leiser 2006b). In response to the publics discontent, the EPA ordered more testing, but by 2008 the EPA has decided to maintain its earlier stance of keeping the waste in place, installing a cap, and continuing to monitor the site (Leiser 2006b; U.S. EPA 2008a). The proposed plan included capping the site by bring in more fill material, namely rubble and rock, to prevent erosion and to increase monitoring of landfill gas and groundwater (Leiser 2006a).

In 2008 a Record of Decision (ROD) was issued for OU-1 that outlined the final plan for the site and what risk factors were considered in determining the permeant solution (U.S. EPA 2008a). The report noted Area 1 was estimated to contain 24,400 cubic yards of radiologically impacted material and Area 2 contains approximately 118,000 cubic yards (U.S. EPA 2008a). It also noted that in some areas in both Areas 1 and 2, that radionuclides are at or just below the surface and contain uranium-238 (U-238), uranium-235 (U-235), and thorium-232 (Th-232) in concentrations above background levels (U.S. EPA 2008a). Also detected at the site were other elements such as arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc, which are all considered priority pollutant[37] trace metals (U.S. EPA 2008a). Additionally, the plan looked at the risk of radionuclides migrating off site through airborne, rainwater, erosion, and leaching transport. In all these categories, it was noted that radionuclides have been present and have the potential to move off site (U.S. EPA 2008a).

While this report was lengthy it concludes that, in all of the above mentioned categories, with the exception of soil erosion, that they do not expected that they will present any significant harm(s) (U.S. EPA 2008a). The report then details why the radionuclides migrating off site through airborne, rainwater, erosion, and leaching transport do not present a significant harm to the general population, as long as they remain restricted from the site. First, landfills produce gases and, in this case, since there is radioactive material present, there is the additional concern of the transmission of radon gas (U.S. EPA 2008a). As

[37] Priority pollutants are the chemical pollutants that are regulated by the EPA. As of 2014, there were 126 and can be found at 40 CFR Part 423, Appendix A (U.S. EPA 2014:1).

uranium decays, it produces radon gas, which will increase over time. The plan noted that in several locations, readings indicated high-levels of radon gas, but if averaged out across both areas, the averages are "relatively low" (U.S. EPA 2008a:15). On the surface it was reasoned that it would likely dilute and disperse into the atmosphere which they concluded was, "…. unlikely to have an impact beyond the landfill boundaries" (U.S. EPA 2008a:15). Another consideration was "fugitive dust," or the small particles suspended in the air that often times contain soil, but this was dismissed because while it may be a pathway for migration, as long as the site is covered in vegetation, it should not present a significant issue (U.S. EPA 2008a). Second, in some rainwater runoff samples, radionuclides were present, but it was noted that these indicated low-levels and again vegetation is assumed to mitigate the effects (U.S. EPA 2008a). Third, similar conclusions as rainwater runoff were drawn for ground water transport. Finally, in terms of erosion, as the material has been known to be present near the surface since the middle 1970s, overtime material has eroded and shifted on site and onto the adjacent Ford Property/Buffer Zone/Crossroad Property (U.S. EPA 2008a). Additionally, samples indicated that radionuclides were present in drainages ditches all along St. Charles Rock Rd., but they state that in all cases it is not present at significant level (U.S. EPA 2008a).

To make sense of health risk, the EPA considered the carcinogenic effects and impacts to imagined persons. The EPA determines this risk at the population level and takes into consideration both estimated exposure and toxicity, which is then put into an equation. In this case, the imagined person exposed would be groundskeepers and "… a worker involved in outdoor storage," rather than the general public (U.S. EPA 2008a:25). In terms of the EPA, "For known or suspected carcinogens, EPA has determined that an acceptable level of exposure correlates to an excess lifetime cancer risk to an individual of between 1 in 10,000 (1×10^{-4}) and 1 in 1,000,000 (1×10^{-6}). This is known as the acceptable risk range" (U.S. EPA 2008a:25). In this specific case, Area 2 was a concern since, "The cancer risk estimate for this receptor is 4×10^{-4}. This is due primarily to external radiation exposure from continued ingrowth of Ra-226 and its eight daughters from decay of Th-230 over the 1,000-year study period" (U.S. EPA 2008a:25). This puts the site over what the EPA defines as acceptable risk for future workers and it means, that the site will remain a landfill, with little hope of it being transformed into something else, like a public park. Additionally, as it will become more radioactive over time, its long-term use is restricted indefinitely (U.S. EPA 2008a). The report concluded that the best course of action was to consolidate the contaminated soil in the buffer zone, install a landfill cover, and monitor and control groundwater, gas, and surface run off. Under this plan, the site complies with both federal and state laws and is cost effective. It also stated (U.S. EPA 2008b:xii):

> "The remedy for OU 1 does not satisfy the statutory preference for treatment as a principal element of the remedy. The contaminants are dispersed within large volumes of heterogeneous municipal refuse and demolition debris; there are no practicable treatment alternatives, and no principal threat wastes have been identified… This remedy will result in hazardous substances, pollutants, or contaminants remaining on the Site above levels that allow for unlimited use and unrestricted exposure; therefore, a statutory review will be conducted within five years after initiation of the remedial action to ensure the remedy is or will be protective of human health and the environment."

This decision was met with considerable public resistance. In response in January of 2010, the EPA asked that a Supplemental Feasibility Study (SFS) be conducted on the landfill to determine the cost of excavating the material either to be shipped to a facility outside the state or to have the waste reburied elsewhere on the 200-acre site (Republic Services, 2014).

However, while awaiting the Feasibility Study to be competed, on December 22, 2010 a completely new problem had emerged, when a contractor in the south quarry at the Bridgeton Landfill, discovered "high-levels of carbon monoxide in a large group of extraction wells," indicating the presence of a "heat producing reaction" (Republic Services 2014a). The heat producing reaction was also referred to as a subsurface smoldering event and by locals as an underground fire (LaCapra 2014; Jeffery Tomich 2013). While this is discussed as if they were completely separate landfills, they are really just different areas of the same complex. The landfill is divided, with OU-1 including just the areas that contained radioactive material, and OU-2 being everywhere else and in this case, the underground fire is in OU-2 (U.S. EPA 2008a, 2008c).

EPA is the lead agency on all OUs, while MDNR maintains an advisory role, but has much more decision making power on OU-2 (U.S. EPA 2008a, 2008c). The company who owns the landfill, EPA, and MDNR have largely characterized the situation as separate problems and even have created separate websites for each. They maintain the site is safe, and residents are not experiencing any negative health impacts because the waste is contained (Brooks 2014). Not long after local residents began smelling a foul odor from the site, which at times was reported 10 miles away, and has lasted for years (Bernhard 2014; Bissell 2015, 2015; Phillips and Marsh 2014; Jeffrey Tomich 2013a).

Residents Mounting Frustration(s) and Distrust of Agencies

This new underground fire created more complexity and as both agencies called for more research to factor in this new problem, the process was further stalled, as the agencies and their hired independent experts are at odds about the best way to move forward and are making competing scientific claims (LaCapra 2014). Residents who are smelling this foul odor, that they think of as harmful because it is giving them headaches and burning eyes and throats, have come to join together with one another and with the Missouri Coalition for the Environment to once again call for the removal of the waste. They argued, that the site remains unpredictable. The quote at the beginning of this chapter characterizes this when a local resident stated:

> "It's a really horrible situation just with the smell, and then you take into consideration … the radioactive waste part of it. We're scared to death. Every time we turn around there's a new report coming out saying they've found something new. And it's very difficult for anybody who lives around the site to feel like anybody has this situation, anybody is in control." --Dawn Chapman (as quoted in Phillips and Marsh 2014:4)

Residents who live near the site have been angry that the site has violated their property rights as it has impacted the way that they can enjoy their properties. The U.S. District Court for the Eastern District of Missouri at one point agreed and awarded some residents a settlement based on their "loss of use or enjoyment of property," but this battle was not easily won and was the result of years of living with the smell (Republic Services, 2014a). This has further emboldened residents as it provided legal legitimacy to their claims and they continue to protest the site.

But more than that, the ongoing conflicts with regulatory agencies has left residents feeling as though they have not been able to make informed decisions about their lives. Rather than these agencies creating a space where stakeholders can come together to make decisions about what is best for their community, they are shut out and because agency roles are siloed, their inability to work together has created even more conflict. Rather than face the issue head on, the proverbial hot potato has just been passed further and further down the road. Many feel that the problem has been intentionally hidden and/or swept under the rug. One resident stated in an online post:

> "I can completely understand how a potential environmental hazard can go unchecked for some time, until there is conclusive evidence that supports one thought process or another. It's the case of we don't know what we don't know until we know. In this day and age, once a practice or process is found to be an environmental hazard, it behooves everyone involved to re-mediate the problem or potential problem as quickly as possible. I am perplexed that so many involved are trying to sweep this under the proverbial rug and are getting away with it. This goes for the original radioactive waste producer, all of the landfill owners/operators over the years, the government agencies (EPA and DNR), and the local municipalities. If an operator were to try to filter the information prior to its release to the public, as the DNR and EPA have, huge fines would be levied against them. What is the recourse when it is the government participating in similar practices? Where is the accountability? When is everyone going to get on the same page and actually work towards a solution as a collective?"

Another resident stated, “Worst of all, the residents of these neighborhoods were never informed by the local governments of this deepening problem, and the EPA has been nearly silent on it--as if they are trying to ignore the issue altogether.” Others express anguish that this waste has remained in the area for so long and that over the past seventy years and countless studies and reports have yielded very little in terms of a solution. One resident stated:

> “It is also something that has been going on over TIME... for decades... think of all those who have lived here and moved on, not knowing that they were carrying cancers and immune system problems like a hidden time bomb. Think of ALL the people that use TAP WATER in the area, from a source that is 8 miles downstream from where Cold Creek dumps its toxic waste.”

That is perhaps, why after learning about the history and how government agencies have responded to the situation, many residents have found themselves distrusting any new information presented and have rejected the regulatory agencies subsequent re-assurances that residents are not in any danger. With so much disagreement, it is notable and suspect to residents that, all parties only seem to agree on their health and safety. Many were quick to note that to them, it felt as if the final conclusions had already been drawn, regardless of what any actual report could and/or would find. In regard to a report issues by the health department, a resident stated:

> “It gives people a reason to mistrust these agencies. I HATE to say they are lying and trying to cover this up, but I'm not being left with another option. I mean, it is so obviously (flawed) that it has to be done on purpose.... Why wouldn't they take into consideration the people who lived in the area during the time frame that we

> know the creek was contaminated!! It is all really disturbing!! The legislators and the Reps. from these communities should be very worried for what this means in the future. Do they think that people living around West Lake Landfill are going to believe ANYTHING that the St. Louis County Health Dept. tells them after this??"

Residents note that remediation is often quite costly, even more so, when it has not been contained and exposed to open conditions. By delaying remediation decisions and/or calling for the site to remain as is, serves the polluters and regulatory agencies themselves. Residents are then left with the consequences in the meantime, left with no recourse if something were to happen to their health or safety later.

Various studies have shown how important trust is in terms of relationships with experts and lay people (Beck 1992; Edelstein 1988; Epstein 1996; Giddens 1997; Malin 2015; Putnam 2001). Trust becomes an important component and necessary as the workings of abstract and expert systems are hidden from view. In times of uncertainty, lay people converge with abstract systems at "access points," where they often come face to face with expert systems and it is here where trust is most vulnerable (Giddens 1997:83). Trust may be freely given but it can also be easily taken away. Trust is something that needs to be cultivated, Giddens states:

> "Trust on the personal level becomes a project, to be "worked at" by the parties involved and demands the *opening out of the individual to the other*. Where it cannot be controlled by fixed normative codes, trust has to be *won*, and the means of doing this is demonstrable warmth and openness… relationships artisanal bond trust, we're trust is not pretty given but work upon, and where the work involved means *a mutual process of self-disclosure*" [emphasis original] (Giddens 1997:121).

In times of uncertainty, expert systems often elude a sense of confidence through "an attitude of business-as-usual" and they often go to great lengths to convey a trustworthiness (Giddens 1997:85). As the quotes above shows, the business-as-usual air also makes residents feel as though enough attention and considerations are granted to the people who a living their lives in the very communities impacted by decisions that the regulatory agencies have made.

Discussion/Conclusion

The presence of radioactive waste at the West Lake Landfill Superfund site has been controversial, and hotly debated, since before the inception of both federal and state regulatory agencies. The vast majority of this chapter focused on how the inception of these agencies impacted a landfill in the greater St. Louis area. Radioactive material has been primarily regulated by the federal government, and while the federal government makes guidelines about landfills, their management is left up to state and local agencies and governments (Rechtchaffen and Markell 2002).

Under federalism, this created a division of responsibility between the federal and state governments, so that national regulations would create a baseline for environmental protections between the states but would allow for local governments to govern citizens as they saw fit (Rechtchaffen and Markell 2002). The division between state and federal shared governance is not always smooth, however, particularly in the case of environmental protections. This is due, in part, to the fact that the EPA is not independent, like other federal agencies (Agranoff 2001; Elazar 1984; Kraft and Scheberle 1998; Scheberle 2005). Instead, the EPA is much more suspectable to White House politics because the EPA's senior officers and administrators changes with each presidential regime (Andrews 2010). Furthermore, environmental regulation is often a stand in for partisan conflicts and can lead to legislative gridlock (Andrews 2010). As the Trump Administration has shown, the office of the president can facilitate conflicts through the choice of appointees, which can further impact legislation (Farber and O'Connell 2017; Konisky and Woods 2018).

The regulation of nuclear things has traditionally been under the purview of the federal government, unless the states agree to take this responsibility on by opting to be an "agreement state." But in this particular case, Missouri is not an agreement state (U.S. NRC 2018). This may be because Missouri does not want to have to invest in the often technical and costly management of nuclear things, especially those that are from legacies of federal partnerships. Regardless, because federal agencies were initially in charge of the radioactive material in question through the AEC, and later NRC, they were given sole decision-making authority over radioactive materials. When the radioactive materials were originally sold to a Colorado-based company, this was not something that the state of Missouri was involved in, nor was it something the state was informed about.

Adversarial relationships between agencies are not uncommon and can sometimes lead to standstills (Bowman 1985; Farber and O'Connell 2017; Kearney and Garey 1982a). This has somewhat occurred at the landfill, as both agencies, residents, and officials have called for more scientific data and also disagreed about the best course of action moving forward. Environmental supremacy and federalism have largely shut state and local desires out of the decision-making process. It was largely assumed that the fate of the landfill would likely follow the same path as the Weldon Springs site; that is, until the discovery of the underground fire. On one hand the discovery of the fire has allowed for greater MDNR participation but in others has also created a gridlock through the conflicts and uncertainties between state and federal agencies. However, this adversarial relationship also opened the door for greater resident participation, which had also been largely suppressed.

With the fire and its subsequent odors, residents have claimed that they are experiencing negative health effects and can no longer enjoy their property. They further state that their risk has increased and that there is greater uncertainty at the site than ever before. They have challenged the decision to leave waste at the site and as this chapter has shown it is because of the organization and structure of how these agencies operate in accordance with one another that has led to the lack of action and has likely brought about additional problems. As Farber and O' Connell (2017) stated, adversarial relationships have the potential to enhance democratic governance. In this case, citizens did not gain a greater voice *through* this adversarial relationship, but rather gained one *because* this conflict created space for them to use risk and health to challenge plans that had largely been shutting them out for decades. The next chapter will focus on how the civic engagement of residents and discussed how regulatory agencies and residents make sense of risk and mobilize around certain claims related to health and safety.

CHAPTER 5: SMELL, KNOWLEDGE, RISK AND THE STRATEGIES IN-BETWEEN

For residents who live near the West Lake Landfill Superfund site, managing the risk and uncertainty surrounding the nearby landfill, which contains both Cold War era radioactive waste and a subsurface smoldering event, has become a part of everyday life. While the landfill had been an ongoing site of contention, concerns about the health and safety of nearby residents took a turn in 2010 when a subsurface smoldering event/underground fire was detected in one area within the complex. Not long after local residents reported an unfamiliar chemical-like smell that sometimes burned their eyes, noses, and throats. News had been circulating for some time among residents about the unexplained illnesses and deaths of children who grew up in the neighborhoods that bordered the contaminated local Coldwater Creek (Hartmann 2013). Residents who lived around the landfill began to wonder if some of the unexplained illnesses of neighbors, friends, co-workers, and family, could be attributed to the landfill and if there were now breathing in radioactive particles released because of the smoldering event.

As chapter three discussed, top-secret security clearances initially barred early war time workers from knowing their own risk(s) and decisions were unknowingly made by officials that impacted the unsuspecting general public. Chapter four discussed how federal, state, and local environmental and health regulating agencies and governments have often been at odds with each other which has resulted in considerable delays, endless testing, and conflicting reports. Local residents have often found themselves on the outside looking in, in terms of decision making and issues of governance. Even though there has been considerable backlash and protests over the last seventy years calling for the removal of the waste. Tragically, the harm that early workers and their families experienced and the ongoing reluctance to acknowledge illnesses and the untimely deaths of residents who lived near Coldwater Creek, has left many residents in the communities surrounding the West Lake Landfill terrified about their future uncertainties. Worse still, many residents believe that they are already experiencing health issues and fear that unless the waste is removed, it will only get worse.

Over the last several decades, the site has amassed a great deal of scientific data, reports, studies, etc., which are often filled with technical jargon and are hard for lay audiences to easily understand. At times various stakeholders like the Environmental Protection Agency (EPA), Missouri Department of Natural Resources (MDNR), Missouri Department of Health and Senior Services (DHSS), Republic Services, Inc., and their independently hired consultants and experts have contested some of these reports and have often outright disagreed about what the best course of action is, moving forward. While federal, state, and local institutions have set guidelines regarding acceptable levels of risk, many residents do not find these levels acceptable and residents believe their knowledge of place, experiences of living and working around the landfill, and its additional increase in the care work of mothers to sick relatives and children, should be taken into consideration. This chapter focuses on the residents who have found themselves in a situation where the regulatory agencies and experts making decisions about their lives have largely disagreed with one another about the future best course of action and where they have largely been left to manage both short and long term risk and uncertainty on their own.

The division between how experts and lay people make sense of risk and how they make decisions in terms of their future planning are relatively common, especially in the case of environmental uncertainty, activism, and decision making. Studies are often quick to point out the differences between how experts and lay people determine risk (Fischhoff, Watson, & Hope, 1984; Slovic, 1999; Tesh, 2000). This division often privileges the experts and scientist's definition of risk which often portrays them as having superior knowledge through the use of technologies, as opposed to lay people who are notoriously bad at estimating the probability or likelihood of events (Glassner 2009; Slovic 2010) and use their own experiences and subjective knowledge(s) to determine risk (Fischhoff et al. 1984; Kahneman and Tversky 1973; Kraus et al. 1992; Slovic 1999).

To that end, various scholars have challenged the so-called, expert-lay divide, as overly privileging experts and failing to acknowledge the importance of lay knowledge (Epstein 1996; Irwin and Wynne 1996; Jasanoff 2005; Wynne 1996). Exaggerating the divide between what is often characterized as rational and non-rational strategies, misses the way(s) that individuals are always already managing their future and does not allow for an accurate understanding of decision making (Zinn 2005, 2008a, 2016).

Instead, it is suggested that a more robust understanding of decision making should include *in-between* strategies that are neither completely rational nor irrational (Zinn 2016). In-between strategies suggest that people draw on both rational and non-rational strategies that include trust, intuition, and emotion (Zinn 2016). These strategies can be seen as particularly useful in this case, as there are various contestations and widespread disagreements about risk and where expert knowledge systems are contested (Zinn 2016). Furthermore, resident have called for a much more nuanced understanding of risk, as they are not only concerned about the long-term implications and future remediation of the site but are also concerned about how to protect their health and safety in the day-to-day experiences of living near the site. Having been left out of decisions making processes for decades, a group of local mothers created a space on Facebook where residents can come together and to discuss all things related to the landfill and its impact on their communities. Here residents discuss how to manage their day-to-day risk and how they utilize, resist, and contest expert produced data. In the process, they create valuable civic knowledges. This chapter adds to in-between strategies by highlighting the way that residents use Facebook to understand and make sense of risk through the use of smell, sensory, and daily experiences and created new ways of knowing through the process.

Data from this chapter was gather from a variety of sources. Historical documents gathered from on and offline archives were used to discuss the both past and present events. As stated above, the West Lake Landfill complex is a Superfund site and has amassed a great deal of documents, reports, newsletters, website updates etc. over the last several decades. Regulatory agencies have made attempts to be more transparent about decision making and have opted to make many of these documents available to the public through online and offline means. These documents were used to describe how regulatory agencies have both categorized risk in the past and specifically for this case, plan to manage the site in the future. Finally, data was also collected through participant observation both on and offline, ethnographic interviews, and through monitoring the West Lake Landfill Facebook Group and related YouTube channel. The group holds monthly townhall, in-person style, meetings for local residents and also makes these meeting available online.

The West Lake Landfill Facebook group is a public group, that now has over 20,000 members[38]. The group was created in 2010 and is still very active as of this writing. This chapter draws heavily on the beginning of the group, because this was when and where discussion about health and safety first emerged. Discussions about smell and odor and past and present illnesses significantly dominated the groups posts. While the group, built membership somewhat slowly at first, the smell and illnesses occupied a significant portion of the group's daily discussions.

Subjectivity in Stakeholder Risk(s)

As noted in the previous chapter, in making sense of health risks, the EPA uses risk assessments to estimate risk at the population level and specifically look at carcinogenic effects (U.S. EPA 2008a). When assessed this way, there is an underlying assumption that there is a level of risk that is acceptable. In terms of carcinogens, both known and suspected, the EPA deems an excess lifetime cancer risk between 1 in 10,000 (1×10^{-4}) and 1 in 1,000,000 (1×10^{-6}) as within the acceptable risk range (U.S. EPA 2008a:25). In short, they stated that an acceptable risk is one in which, on average, between 1 out of every 10,000 and 1 out of every 1,000,000 people will receive an excess lifetime cancer risk (U.S. EPA 2008a:25).

In the case of this specific plan and landfill, the 2008 ROD suggests with very restricted use, a cap and cover, and additional methods to monitor migration, the landfill will be a risk to groundskeepers because the landfill, in some places, will become more

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[38] West Lake Landfill's group page, accessed December 2017, https://www.facebook.com/groups/508327822519437/

radioactive over time (U.S. EPA 2008a:25). Under this plan, it is noted that the risk will be outside of the EPAs guidelines and be 4 x 10,000 (4 x10^{-4}), and due to the complexity of the site, this is the best alternative (U.S. EPA 2008a). Instead, they were met with a large public backlash and the EPA has asked the PRPs to gather more data, which in turn has led to widespread expert disagreements and delays while data is being collected. Residents and local governments have been calling for the removal of this waste since the 1970s and have widely rejected the plan because not only does it leave the RIM in place, it also admits that some RIM has already been leaving the site, even though they suggested it was doing so at what they deemed to be non-significant levels (Leiser 2006a, 2006b; MDNR 1979).

This highlights the "fundamental paradox of nuclear safety," which is often also true of other industries working with hazardous materials, that "…some level of exposure is unavoidable when working with nuclear materials and that any level of exposure comes with an associated biological risk" (Cram 2016:522). Therefore, *any* contact with these materials can be understood as a risk. Industries tend to mitigate this effect through employee monitoring for health and safety and through the compensation of employees that are willing to put themselves at risk (Conca 2019; Nuclear Energy Institute 2020). Studies have also shown that people are often more willing to take risks in which they perceive benefits too and/or in cases where the risk may take a long time to manifest (Slovic 2010).

As chapter three outlined, the AEC and other regulatory agencies operate under the assumption that there are justifiable economic, political, and national reasons to risk exposure, that are not only unavoidable but necessary. In this case, radioactive materials came to the area during weapons production during and prior to the Cold War (Fleishman-Hillard, Inc. 1967), because war time relationships and needs necessitated that individual needs were sacrificed over national ones, which went largely unacknowledged until the Clinton administration (U.S. DOE 1995a). This also extends to the environment, as places and the people who live there, have been described as sacrifice zones because of the high-level of contamination and pollution left behind from industries and/or nuclear production (Bullard 1993; Kuletz 1998; Lerner 2012).

Regulatory agencies, institutions, and public policy set guidelines regarding what they consider to be allowable limits and/or what Cram refers to as a "safe injury," but that does not mean it is an acceptable risk for individuals (Cram 2016:522). Whether or not a person decides a risk is acceptable is a personal choice (Cram 2016). What one person may find acceptable and/or might be something another worth the risk, may not be for others (Slovic 2010). While the EPA assesses risk in terms of the population level and makes a calculation on averages to determine the excess lifetime cancer risk, this is not how the actual exposures works within individuals. As acknowledged for the next 1000+ years, those in the general public who do not abide by the order to stay off site and/or those individuals who have to do maintenance at the site, will be putting themselves at greater risk, the risk for the surrounding places is not zero.

While the EPA acknowledged some radioactive material was migrating off site and the fire is an additional concern and complication, those in the surrounding communities will be at some risk of even low-level exposure. However, data on the impacts of low-level exposures remains contested (U.S. EPA 2014). Nonetheless, the EPAs website states, "Exposure to low-levels of radiation encountered in the environment does not cause immediate health effects but is a minor contributor to our overall cancer risk" (U.S. EPA 2014). This site, in particular, has largely sat for decades without remediation and residents worry that their low-level exposure has already impacted their health. Radiogenic diseases often take decades to appear and manifest in different ways in different bodies (Cram 2016). Residents then are left to wonder what their exposure will mean for their lives moving forward.

Smell & the Experience(s) of Place

Many residents reported that their first indication that something was off at the landfill was because they noticed an unfamiliar smell (Bernhard 2014; Schuessler 2015a; Jeffery Tomich 2013; Jeffrey Tomich 2013a). Landfills in general often already have porous boundaries and landfill operators and owners must work to convince local communities that the boundaries are sufficient (Reno 2011). Since most people would prefer to not live in close proximity to a landfill, owners and operators often turn to technological solutions and displays of expertise to build trust with citizens (Reno 2011).

In this case, while regulatory and landfill officials eventually agreed that the smell was creating a nuisance, they maintained that the site was still controlled, managed, and safe (Brooks 2014; Schuessler 2015a). The presence of the underground fire compounded residents ongoing fears about the radioactive waste and added to their disbelief that it was and/or could be sufficiently contained for thousands of years to come (Bowers et al. 1989b, 1989a; Leiser 2006b, 2006a). Landfill fires are not uncommon (Thalhamer 2011, 2013), but this seemed to confirm residents worst fears, that the landfill was both not under control and could result in a large scale disaster in the area. The addition of the smoldering event, for them, provided further evidence that the sites future safety was indefinitely uncertain.

Once more, as the landfill began to emit a strong powerful odor, it seemed to be pervasive and impacted many aspects of their lives as they could smell it at home, in the car, at work, at school, etc. Again, residents questioned, how officials could definitively say they have the situation contained when the smell was invading their homes. One resident posted, “It is starting to come into my kitchen under the side door of my house,” and in small talk before a townhall meeting residents sitting nearby shared with us that the smell seemed inescapable. Many agreed and stated that they too smelled it at home, running errands, and anytime she was outside. Residents further claimed that independent scientific testing had shown evidence that radioactive particles from the landfill have been found within some of their homes[39] (Berfield 2017).

While olfaction does not receive as much attention as our other senses, it is an important way we make sense of the world (Herz 2009; Reinarz 2014; Waskul and Vannini 2008). While smelling something may be ephemeral, smell is tied to our memory, emotion, embodiment, and personal biographies (Herz 2009; Reinarz 2014; Waskul and Vannini 2008). Smell has phenomenological properties as it is but one way we experience where the material and cultural worlds meet (Parr 2006; Reno 2011). In terms of place, landfills are often areas set apart, pushed to the margins, so that discarded items are out of sight and mind, where they can be forgotten. Simply put, most people do not have connections to waste and the places that hold waste (Strasser 2000). Instead, we prefer to create meaning,

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[39] In previous chapters, it was noted that the radioactive waste that ended up in St. Louis was from the Belgian Congo. This particular ore was highly toxic and contained some of the highest concentrations of both U-238 and U-235 ever discovered. Given this particular make up, residents have paid independent testing facilities to sample areas in their homes and claim that the testing conforms a clear and definitive link to the Belgian Congo pitchblende. pitchblende was unique in character compared with other ores, as it was known to contain “as much as 60 percent uranium, both U-238 and Uranium 235, which is very rare and highly toxic” Dreiling 2003:3).

emotions, and attachment to places like our homes, that become familiar and predictable to us (Bachelard and Jolas 2014). Smell then, is an aspect of boundary making that creates expectations with spaces and also social settings (Largey and Watson 1972). Different experiences of place both create situated knowledge (Haraway 1988), and knowledge that "cannot be separated from the bodily world of feeling and sensation; knowledge is bound up with what makes us sweat, shudder, tremble, all those feelings that are crucially felt on the bodily surface, the skin surface where we touch and are touched by the world" (Ahmed 2004:171).

Except for vision, our bodies contain more receptors for smell than any other sense and receptors for olfaction are the only ones directly exposed to the outside world (Herz 2009). To smell is both, intimate and personal, and public and shared (Herz 2009; Largey and Watson 1972; Waskul and Vannini 2008). Smell is something that most often can only be discussed in the past tense and is a cultural experience as it is often discussed about in metaphors, as in, something may smell like something else (Reinarz 2014). To smell is an action, but to make sense of smell, what researchers call "somatic work," relies on the social, cultural, and moral orders (Waskul and Vannini 2008).

Somatic work is a "process by whereby a somatic perception undergoes a reflexive interpretation. Such interpretation is marked by activities such as active reminiscing, forming chains of associations, evaluating, interpreting the significance of unique biographical particulars and/or social norms, and attributing meanings" (Waskul and Vannini 2008:58). Smell and odor are both intertwined in meaning making and are profoundly social experiences (Herz 2009; Reinarz 2014; Waskul and Vannini 2008). However, smell has religious (Harvey 2015; Summers 1994), moral (Reinarz 2014; Vannini, Waskul, and

Gotschalk 2012; Waskul and Vannini 2008), gendered/sexed (Ellis 2018; Herz 2009; Largey and Watson 1972), classed (Corbin 1986), and racialized (Chiang 2008; Molina 2006; Shah 2001; Smith 2006) underpinnings, and while the associations are historical, social, and contextual, they have been used to created dichotomies of good/bad. In short, to be good, virtuous, clean, and worthy is associated with having a good smell (Chiang 2008; Herz 2009; Largey and Watson 1972). Since we judge smell(s), it is something that many people monitor and control, specifically in terms of their bodies, as the failure to do so may lead to stigmatization (Chiang 2008; Largey and Watson 1972; Waskul and Vannini 2008).

Just Moms STL, Facebook, & Creating a Virtual Meeting Place

By the early 2000s, reports of unexplained illnesses had already begun to circulate throughout the St. Louis and St. Charles areas both on and offline. First, there was news of the illnesses of the men and women who worked either at Mallinckrodt's downtown location, its Weldon Spring location, and/or those who hauled material between sites before and after WWII (Bowers et al. 1989d, 1989a). Second, there were also more recent stories, like the unexplained infant deaths in the Immaculate Conception Parish of Dardenne, which is near the Weldon Springs site, which in spite of remediation beginning in the 1980s, groundwater testing has shown that some areas, " …continue to test positive for thorium and uranium, in some cases more than 15 times the maximum contamination level for public drinking water set by the EPA" (Schuessler 2015b:3). However, a 2001 health study conducted by the Missouri Department of Health and Senior Services determined that St. Charles County was not experiencing significantly higher rates of infant deaths, but some experts and local residents have called the methodology flawed, as it included the entire count, rather than focusing on this specific area (Schuessler 2015b). Finally, the McCluer North High School class of 1988 had their 20-year reunion and had made the unfortunate discovered that many of their peers were sick and/or had passed away fairly young from a whole host of illnesses (Hartmann 2013). As children, many of the alumni grew up near local Coldwater Creek, which bordered many backyards, was prone to flooding and a popular spot for children to play in, and unknown to them at the time, also bordered properties where nuclear waste was stored (Hartmann 2013).

This group created a Facebook Group[40] a year before the West Lake Landfill group, to and track illnesses from former and current resident and were shocked a what their public epidemiology found. But officials refuted these claims too, by analyzing health data from a number of local zip codes between 1996-2004 and found that there were not significantly higher rates of illness and instead cited lifestyle choices as a culprit for the illnesses recorded. However, residents stated that they were not testing the correct time period since many people have moved outside the areas, and residents remain convinced these illness and disease have a connection with exposure to radioactive materials (Hartmann 2013).

In November of 2012, local resident Karen Nichols created a group page on Facebook titled simply, "West Lake Landfill" for the purposes of keeping information about the landfill in one location. By this time, knowledge of the illegally dumped radioactive waste was well known by regulatory agencies, state officials, and anti-nuclear activists, but not widely known by the residents of the communities surrounding the landfill. Having once lived near the creek and now near the landfill, Karen created a separate place for people to

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[40] This public group is called, "Coldwater Creek Just the facts- Please," accessed January 2019, https://www.facebook.com/groups/217215444963933/

come for more information. The first post in the West Lake Landfill group states, "this group has been formed by concerned residents to inform and keep the public updated about the radioactive waste in the West Lake Landfill in Bridgeton, Mo"[41] By the time the page was created, the landfills had already amassed a great deal of data and according to official reports the "smoldering event" had already been detected (December 2010), but many residents were unsure what has happening (Republic Services 2014a). As a public group, Karen reached out to people she knew and encouraged them to reach out to people that they knew. The group has already amassed a bit of a following when a few other local moms joined the page and began discussing not only the data within previously available government reports but began requesting that citizens be updated about the landfill in real time.

Organizing under the banner of motherhood, they argued similar to many mother-activists before them, that in order to fulfill their duties as women and mothers and to keep their children safe and healthy (Brown and Faith 1995; Jetter, Orleck, and Taylor 1997; Krauss 1993; Mazur 1991; Tesh 2000), the radioactive waste needed to be relocated and the smell needed to be managed. While smell is a subjective and ephemeral, it is also public (Waskul and Vannini 2008). Seeing may be believing, but there are religious (Harvey 2015; Summers 1994), moral (Reinarz 2014; Vannini et al. 2012; Waskul and Vannini 2008), gendered/sexed (Ellis 2018; Herz 2009; Largey and Watson 1972), and class dimensions (Corbin 1986) to smell. In U.S. society there are social norms against what are interpreted as foul odors and also social norms that dictate to mention odor is impolite (Largey and

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[41] Administrator of West Lake Landfill's group page, accessed December 2017, https://www.facebook.com/groups/508327822519437/

Watson 1972). Smell is associated with health and cleanliness and associated with virtue and religion (Harvey 2015; Summers 1994), as the common phrase, "cleanliness is next to godliness" dictates. Since it is also classed, racialized, and stereotyped it has been used historically to subjugate and shame individuals, communities, neighborhoods, etc. (Chiang 2008; Molina 2006; Shah 2001; Smith 2006). Women, and mothers in particular, are often responsible for the upkeep of household tasks and childcare (Friedan 2013; Parker and Wang 2013). This may be of particular concern to mothers who care for children who already have breathing issues such as asthma and/or children who are immunocompromised.

Within the home, women may feel greater pressure for the impression management of odors, through de-odorizing and/or odorizing through perfumes (Largey and Watson 1972). To be a good mom then, is to prevent negative health impacts of children and limit harms that may befall them. The Facebook group was managed and created by a group who call themselves "Just Moms STL" and was a way in which residents to share and gather information in order to make decisions about what is best for their families (Just Moms STL 2012). They are referred as mother activist throughout this study as like many of the activists before them, they identify first and mothers and became activists, somewhat reluctantly, as an extension of mothering (Brown and Faith 1995; Krauss 1993; Mazur 1991).

For residents who live around the West Lake Landfill Superfund site, Facebook has emerged as an important modality in making sense of their risk. This is consistent in with other scholars who suggested that social networks and the media are important sources in making sense of risk (Douglas and Wildavsky 2010; Short 1984). Facebook has created a virtual gathering place to share information, "a place where ordinary people can "have their say",” (Hine 2015:12), and perhaps more importantly, as web 2.0 application, it has created s space for users to upload their own content (Kaplan and Haenlein 2009). Used in this way, “online activity can make more visible and amplify concerns, problems, and divisions that are part of social life in physical space, and it can raise concern about new issues, too” (Chayko 2017:2).

Social media sites have become so embedded within our everyday lives, that they are among the first sites visited when people gain access to the internet (Chayko 2017). With over 2 billion worldwide users, Facebook has become the most popular social media site (Chayko 2017; Harvey 2014). While the digital era has provided tools that have sped up communication and connectivity, the likes of which have never been seen before in human history, scholars remain divided on its implications for civic engagement and democracy (Chayko 2017; Harvey 2014; Schneider-Mayerson 2015). On one hand, the internet has been called a “a fundamentally individualistic medium,” (Schneider-Mayerson 2015:93) and social networking sites (SNS) in particular have been accused of, “eroding intimacy, community, and democracy” (Chayko 2017:35), while on the other hand, social networking sites have, in many cases, also allowed for greater access to communicate reciprocally with governments, corporations and various institutions (Harvey 2014). Social networking sites have also emerged, while often polarizing, as a place for information and an alternative news source (Harvey 2014).

Experiencing the day-to-day

With the vast majority of information, data, and reports from Republic Service, Inc. and regulatory agencies appearing after the fact, residents were often upset about, and left with, virtually no scientific data on how to manage the day-to-day progress of the landfill and instead, relied on their experiences of living near the landfill to make determinations about their days. Decades worth of reports and data have been collected, which revealed at a minimum that the RIM was migrating around the site, but since it was all largely contained on-site, both the company and regulatory agencies largely viewed the landfill as low and/or insignificant risk. In instances where material was leaving the site, it was still noted that it was not in persistently significant levels. Since the company and regulators saw the landfill as not being a risk, they saw very little need in providing real-time, scientific landfill data to residents. While many residents felt that risk was being minimized, even those who also believed the risk to be minimal, they still wanted to reduce their risk as much as possible and wanted to adequately prepare themselves for the unknown. It greatly troubled residents that there weren't any immediate telltale signs that they had been exposed and/or if the material was leaving the site. Instead, they had to rely on and trust that the regulatory agencies, companies, and expert systems were doing their part. This was one of the reasons residents had been calling for the removal of the waste since the 1970s.

By the spring of 2012, the subsurface smoldering event had been underway for over two years. In meetings, some residents stated that prior to the smell being detected, "I didn't even know I lived next to a landfill," when they moved into the area and/or certainly did not think it was as close as it was (as quoted in Schuessler 2015a:1). As the Facebook Group was established residents turned to the group to discuss the smell. Residents who lived and/or worked near the landfill shared their experiences with the landfill producing the odor. A few residents stated that they were able to detect a trash or garbage smell every once in a while, some stated every few years or so, and others reported being able to smell it more frequently, like once a month. But almost everyone felt that the issue was getting worse.

There was a great deal about this odor that older residents found troubling, namely that they felt it wasn't *just* a trash smell but a trash *plus* something else. Residents who lived father away, who never could detect the smell previously were alarmed that they now could, and also agreed with the other residents that it didn't *just* smell like trash. Besides discussions of current and former resident illnesses, discussions of smell and odor was posted about and discussed frequently. The Facebook Group was created in late November of 2012 and the first conversations about odor began in January of 2013. Residents described the smell as a chemical odor, putrid, bad, awful, noxious, etc. (LaCapra 2013; Tomich 2012). Republic Services Inc., tried to re-assure residents that the landfill was being monitored closely and that they were purchasing equipment, installed more monitoring points, added gas extraction wells, hired more staff, and purchased a "high-density-polyethylene" liner to cover the site (Republic Services 2014a). But, despite their best efforts, by spring of 2012 complaints of odors increased.

It wasn't simply that people detected a smell, but that the odor was unfamiliar, persistent, spread out over large areas, and reminded them of chemicals. A local resident stated, "It was almost a chemical odor, and it was — it was overpowering at times, to the point where you didn't like to be outside" (as quoted in LaCapra 2013:1). A longtime resident stated, "I have lived in Maryland Heights for fifteen years...it used to be, a nasty smell would occur once or twice per year....you could always recognize it…it smelled like a big huge stinky trash dumpster.....since October the smell has changed...it's a strong rotten eggs toxic smell...it's just horrible." The smell was described in a number of ways within the group. The following are examples some of the hundreds of posts describing the smell:

> "…the smell is beyond horrible!! I can't describe it other than to say it was like garbage mixed with some sort of fuel like gasoline and tar!!"

> "… very strong with a gas but like rotten egg smell."

> "…smells like dead animals mixed with a gas leak."

> "The smell almost had a decomposing body scent. Terrible smell last night…"

In the beginning, as the smell persisted, many people started calling 911 and other emergency services to report it, but as more and more time passed, people turned to the Facebook Group to voice their frustrations and the group grew steadily. A significant number of people turned to Facebook to ask things like, "what am I smelling?" "Could this be the landfill?" and some people over ten miles away expressed shock and dismay about being able to smell the landfill. As this unfamiliar smell persisted, it allowed some of the somatic work to become visible (Waskul and Vannini 2008). Additionally, the smell was sometimes accompanied by and/or brought about negative physical reactions. Residents reported burning eyes, noses, and throats, upset stomachs, asthma, and headaches and migraines. Residents stated:

> "The smell is horrible in [my apartment complex] and it's giving me a terrible headache that I can't get rid of. My head started hurting last night and has continued

today. Now my daughter is telling me her head is hurting too and asking what that smell is. Does anyone know how long it's going to be before they fix it?... I get a headache every time I smell it and the longer the smell lingers around the worse the headache gets. I just want it to go away and I feel so sorry for the people that live a lot closer to it than I do."

"I've had a nasty headache for three days… more headaches in the last year & half than I have the prior 40 years combined."

"…In a matter of about ten minutes it went from a faint odor to a throat burning stench."

"Just got off work and this smell upsets my stomach. Makes me feel like I have to vomit."

"I can tell you that tightness in my throat occurs on days the stench is worse than others… So, I think we can't underestimate the power of this stench. I used to just think it was regular trash dump stink when I smelled it and not this burning concoction."

"If we know nothing else one thing, we know for sure is this smell has the strong potential to bring on an asthma attack... asthma can be deadly!"

> "Just about 30 minutes ago my husband closed all the windows... I asked why... He said his eyes and throat were burning ... But no detectable odor."

Our cultural norms about smell necessitates the importance of controlling smell and odor though both deodorizing and perfuming (Largey and Watson 1972; Waskul and Vannini 2008). While people try and control spaces in public, there isn't an agency to regulate smells and odor unless it impacts public health, which falls in Missouri under the jurisdiction of the Department of Health and Senior Services.

Beyond experiencing the smell, it was the pervasiveness and inescapability that residents found deeply unsettling. Many residents felt as though they had little reprieve, especially those who lived and worked in the area. The landfill and its subsequent odor had become something that had to be taken into account during the course of one's everyday life. People discussed it disrupting their habits and routines, activities they once found pleasurable, and even the safety of being at home. They could detect it in their kitchens, as they cared for their children, and some residents discussed it interrupting their sleep. At a meeting I attended, a woman behind me was talking to a neighbor, but loud enough for everyone around her to hear, that, the smell of the landfill woke her up from "a dead sleep" and with palpable anger she said, "when was the last time a *smell* woke *you* up?" When I turned in my seat to join the informal conversation, she repeated, "*a smell*," and a few minutes of silence passed as we all silently thought about it. I mumbled, "I'm not sure," and she replied, "*I am* and it's getting more frequent." Online residents stated similar things and spoke about not being able to enjoy their properties, which often meant modifying activities. But even the most basic home activities were transformed by the smell. In that fair-weather time in spring, residents often spoke of not being able to save money on their energy bills by opening windows.

Leaving home to go to work was often not a reprieve. People reported experiencing the smell at work too. They stated:

> "Smell is terrible today in [work location] in Bridgeton. Smell is getting INSIDE our work facility regularly! I grew up in this area, and my father passed at a very young age from pancreatic cancer."

> "I agree with the earlier post about the smell in early evening, my office is near [two central cross streets] and the smell is pretty horrid when I walk out at around 5:00pm."

They could detect it in their cars on the way to places. They state:

> "So gross even turned my heat off to see if the smell would stay out of my car."

> "Such a nice day. Driving down St. Charles Rock Road near Best Buy and [local furniture store] and I had to put up my windows because of the smell :(3:10pm."

> "… horrible smell, burning eyes. The smell is penetrating the vehicle I'm in."

It was detectable as people were running errands. While at Target, Kohls, Best Buy, Dollar Tree, Steak N Shake, Applebee's, etc. To residents, even the local hospitals were not a reprieve and/or was problematic, because the nearest hospital was very close to the landfill and often, the smell was detected within the hospital itself. While the company and regulatory agencies said very little about the smell initially, the Missouri Department of Health and Senior Services put out a statement that if the odor caused issues, that they should seek medical attention[42]. However, residents didn't see the hospital, where it was suggested they go too, as a reasonable source of help, as they reported that the smell was inside the hospital as well.

> Resident #1 to Resident #2: "It's a shame that while our community is being forced to breath toxic emissions that are making many people sick with respiratory, breathing difficulties, and asthma issues, we can't even address our immediate health issues at [local] Hospital because the smell is often reported inside the hospital itself. Therefore, for those needing immediate medical attention we must go outside of the impacted area for treatment."
>
> Resident #2, in reply: "you know....when your little girl has asthma you take them to the closest ER in an emergency situation...but if the cause of her asthma attack is the smell...and the closest ER is FILLED with the smell...I have no choice but to take her to [another local hospital] which is about 15 minutes away! Her doctor said the same thing...don't take her to an ER with this smell."
>
> "I smelled it yesterday at [local hospital]. I was walking from the hospital to one of the office buildings next to it."

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[42] In September of 2018, these claims would be called into question as Missouri Department of Health and Human Services admitted that exposures could have impacted human health (Cazares 2018).

It was not difficult for me to imagine what the residents meant when they spoke about the odor. The admins to the Facebook Group also held townhall community meetings that were recorded and then uploaded to YouTube and shared on Facebook. I was able to attend some meetings over the last several years and was always stuck by how close to the landfill these meetings were held. The meetings were most often within a three-mile radius, if not closer. I could smell the landfill in my car on the highway and in the parking lot before and after the meeting. Like many of them, I kept my windows up and air/heat off until I was out of the area, because it would indeed feel like it was surrounding me. But, for me, it was fleeting because I left the area. Nonetheless, like them, I found the odor hard to place but hard to ignore, especially because it was so unpleasant. Over my years studying the landfill, even in casual conversations with friends and family in the St. Louis area, many would ask, is that what I am smelling as I drive on the nearby interstate? Many people who often reacted in shock and would reply something along the lines of, "but how do people stand it every day?" Sadly, over the last several years, a few members of my extended family from the area have passed away and as my family has gathered, conversations always turn towards the landfill and creek. These conversations always mirror many of the conversation and concerns shared in the Facebook Group. Were their illnesses and deaths because of contamination?

Separate and Together, Managed and Unique

The company and regulatory agencies did not view the smell in quite the same way. Since the West Lake Landfill Superfund site historically accepted different types of wastes at different times, the regulatory agencies and the PRPs saw the site a divided and representing different areas (U.S. EPA 2008a, 2008c, 2018). The complex accepted waste before and long after the radioactive material was dumped there in the 1970s and the PRPs and regulatory agencies wanted to make clear distinctions about what area they were responsible for (U.S. EPA 2019). Generally, landfills are managed by the state and under the oversight of the state regulators, in this case, the Missouri Department of Natural Resources, but as it also contained radioactive material and has been given Superfund status, the entire complex was technically under the oversight of the Environmental Protection Agency.

However, at this site, the EPA primarily oversaw the sections of the landfill that contains RIM, often called OU-1, while MDNR manages everywhere there was not radioactive material, which was called OU-2. Part of the issue here was that OU-2 contained the underground smoldering event and/or underground fire and OU-1 contained the radioactive material (U.S. EPA 2008a, 2008c, 2018). This division was also represented online, where the two sections have separate websites and largely do not discuss the other section(s). In reality, these areas are physically fairly close together, separated by approximately 900-1200 feet (LaCapra 2014; Phillips and Marsh 2014). As stated above, experts and regulatory officials have been at odds about if the fire was moving closer or father away from the radioactive material and what will happen if it meets. While officials readily admitted that this situation is the first of its kind in existence, they also have told residents that it was managed and safe (Bissell 2014; Brooks 2014).

According to their website, when the odor was first detected, Republic Services, Inc. the parent company of Bridgeton Landfill, LLC, notified St. Louis County officials and state regulators within 24 hours of this discovery, and over the next month begin working closely with the Missouri Department of Natural Resources (MDNR), neighboring businesses, and local first responders. The company further reported that over the next six months Republic Services, Inc, invested in technologies and equipment to reduce odor, installed more monitoring points, installed high-density liners at areas that produce odors, and employed a team of environmental professionals who monitored data at the site daily (Republic Services 2014a).

For all of the residents' discontent, in December of 2012, Bridgeton Landfill, LLC, reports that a "comprehensive air sampling event concludes that the odors, while unpleasant, do not pose a risk to public health or safety" (Republic Services 2014a:1). For many residents this felt like a form of word play, as the air sampling tests did not find anything notable and therefore, it could not be a risk and if it was not a risk, it could not cause health and safety harm to the general public. But the general public had already been reporting that the smell was greatly impacting their lives, and made people sick to their stomachs, burned their noses and throats, and was impacting those who already had health conditions. Residents didn't disbelieve the data, but could not dismiss their own symptoms either, and/or believed that the wrong things were being tested. Additionally, calls for the removal of the waste went ignored and/or unanswered for decades.

Notwithstanding, the company was willing to admit a portion of the odors as a spokesperson from the landfill is quoted as saying, "Like any manufacturing facility- or bakery down the road- there's an inherent odor sometimes in the process. A piece of equipment goes down, or something like that, and we respond to that immediately," (as quoted in Schuessler 2015a:1). However, residents who live near the landfill believe that they are able to tell the difference between smells. When being questioned on how one resident knew it was this site and not say, another nearby landfill (i.e.- Champ) the resident states, "It's the same smell we have been smelling. We don't need them to tell us what we're smelling and what we're not smelling. We're flustered over it. We're just hopping mad" (Bernhard, 2014). Many residents viewed this as just another attempt to disregard their concerns and to add insult to injury, also insulted their intelligence. While data from the landfill had indicated the odor was not harmful, residents who live around the landfill believed that the smell affected their lives in other ways beyond health and safety, such as their ability to enjoy their property. In April of 2014, the US District Court for the Eastern District of Missouri agreed, and a settlement was reached requiring the company to pay roughly 4.8 million, "fair compensation to 76 percent of landfill neighbors for any loss of use or enjoyment of property as a result of odors emanating from the site" (Republic Services 2014a:1). While the smell of the landfill was a concern, the residents who live around the landfill are unwilling to define the situation as just odor, because the odor obstructs their daily life by limiting the ways in which they can use and enjoy their personal property.

Frustrated at not being believed, the residents began tracking the location of the odor, the severity, and how it was made them feel. This was initially done on Facebook within the group, but then was taken over by the Missouri Coalition for the Environment. This prompted the regulatory agencies to create an odor log that residents could use to report issues which was also shared with the company so that concerns could be addressed case-by-case. The odor logs have grown to be an area of contention because on one hand, it has been a way for the residents to provide feedback and participate, but on the other hand as the years have passed, many have come to feel as though it isn't helping in the same way they wanted. Additionally, some residents felt as though the odor logs themselves were being used to downplay, disregard, and sometimes deny that the landfill was the source of the odor. In the same place that residents could file an odor concern the website denies some of their concerns by stating, "Today, three out of four complaints filed are determined to have originated from a non-landfill source" (Republic Services 2014b:2). This served as a reminder that the landfill was in a densely populated area with many different industries, business, and even another landfills.

However, residents were worried about the radioactive waste, the underground fire, and what would happen if they were to meet. The EPA and Republic Services Inc. worked quickly to assure residents that since they had sufficiently contained the radioactive waste on site, that it was not a risk to them. Early on, the EPA maintained that the radiological waste was securely contained within its own property lines, which was surrounded by a chain link fence. Residents were quick to note that, a chain link fence, not only was a rather flimsy barrier since it is not solid, but also it was made to keep people out of the area, not to keep the waste in. Furthermore, it does nothing to actually contain what was already inside from moving and according to the 2008 ROD, this already was an issue (U.S. EPA 2008a). Residents found this exceptionally inadequate and deeply insulting, so much so, that it was and is referred to as the "magic fence" by residents. Residents even made satirical memes about it. The meme is captured in Figure 22. On the image, which showed a picture of Albert Einstein, one commenter wrote, "Talked to 3 PhD[s] in chemistry and not one said a chain link fence would contain radiation. But all three had a good laugh," and another resident who commented on the meme's post said, "The Magic/Magical Fence and Green Monster, are symbols of how they insult our intelligence. A way to gaslight us into thinking what we see is not real. Still currently happens when their spokespeople arrogantly proclaim the safety of the site and foolishness of your fears. At some of the earliest years of education children are taught the danger of the biproducts of that man's equations." Residents felt that officials failed to take responsibility for their portion of the risk and also did not take residents' concerns seriously.

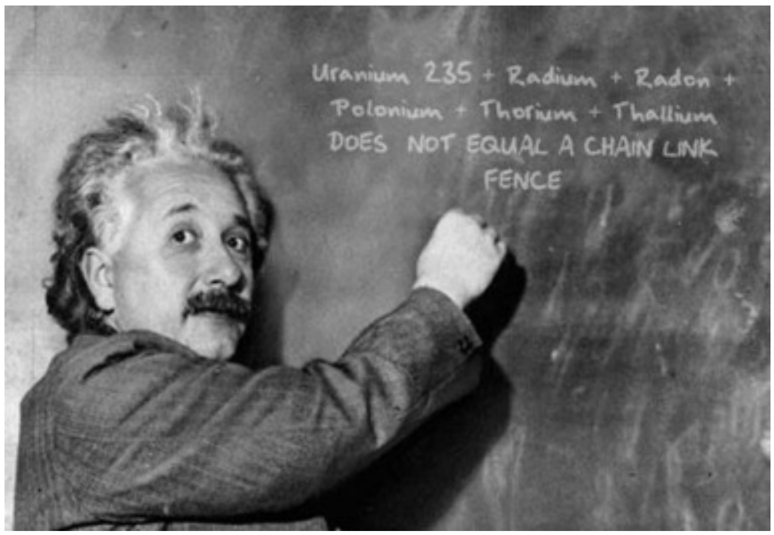

Figure 22. Einstein Meme.
Data Source: Facebook Group User, July 8, 2013

In short, residents wanted to be prepared and wanted to know what to expect, so that they could make decisions about their own risk, but they often were hit with roadblocks and regulatory agencies and government officials who were unwilling to comment on what the worst could be.

Sometime in the middle of 2013, in a meeting with regulatory agencies and community residents, that was uploaded on YouTube and shared within the Facebook Group, a woman asked, "what is the worst that could happen?" and an official replied, "Ma'am the answer that the EPA expressed tonight is an honest answer. We are studying the question; we don't know as we stand here today [audience murmuring] …. but there is an important point to make here and that is the weight of the evidence shows that there is adequate time for the agencies to consider that" (Daves 2013). Faintly you can hear, someone yell out, "but that is not what she is asking" (Daves 2013). Residents were/are both fearful that they may be or have been exposed to radioactive particles by living in the area and now through the underground fire, but also unsure of what may happen when the waste and the fire meet. Would it explode like a bomb? If there isn't an explosion, then how would they know if it did? But, later in the same meeting a gentleman stands up with a stack of papers in one hand and a microphone in the other. He stated (Daves 2013):

> "Unfortunately, the question I have is going to change slightly. I am, just have to say, I am shocked to hear you say DNR is in charge of radioactive waste studies at the site. DNR is underfunded and understaffed and everybody know that, and I love DNR, but they are not equipped to handle this, so that's the first thing you should fix. It is a Superfund site and the Department of Energy should get some money to get real monitoring because you can't defend on the [inaudible words] ... it's not fair to DNR to ask them to do that and it is not fair to any of us. So, for 40 years this waste has been here. From the EPAs own standards, [he begins reading from his papers], "The fundament goal for controlling any type of radioactive waste should be complete isolation over its hazardous lifetime. Controls which are based on institutional functions should not be relied upon for longer than 100 years to provide such isolation; radioactive wastes with a hazardous lifetime longer than 100 years should be controlled by as many engineered and natural barriers as are necessary." I go on, "no safe level of radioactivity can be established from the available evidence. Risk associated with any given method of control should be considered unacceptable

> if risk to future generations are great than what is acceptable to the current generation and if the selective control option and if waste [inaudible word] stems beyond 100 years, decision makers can NOT rely on [inaudible] customary usages of land… So, my question is we are 40 years in now, and you cannot tell me that chain link fence, and the horrible job the government has done with their waste that are illegally dumped there, you have no excuses anymore. Clean it up, move it out, do what [inaudible, audience starts clapping] We don't want to wait another 40 years, there are people in this audience that have experienced this. My father had pancreatic cancer and worked next to the SLAPS site. I think that's where it came from and you don't get a little convenient flag that says where your cancer came from. But people have suffered in this area for this whole time and it's enough. Clean it up. It's an emergency… when will you take it to a licensed facility? [audience stand and begins to clap and chant, "move it out," "get it out," and "clean it up."]"

This was a very powerful moment, as it captured resident's emotions and frustrations. Residents understood that the landfill fire complicated decision making, but many believed it was a problem that the regulatory agencies themselves created. Activists, local government officials, and some residents had been calling for the removal of the waste for decades, and if it had been removed, then there would be little need for barriers and/or magic fences, and if an underground fire occurred later, it would have still called for some alarm, but likely not on the same level of it being near radioactive waste. The situation had become unique and the first of its kind, because they waited too long, were overly confident that something unexpected would not happen, and did not adequately factor in the unknown. To residents, the landfill fire was evidence that the unknown and unexpected could absolutely happen and was happening. Therefore, how could they be so certain that their plans, to leave the waste in place would not be a harm to anyone on site for over a thousand years and that it would not meet another unexpected future event? Likewise, residents were struck by, and outwardly rejected, that they should be put at even higher risks than what was typical of the EPAs own standards. Why should they be left to carry the burden on such a unique never before seen issue?

In an attempt to prevent the fire from touching the radioactive waste, a possible solution was proposed, in June of 2014, which included building an isolation barrier between the fire and waste. Multiple parties met to discuss some of the proposed plans and the Army Corps of Engineers commented on the plans. Determining where to put the barrier was difficult as Karl Brooks from the EPA stated, "Getting all of those disparate technical pieces together to satisfy the scientists and engineers of the EPA will take some time" (as quoted in Phillips and Marsh 2014:2). The Army Corp of Engineers advised that the exact location of the radioactive waste must be determined before construction could begin. EPA assured residents that they would have enough time to construct the barrier before the fire spread further (Phillips and Marsh 2014). As, of this writing, in spring of 2020, the barrier continues to be indefinitely delayed.

Managing Risk

In March of 2013, a local news reporter made a post in the Facebook group, asking residents for their thoughts on something that appeared on the Missouri Department of Natural Resources website. She asks, "What do you all think of this statement posted yesterday? It seems as close as the state has come to saying there "Might be" a "possibility" of a future public health threat." [several comments later] …. "It is interesting that this was updated on the DNR homepage, but no press release went out." A local resident commented:

> "As a parent I am faced with a difficult decision. My job is to protect my children at all costs... do I wait until they say it's a "THREAT" before I move my children out of what could be "harm's way" or become proactive? The problem is if they say it is a threat in the future it means that it has been a threat for the past two years that we have been breathing this stuff in. And they have yet to test for Dioxins or any of the multiple other toxins to which their equipment is not sensitive enough to pick up. The DNR sited Republic [Services inc.] for having this fire back in July of 2012. On their situation it says "This event has created odors which are migrating off-site and have resulted in numerous odor complaints. These odors currently continue to cause a nuisance. If emissions from the SSE are not controlled or conditions intensify further, these emissions could potentially pose a risk to public health." THEY ARE LATE TO THE GAME ON THIS ONE!!! And now my children, friends, and this community may have to pay for it."

Other residents are quick to note that up until this point Republic Services Inc. and the EPA have been unwilling to admit the possibility of any risk. Another resident posted, "What was that about "no safety risk" on the flier from Maryland Heights as well as Republic a few weeks back!?!?", while another says, "Bottom line is, Republic Services saying that their own air quality testing reveals no health risks is like allowing the defendant in a murder trial to also sit on the jury! I don't know about the rest of you guys, but I'm from the Show-Me

State. If Republic Services is doing air quality tests that reveal no health threat, I say they should cough up the data and prove the DNR wrong!"

As the block quote above shows, much like the residents at other sites who refute the methodological flaws in the studies and refute claims, residents here noted that, the company and EPA routinely used air testing to draw conclusions about health. They make these claims of health and safety by concluding that, their data did not show particles above harmful levels and therefore, it was not possible to cause any health problems. While many residents believed that the regulatory agencies were not testing the correct things, they also believed that the landfill owner and regulatory agencies had a vested interest in downplaying any possible effects. It was noted that no one was specifically collecting data on public health in the area. For residents, claims about health remain unsubstantiated because the data collected above was on particles and not the actual people who live/lived in the area. Therefore, radioactive particles could have been blowing and/or migrating off site for years and impacting resident health, but since no one was collecting health data, no one could know for certain.

Regardless, residents still wanted to minimize the risks that the experts were deeming minimal and/or acceptable. Many residents, especially mothers and those with pre-existing conditions were interested in limiting their current exposures to as little as possible. Often when risks are deemed too great for us as individuals, we turn to avoidance, but in this case, this is not an option (Largey and Watson 1972). One may be able to attempt to mitigate some of the effects, as will be discussed in further detail below, but no one could opt out completely. Breathing isn't an activity that one can opt out of, nor is it immediately clear if strategies to limit exposures, are effective. Residents often remained indoors, kept windows closed in warm weather, and modified their activities by going outside of their community. Some residents stated:

> "One of my most favorite things to do in the warm weather is roller blade around the lake listening to my music, watching sailboats and just enjoying nature. I can't do that this year because of the nauseating odor :-/ That's not fair!! I will have to go to Forest Park."

> "I'm glad at this point, I'm not getting out of my house much, so the smell does not get to me at all. At the same time, I'm affected by [respiratory diagnosis]. I'm not sure how a 30-year-old, nonsmoker, fit, active person, got this. I wonder if this is the reason I stop breathing in my sleep, have asthma attacks in my sleep, gripping rescue inhalers in my hand while I sleep. Fighting to come out of it and wake up to be able to breathe comfortably. I have no answers no certainties. But, one day if my lungs stop working promise to help keep the lands clean around you. Help protect the environment around you. That's my one wish."

> "I used to just think it was regular trash dump stink when I smelled it and not this burning concoction. I limit my outdoor activity now when I smell this. Sunday May 5 it was horrible. I hate that our weather is going to finally get nice enough to enjoy our spacious patio and landscaped backyard and we won't be able to sit out."

Some residents purchased products to either control or filter the smell and/or products to control the associated risks. Residents especially those with breathing issues, purchased masks and/or purchased products associated with being sick to manage sore throats, burning eyes, etc.

Residents paid special attention to the news and weather reports to plan their days and activities to try and limit their exposure. In discussions with a few residents, some stated that after getting away from the smell, they immediately felt better, so any attempt to escape it or avoid it was attempted. For example:

> Resident #1 to resident #2: "Winds tomorrow should be from the North, so those areas south of the landfill likely will smell it. Over the weekend winds should be more from the South and Southeast, meaning Earth City and St. Charles will likely smell it the most. The coolest times of day should be the worst too (cool air is heavy and tends to sink downslope) -- late afternoon through early morning."
>
> Resident #2: "Thank you for that information, very informative! Thanks."
>
> Resident #1: "You're welcome. The smell is disgusting. And knowing that very dangerous gases and particulates are odorless is very disconcerting."

Mothers in particular, often followed the news closely to try and manage the amount of time their children spent outside on days that the smell was and/or could be worse. Depending on the direction of the wind, time outside, and /or at the first indication of children experiencing any symptoms such as headaches, burning eyes and noses, or general unease, mothers brought their children inside. A place where this took on particular importance was while children were at school. At school, children would play outside and then upon returning home, sometimes feeling unwell. Their risk was something that they would then take into account within their daily lives.

Challenging Expertise & New Ways of Knowing

As stated in the examples above, residents were very concerned about what they were breathing in and its associated risks. While the official word, was that the smell was harmless and there wasn't any continued need to track it, residents felt that they were being harmed and believed if it wasn't being tracked in a formal way, then someone had to do it. To be clear, it wasn't that experts and officials in the area did not believe that there was a smell, as it was very hard to miss. They also did not dispute the mothers who said that their children felt sick day to day. What was disputed was in some cases, if the smell was from the landfill and/or of the smell could be linked back to the site *and* if it was causing significant harm(s).

Local mothers felt compelled to track what was making their children feel sick from day to day and made the associating that the longer their children were exposed to the smell, the worst they often felt. They monitored the smell and monitored their children closely for any signs of discontent. The smell was not something that had been tracked and or monitored in an official capacity, so residents created their own tracking and warning systems, so they knew how to organize their lives. Therefore, residents somewhat early on began logging and tracking where, when, severity, and health effects of the landfill smell.

> "I think it would be a good idea for everyone to take a second and post when they are smelling the horrific landfill smell... I think we should post the date and the location you are experiencing it. I would like to know how far out this is really

> reaching and how often it is happening... I know since Oct 27th, 2012 our neighborhood has been experiencing it and the time between the smell is becoming shorter and shorter."

> "It is very important for us to document the date, time, and location when we are experiencing the AWFUL smell...ALSO...Please list any symptoms you are having when exposed to this smell... burning eyes, respiratory, headaches...or any other things. Thanks!!!"

> "I am at Target buying ANOTHER bottle of cough medicine for my 6 y/o daughter. I'm mad now. That is not something I like to be. The "smell" is overwhelming. Fixed???? I think not West Lake Landfill. This is NOT fixed. I will be logging this and emailing everyone today. What the hell is in the air now that is choking my child?!?!?"

With so many residents tracking, they were able to use this information to make determinations about their day and activities. Residents tracked the smell informally for months. The regulatory agencies and company continued to maintain that the smell was harmless and that in some cases the installation of equipment was to blame for part of the problem. They reasoned that the installation of gas wells and equipment would increase the smells in the short-term but produce long-term gains and went a long way to try an reassure residents that the site was maintained, controlled, and managed. Since the odor was impacting their lives, residents petitioned the regulatory agencies and company to notify them of days in which the smell would increase. If it were a matter of work being done, then they could conceivably warn people in advance of when it would happen, so residents knew what to expect.

Residents noted early on that an official warning system and/or a centralized area to access up-to-date information on environmental conditions was virtually non-existent. Weather channels and website could be used to track the weather, wind, and even allergy counts, but not for something like this. Residents worried about what would happen if/when the fire met the waste, how would they know, and where they would receive words on what to do in an emergency. In addition to tracking smell, and discussing past and present illnesses, a great deal of posts in the early years of the group was dedicated to finding out who was in charge and what should be done in case something unexpected happened.

Residents wanted to know more information about smell, preferably in real time, but as much as regulatory agencies and the company discussed management and transparency, there wasn't anything requiring them to share the information. At the beginning when the smell was particularly bad, the public was often informed after the fact that there was an increase in odor and/or smell that day. Residents were quick to point out, that this was information they could already detect and /or it was not helpful after the fact. In response to the ongoing odor complaints sometime, not long after residents' complaints of the smell increased, MDNR started an "odor log" where residents could call in and file complaints. Residents are encouraged to report the date, time, location, odor strength, and provide contact information for follow up questions.

Residents used the odor logs, their experience and scientific reports to make sense of what was happening and to gauge the level of communication by the company and regulatory agencies. While residents were often upset that they didn't have information in the moment, so that they could plan their lives, they did use reports to compare what the reports said to what they experienced during the same time period. Residents were able to see what the air sampling reported, where it was reported, and its strength. Residents often felt vindicated when they were able to align data points within reports to their own reported experiences. This was proof in several ways that their management strategies were beneficial.

Residents also used these reports and their tracking of smell to challenge decisions made at the site. For example, in May of 2013, Republic Services Inc., stated that they would be doing some maintenance at the site which would increase the odor and were paying for residents in a 1-mile radius to be temporarily relocated for a short period of time. On Facebook, residents challenged the reasoning behind the small radius, because they had evidence through tracking odor that it was much more widespread and should be made into a 3-mile radius. While this did not end in a major victory regarding the expansion of the radius, it was a victory in terms of making visible the way that decision makers often make decisions outside the boundaries of sound science and the continued importance of residents in collecting their own data.

Discussion/Conclusion

Throughout the Facebook group's history, stories and experiences of the past have shaped people's ongoing perception of risk. As residents started to become aware of the site, whether through neighbors, the media, social networking sites, and/or through their own experiences of sensory perception, a great deal of the group's activities centered around making sense of not only their own experiences but also what they believed the official data collection at the site lacked. They believed that the data lacked actual resident health data from both past and present residents.

The 2008 ROD indicated that radioactive material was migrating around the site, and at times off site (U.S. EPA 2008a). Because general evidence of the impacts of low-level exposures of radioactive material within scientific literature is lacking, this was often used as an indication that residents were not experiencing impacts (U.S. EPA 2008a, 2014). With very few answers, residents began listening to their own bodies for clues about environmental information. Former residents believed they have already been impacted. Current residents feared the impacts of long-term low-level exposure and their exposure to the smell. Previous residents' health histories were often difficult to prove in terms of exposure, because causation is difficult to prove within the context of a person's life.

Even some of the most famous cases of contamination, like Love Canal, NY have produced inconclusive findings (Tesh 2000). Additionally, the burning throats, stinging eyes, headaches, and trouble breathing that residents reported are not considered "data' in the strictest sense, and in many cases, these reports have been completely disregarded. Comments such as the following, from Russ Knocke, Vice President of Communications and Public Affairs at Republic Service's Inc., were both dismissive of residents' experiences and self-reports. He uses the language of "proof" and "certainty of the scientific community" to do so. In an article, he stated (as quoted in Berfield 2017:15):

> "We've been the only adult in the room for a long time," Knocke says. "It's been this spin-up of noise and fear and anxiety, and we generally feel like we've been the only ones that have been trying to say, 'Guys, here's the science.'" "You might see the ground dry up a little bit; you might see cracks; you might see radon emitted into the

> air," he says. "That's the what-happens-if. Not St. Louis goes boom." The Moms, he said, have shown "a complete disregard for science and distrust of institutions" and have scared the community."

In short, with the use of some scientifically collected data, they claim that the lack of evidence of an exit pathway, and/or harmful elements, equated to proving the site is safe and healthy for current and former local residents. However, residents did not disregard scientific data, rather felt their experiences made up for what the data lacked.

While the Facebook group initially was started to discuss the possible impacts of radiological material at the West Lake Landfill, the underground fire and increase in odor was often discussed. Longtime residents characterized the smell as the somewhat typical trash/garbage smell, *plus* something else and spent a great deal of time trying to determine what the *plus* was, which many thought and/or compared it to chemicals, burning tires, rotten eggs, decay, etc.

In terms of what the smell reminded them of and what they compared it to, the important cultural references here cannot be ignored. The rotten egg smell is something that is added to natural gas, because natural gas is tasteless and odorless, the additive is used as a way to alert residents of a possible leak, which can create explosion and/or be deadly (American Gas Association 2020). Residents are told if they smell that, they must act quickly (American Gas Association 2020). Residents also found the smell to be something they had to manage, because at a minimum it was a nuisance, but it also created problems of its own. Residents found the pervasiveness of it alarming, because it seemed to occupy so many places, and often all at once. Smell is also something many people actively try to control within daily life. Taking out the garbage so it doesn't smell, wearing perfume, and managing body odors are not typically considered activities that reduce risk, but if these cultural mores are not followed, there is a chance that anyone who comes in contact with them may judge them unfavorably. The harm then, is as social as it is physical, so as to not come off as offensive to someone else.

Managing an underground fire and a nuclear waste site within one's community is not something that can be controlled at the individual level because of the enormous amount of resources, knowledge, expertise, and coordination required in remediation activities. Due to this, residents still called for the removal of the waste, as this seemed to them the best long-term strategy to ensure the safety of the community. Wearing masks and staying indoors were things that residents did in the day-to-day to reduce their exposures, but they were also aware that these activities were not a permanent solution.

However, in short term, since the regulatory agencies and company were routinely dismissive of health symptoms, it became something residents had to manage. Residents wanted to reduce even what the regulatory agencies and company had categorized to be small risks. Even low-level exposure and its attendant uncertainties for how it may impact the health and safety of residents in the community later, was something worth trying to reduce the exposure of. While radioactivity does not produce a smell, and often does not produce any immediate discernable and/or detectable bodily symptoms at low-levels, the smell of the landfill and the uncertainty about when, and if, the smell would meet the waste was something that residents tried to avoid. Without any established mechanisms, residents turned to Facebook to track and warn one another about where the smell could be detected, its strength, and any physical symptoms. In this case, smell was something to manage and also served as a warning system.

Smell and it's in/ability to be controlled also became an indicator of regulatory trust and management but was also used in conjunction with the official data reports at the landfill for residents to make sense of their own experiences. Residents could use strategies that are often described as rational and objective and those considered non-rational and subjective to help make up for the health data, they believed officials were missing. They also compared their experiences to what official reports said about what was happening within the environment. This was especially important in this case, as residents felt as though they were not being taken seriously because their symptoms were "not significant enough;" their exposures were not high enough; and their health, despite living near a potentially risky site, was not being monitored. Additionally, the site was believed to be controlled and managed, even while residents could smell the site miles away, as they tucked their children in bed at night. Residents, therefore, relied on *in-between* strategies to make up the difference (Zinn 2016). While in-between strategies suggest that people draw on both rational and non-rational strategies that include trust, intuition, and emotion (Zinn 2016), this chapter shows that people draw on their understanding and histories of spaces, as well as sensory information to make decisions. In doing so, they have created new ways of knowing that has grown out of many residents' experiences of gender and motherhood.

Additionally, residents used social media as tool to help track their experiences and compare them to others. Computer mediated communications (CMC), such as Facebook, are known to change the way people interact with one another (Chayko 2017). Facebook Groups and Pages have turned into a space for residents to unite amidst their own uncertainties. They are places where residents can challenge, contest, and create knowledge. What once was considered a place (cyberspace), or an activity (surfing the web), with expanded technologies, social media and the internet has allowed users to discuss topics and upload videos in real time (Chayko 2017). It can also allow a community to come together to make sense of the environmental uncertainty they have found themselves in. Perhaps more importantly, it can "shape our experiences of embodiment as information and insights we find online help us understand ourselves in new ways" (Hine 2015:44). Using the internet and Facebook groups for more than just health information, residents have also used it to track sensory experiences like "smell." As a participatory space, this has potential beyond just the sharing of experiences, as "… it offers the potential to radically reshape relations of expertise, positioning ordinary people as experts, and sidelining traditional sites of authority" (Eysenbach 2008b, 2008a; as cited in Hine 2015:12).

CHAPTER 6: CONCLUSION: SUBJECTIVIES OF RISK MOVING FORWARD

Environmental problems that cannot be solved, and instead become something that must be managed and re-managed, have been described as wicked problems (Rittel and Webber 1973). "At best they are only re-solved- over and over again," because they are not just problems for the natural sciences, but instead are also issues of government policy and planning (Rittel and Webber 1973:160). Ever since radioactive material made its way to the St. Louis area, it has had profound implications for communities there, specifically those that live near contaminated sites.

From the beginning, I sought to explore the ways that lay people make sense of risk in environments of high uncertainty when narratives of risk are being contested by experts. I hoped to uncover, not only how lay people managed and lived with risks, but also to find out how they produced and contested knowledges in the process. I utilized a case study design because it became clear early on, that there wasn't any one true methodology that would be sufficient to answer these questions. I utilized methods that included: observation/scraping of the public Facebook group(s), interviews, archival data, and observations of townhall meetings. The Facebook group in particular, was an important site to explore the ways in which people made sense of risk. As the chapters move from the policy level to the individual, so too do the conclusions, as I put some of the main themes of the project into a larger context.

Risk and beyond the Welfare State

Chapter 3 provided context to the project as it outlined the historical, political, and economic circumstances that brought radioactive material from the Belgian Congo to the St. Louis area. Residents in the area who now live, or have lived, near an underground fire and/or nuclear waste have found themselves subjected to decisions that were made decades ago. These decisions not only brought the material in the area to begin with, but then decisions were made again and again to keep the material there, long after the war ended. While I am of the mindset that historical anchoring is often necessary in sociological analysis, in this case, it was also important to residents. This in particular, how and why there are radioactive materials in the landfill, was something I heard over and over again.

The answer was also a story, or some version of it, that has been told over and over again. My retelling is largely an echo of these retellings, and one I must admit does not add much beyond some sociological analysis. However, it was still vitally important to me to not only see what the historical record said, but also to retrace the steps that so many of the residents themselves had. On the surface, the kneejerk reaction almost everyone has been one of disbelief at the combination of radioactive waste and underground fire. It is, in the cultural milieu, as a somewhat common cliché, an absolute worst-case problem, to call something a dumpster fire, and only made worse by a dumpster fire going nuclear (Merriam-Webster 2020). It is quite another to be living near it. The whole situation seemed far-fetched, and as Missouri is known as the show-me state, as if wanting to verify something with our own to eyes (and even noses) and requiring proof of claims, is regional. All of that to say, historical documents were made available, sought out, posted, and discussed within the Facebook Group, meetings, interviews, and in casual conversations. People of course wanted to know this history of the site, but they were also interested in the documents to further think about harm and its legitimacy.

In the 1930s when the U.S. was in the midst of the Great Depression, President Roosevelt established a number of welfare programs aimed at strengthening the social safety net (Skocpol 1995). At a time when there was mass unemployment and widespread economic hardship, the state had stepped in to help manage some of the uncertainty and risk citizens faced (Skocpol 1995). By the end of the 1930s, global political tensions had again begun to rise, and while the U.S. publicly had expressed the desire of neutrality, it nonetheless began planning for war (United States Department of State 2019). But the president also saw an opportunity to protect citizens both psychically and also financially through the potential development of atomic and nuclear products and weapons. In order to explore these possibilities, new relationships emerged between the State, industry, and academic scientists (Jasanoff 2005). The Manhattan Engineering District (MED) had to rely on companies to create the necessary materials for the project and thus, very early on, Mallinckrodt Chemical Works entered the picture (Fleishman-Hillard, Inc. 1967).

One of the more interesting aspects of these relationships and this time period was the secrecy in which these relationships were established and marked (Anais and Walby 2016). This project operated outside of Congressional, state, and civilian oversight, and was able to do so long after dropping atomic bombs on Japan. In St. Louis, the MED supplied the raw material and agreed to oversee issues of health, safety, and radiation at the site, while Mallinckrodt Chemical Works supplied the labor (Makhijani et al. 1998). It is important to bear in mind that not only was this largely occurring before standards for occupational health and safety, but much of what employees were working with was also hidden from them. While the MED worked with scientists, it did so under the threat of war and was primarily a military operation (Hacker 1987; Zwicker 2005). As such, it was argued that it was necessary to prioritize tasks and increase risk taking to speed up the project and to prevent delays (Hacker 1987; Zwicker 2005). Decisions during this time have had profound consequences in terms of both the ongoing management of production waste, and the health and safety of workers and civilians.

Gabrielle Hecht's (2012) concept of nuclearity helps shed light on how radioactive material has been thought about as it has made its way around the St. Louis area. As nuclear is not a technical category, it not only varies across time, place, and by degree, it also is not easily transferred from one domain to another (Hecht 2007). Since nuclear things are not detectable to our senses, we have to rely on technologies to make them visible (Murphy 2006). When something was thought about as nuclear/hazardous/dangerous, technologies are put in place to monitor levels of exposure, but when they are not thought of this way precautions may not fully be taken advantage of. Mallinckrodt employees who worked downtown worked for years in a plant only designed for months, and at the Weldon Spring site, the pace of work and production was such that workers worked long hours to meet demand (Fleishman-Hillard, Inc. 1967). While certain technologies were used to render radiation and exposures visible, it was something that was managed, to varying degree, in the short term. This led to Merril Eisenbud, who was with the AEC, to state that plant was one of the two worst plants in terms of health and safety (U.S. DOE 1995b).

At SLAPS, where the material was stored, technologies were also used, but employees reported being told by management to ignore radioactivity readouts (Bowers et al. 1989b). Here, nuclearity did not translate to the drivers that hauled material between sites, nor did it translate to the material migrating off the site (Bowers et al. 1989b). Early documents showed evidence of material leaving the site and making its way into local Coldwater Creek, but any long term implications was reasoned away, without evidence (Kelvin 1948).

Where all of this takes on particular importance today is in matters of challenging exposures and expert systems. In this case, the State has both created the problem through partnerships with a local company, and also has set the guidelines by which exposures are seen and legitimized. Through federal programing, the federal government has admitted that over 100 sites around the St. Louis area have been contaminated due to Cold War era activities. As such, most are undergoing remediation (U.S. Army Corp of Engineers n.d.).

However, the nuclearity of these sites has not translated to the bodies on those sites, and instead, this has been a separate battle. The State does not guarantee citizens a risk-free life, but even in the case when there was more or less acknowledgement that certain citizens were put in riskier positions, it is still something that citizens must prove to be seen as legitimate. For example, the National Institute of Occupational Safety and Health (NIOSH) uses dose reconstruction to assess how much a person may have been exposed to while working at a contaminated site in the past (Subcommittee on Immigration, Border Security, and Claims 2006). In many ways, dose reconstruction creates an artificial reality, because it is always at best, an estimate. Further, since many of the workers who worked with radioactive materials have passed away, there is no real way of knowing the full extent of their actual exposure and the impact it has had on their family (Subcommittee on Immigration, Border Security, and Claims 2006). Dose reconstruction further narrows risk, by only considering bodily harm and suffering, and not any associated risks because of the exposures.

Nonetheless, a family must undergo a process under which risk is made real, measurable, and quantifiable, which then is used as an objective and rational way to assess and quantify harm.

For families to qualify for benefits on behalf of their family member, they must engage in a bureaucratic process that takes a considerable amount of time and energy. Once eligible, former workers are given special cohort status, which qualifies them for benefits (Subcommittee on Immigration, Border Security, and Claims 2006). As stated in chapter 3, the difficulties associated with this have, by and large been so complicated that many of the families have not gotten compensated. In a subcommittee hearing convened at exploring this issue further, the chairman noted, "It appears no effort, however, is made to acknowledge or challenge the real fact that NOISH found few dose records were available and that the integrity and validity of that data was in serious doubt." (Subcommittee on Immigration, Border Security, and Claims 2006:3). He goes on to say that is was a case in which the people were knowingly put in harm's way. He stated:

> "The United States steps up and provides billions of dollars without a blink when there is a natural disaster and people are harmed throughout the world. We as a government are not to blame for that natural disaster or that harm. In this case, we as a government did the harm, knew we were doing the harm and intentionally deceived people working to protect this nation from harm…Unlike assistance programs where millions of dollars are paid to out on fraudulent claims of harm, the claimants under this program cannot fake cancer. It is true that some of these workers' cancer may not have been caused by their exposures. But we should all remember that the chance that their cancer may have been caused by their exposures is possible in many cases only because of the Government's willingness to put them

> in harm's way to manipulating the record of their exposures or out-right deceit about the safety of their workplace" (Subcommittee on Immigration, Border Security, and Claims 2006:3–4).

The above quote is powerful, and clearly articulates the issue. These workers were harmed by government actions and inactions. The workers' harm was not acknowledged until the Clinton Administration, long after many of the workers had already passed away (U.S. DOE 1995a). These workers' harm(s) were acknowledged because of the tireless activism of women like Denise Brock, who have spent much of her life fighting on behalf of her parents.

Bring this back to present day, the families who live around the landfill and Coldwater Creek believe that they are experiencing negative health impacts, not only because the radioactive material was brought to the area for a war time production, but also because of the decisions that were made about that material that are now putting them at greater harm. Many of the harms were created with the caveat that once the war was over, they could be attended to. But people still believe they are being impacted and feel these obligations and promises made by the federal government have not been fulfilled. Will this happen to the people in this community? The war is long over, and residents are left wondering why, then, is this something that they need to consider within the course of their lives? And why must this be something that this community must manage for thousands of years in the future? Many residents are somewhat understanding about the decisions made during war time that may have put them at a greater rate of harm, but they cannot understand why a war that lasted about six years should knowingly be allowed to impact a community in perpetuity. Simply put, they have carried this burden long enough.

Risk, Regulatory Agencies, & Corporate Interest

Chapter 4 discussed how the secrecy that protected much of the early war era activities came to light in the middle 1970s through investigative journalism (Bowers et al. 1989b; Freivogel 1976a, 1976b). This was particularly timely, as the 1970s had brought about a focus on pollution and other environmental issues. Prior to this time, landfilling was seen largely as a local issue, but as production increased, more waste was created (Percival et al. 2013). Since industries were not required at the time to follow guidelines with the management of waste and disposal, it was not something that was factored in and/or given a lot of thought. Additionally, it was difficult for local communities to be strict about waste, particularly industrial and production waste, because they could easily move their business somewhere else (Horinko and Courtin 2016). Individual states already competed for businesses and depended on them for their economic stability. Unfortunately, the lack of regulations had led to increases in the pollution of waterways, the air, and land (CAA 1963; CWA 1972; SWDA 1965). To manage pollution at the national level, the Environmental Protection Agency (EPA) was created, and many states followed suit to create their own regulatory agencies.

The management of hazardous and radioactive waste took much longer to sort out and regulate (Bowman 1985; Szasz 1994). By the late 1970s, the federal government was finally willing to attend to of the properties that were contaminated due to Cold War era activities and established Formerly Utilized Sites Remedial Action Program (FUSRAP) (U.S. Army Corp of Engineers n.d.). Cleaning up contaminated properties, especially ones that had a couple of decades of movement and change, is not a quick, cheap, and/or easy process. For most of the contaminated properties in the area, they became eligible for remediation under FUSRAP, but the West Lake Landfill has become a site of contestation. The landfill was never meant to be, nor was it ever, a production site for radioactive materials. However, the AEC make the decision to sell radioactive material to begin with and knew that not all of it had a known use. Furthermore, through the sale, they moved from owning and self-regulating to merely regulating it. They also knew that facilities capable of storage of the waste was few and far between and to date, the U.S. has yet to come to grips with the long-term storage needs of nuclear waste. The AEC was able to dump its own waste on its own land which was also regulated by them and later they were able to use federal programs and regulatory agencies that had taken over many of the duties of the AEC, to manage remediation and clean-up activities.

After negotiations to manage the nuclear waste failed, the Cotter Corporation, found a loophole. Radioactive material that was deemed insignificant did not need to be licensed and could be disposed of virtually anywhere. The company decided that they could make the material insignificant by diluting it, which is exactly what they did. Mixing "…8700 tons of leached barium sulfate (Ba SO_4) which contained about 7 tons of natural uranium (0.05 to 0.10%)", with 3.5 times as much topsoil (Allen 1974:1), the company hired a subcontractor to manage the site and the material was dumped in the West Lake Landfill. By doing so, they dumped licensed material in an illegal manner, but they had also made the material into an unlicensed amount. This was discovered by the AEC during an inspection and put the AEC in an odd predicament. Did they cancel each other out? How should this violation be managed?

Before this could play itself out, the AEC was dissolved, and two new regulatory agencies were created to manage some of the AECs previous tasks (Energy Reorgination Act of 1974 1974). However, this was not seamless, and was far from straight forward. The newly minted NRC wanted to accurately characterize exactly what was in the landfill before making a determination about its long-term management. As stated earlier, while hazardous waste policy was slow to unroll, when it did, it created regulations on the type of place that could manage this type of waste. Ironically, the West Lake Landfill does not even meet the minimal qualification of these regulations because it is unlined, in a flood plain, and near the city of St. Louis's drinking water (Leiser 2006b).

However, various tests and studies were carried out over the next two decades before it was determined in the late 1980s that the material must be managed in some way and could not remain in the landfill indefinitely (U.S. NRC 1988). When the NRC looked into what legal recourse, they may have to remediate the site, they were told the statute of limitations had run out (Treby 1988). Not wanting to pay for the remediation themselves, the site was listed on the NPL to await remediation under the Superfund. The Superfund program has been subjected to various controversies over the years and since it was not renewed, the fund has long since emptied (Voltaggio and Adams 2016). Today, the EPA tends to work with polluters to clean up their own sites and sites in which responsible parties cannot be found, are cleaned up under the U.S. General Accounting Office (U.S. General Accounting Office 2003). As such, there is a great deal of inconsistency between years and the number of sites that are cleaned up. This is primarily because the EPA, which often oversees these projects, does not operate in the same way as other regulatory agencies. It has much closer ties to the White House and is often rife with bipartisan political clean up (Andrews 2010).

Residents who live around the landfill then, are at the mercy of this political tug of war. Additionally, residents and local and state governments have had very little say about the site and since the lead agencies have been federal, there has been little recourse for disagreements. Even sites that were cleaned up under FUSRAP have been far from perfect, as regulatory agencies and local governments are largely unable to dictate the manner in which the site is remediated. The Weldon Spring site was cleaned up to meet recreational standards, but not residential ones (Davis and Puro 1999). This means, that the site can be used for activities, because people will likely not be on the site long enough to increase their exposures to a level that would be concerning to EPA (Davis and Puro 1999). However, this would not be the case if the MDNR's recommendations to make the land was habitable, was followed (Davis and Puro 1999).

The 2008 plan for the landfill did not intend to remediate the site to either the habitable or the recreational level, but instead, would keep the waste on site and need to remain restricted (U.S. EPA 2008b). Anyone who managed the site, including grounds keepers, may be putting themselves at risk. Once more, the site must be restricted for thousands of years in the future. For residents who live around the landfill, this has created an undue burden. Combined with the 2010 discovery of the underground fire, residents are even more fearful about the containment and suitability of the site. But, the fire and laws surrounding property rights have given residents and the state agencies an opportunity to have a greater say in the process (Republic Services, 2014a).

Risk & Citizenship

Residents have now found themselves in a situation where they must assess and manage their own risks surrounding the landfill. Since the status of the landfill has been a source of debate for decades, a great deal of information is available about the site. Additionally, various data points are still being collected and made available to residents. Regardless, regulatory agencies and the company that own the landfill maintain that the site is safe, managed, and controlled (Brooks 2014). They share via their website the ways in which technologies are being used and invested in, as well as the amount of money that is being spent on the site. All of this conveys that the site is being sufficiently managed to the best of their ability. The smell residents are experiencing is reasoned away as more of a nuisance, because air testing did not reveal persistently higher rates of particles that are deemed dangerous. They reason, that since, any material leaving the site it not at a significantly dangerous level, and because the air testing has not revealed any consistently significant levels of dangerous elements, the site is safe. If residents are experiencing health issues, it could not be from their site, but perhaps somewhere else. They go a step further on their website to say that when odor complaints are investigated, they are determined to be most often from a non-landfill source but stop short of saying what that source may be.

However, residents grew more and more concerned about the smell. People who had lived in the area for years and admit being able to detect the smell on occasion, stated that the smell was different and included the typical smell, plus something else. The smell is, and was, fairly evasive and unlike other types of smell that is ephemeral, this odor appeared to be there to stay. Residents had a difficult time controlling the smell, try as they might. They could smell it at home, at work, in the car, at their kids sporting events, at concerts, in the hospital, while running errands etc. For some residents, the smell caused physical symptoms like burning eyes, noses, and throats, as well as migraines. Residents worried that the underground fire had met the radioactive waste and that they were now breathing in particles produced by both issues. Resident grew upset that claims about the landfill turned into claims about their health. How can they say that the people are not experiencing ill effects of the landfill without testing the actual people? Since the EPA and the company seemed to use this as a strategy to both manage risk and deny it, residents had to develop ways of knowing on their own.

Even as the risk was deemed minimal, residents still wanted, at the very least, ways to manage that minimal risk, even though many believed the risks were being downplayed. Residents turned to social media, namely Facebook, as a way to collectively understand risk and as a way to make sense of information so that they could manage it independently. They began tracking the smell, where it was, time, strength, and issues it caused. Residents could see and make guesses using both past experience and the weather patterns to determine the best course of action. Additionally, they tried to limit their exposures on particularly bad days by going farther out for activities and/or changing plans, such as keeping kids inside to play. As the Facebook grew to such large numbers it also became a tool for activists to convey information and coordinate activities. It also became a way to pressure regulatory agencies and the company. This last point is something that needs to be explored further in future research.

Finally, residents used in-between strategies to manage their own risk. Rather than thinking of the expert lay divide, these strategies explored the ways in which residents draw on a number of sources to make sense of their world and plan for the future. Residents used scientific data, Facebook, and their own sensory and personal experiences, to make decisions about how best to manage uncertainty. Residents had to rely on these, in part, because the experts themselves created several standstills where they disagreed and the latent effects had been a pause on making decisions at all, which many residents say as a way to prolong the process. Residents fought for their different types of harms to be seen as legitimate, namely what they were experiencing, but while they were sometimes given spaces where they could voice their concerns of frustrations, this was never considered as legitimate as the collected data. Residents still use the Facebook group on an ongoing basis to track smell, manage risk, and for trusted information.

Study Limitations

Like any study, this project had various limitations. The first limitation was simply in the scope of what this project set out to achieve. This was not the dissertation I thought I would be writing, as that one seemed neater and straight forward. I had originally planned to do interviews, and to be honest, still may in the future. However, as awareness about the site grew, especially in the media, residents were contacted by the press over and over again for interviews. In this regard, I never felt as if my requests would be denied, because their intention was for greater awareness, but what had become more and more apparent was that the interviews in the press seemed to all say similar things. The same people, namely Dawn and Karen, were interviewed over and over again. This is not a critique, of them, their stories, interviewers, etc., rather this reflects consistent messaging among those interviewed, and perhaps evidence of data saturation, making additional interviews less salient.

Being a member of the Facebook Group, I noticed that in interviews, the story was summarized, the edges were smoothed, and they were keenly aware and mindful (as many people would be) of how they were being portrayed. This felt significantly different than the posts and conversations happening in the Facebook group, which may point to the differences between journalism and depth and rawness of research. The group was very active, and by that, I mean, people posted in real time, all day, every day and often multiple times. People posted on the go, as they were out and about, on their cell phones. These were sometimes emotional like, "I WANT TO PUKE," and hurried and contained spelling mistakes. In interviews this came across much more practiced, so that the above may be translated to "I am upset," which is also fine, but I saw great value in how the residents were experiencing the site, all the emotions, etc., in real time. I found myself asking, how angry must you be and how disruptive must this feel for you, to post about the landfill from the Target parking lot, after you have buckled in your children? There was just something different about what was happening within the Facebook Group to me, that felt edgier, real, and unfiltered. The data in the Facebook Group was untapped and told a different story.

This leads me to the second limitation, which was the sheer magnitude of posts and the nature of Facebook. Unlike other applications, Facebook does not make a researcher's job any easier. I could see how many people were in the group (today it is over 21,000) but I could not see the demographic breakdown of members, and/or exact numbers about posts. Unlike Twitter, or other social media platforms, researchers do not have access to the metadata of posts (Chayko 2017). In the above example then, I cannot say whether or not the person was actually at Target when they posted. Did they post it in the car on the way home? In the store itself? And/or after they were long home and reflecting on their day?

Granted, many residents did provide their own metadata of sorts, by adding date, time, location, and smell information, but regardless, any further analysis or breakdown via demographics was not accessible to me. Additionally, the Facebook Group was public and easily searchable, but not easily downloadable. I was able to use the mobile version of the site to print off posts, and also relied on weekly memos to capture the broad strokes of what the group was doing along with notable posts. Finally, at multiple points, people suggested that I make some sort of sampling frame, but I was hesitant to do so because I was interested in the nuances and understanding the day-to-day. To make a sampling frame was actually more complicated because of all the reasons above. However, as most studies on risk use survey designs, I felt my study was making a unique methodological contribution, and it would be best to allow the events to unfold as they did.

Finally, because of the above, and the ongoing nature of the landfill, and since dissertations are timebound (sadly, but also, thankfully), this project focused more heavily on the historical data up to the beginning years of the Facebook Group. As of today, the Facebook Group is still very active, meetings are still being held on a somewhat monthly basis, and the site remains contested. While I continue to follow the group, I had to draw boundaries around what the dissertation focused on. The most up-to-date data presented within the dissertation is from around 2015. To stop there was necessary for this project, but the situation remains ongoing and great deal has happened over the last 5 years. While I cannot do it justice in such a short amount of space, I will provide where the landfill is at now, in the broadest of strokes.

In February of 2018, the EPA announced the "final" proposal for the site (OU-1). The plan, referred to as "Excavation Plus" and/or "alternative 4," removes roughly 67% of the radioactive waste at the site to the depth of 16 feet (U.S. EPA 2018b). The plus aspect of the remediation is that if material is readily accessible at the 16 feet deep mark, it will be removed, but as some of the material is not easily reached and would take more time, resources, and money for little pay off, according to the EPA, justifying the 16 foot threshold (U.S. EPA 2018b). The proposed plan is estimated to cost $236 million and will take approximately 5 years to complete (U.S. EPA 2018b).

After the announcement, the EPA hosted a public listening session and opened their it to get responses from the community. Figures 23 and 24 show, how many people attended an event that was so crowded, only standing room was available in the back. If I recall, this was also during an emerging snowstorm, which led me to leave the meeting a bit early. All of this is to say that the community was eager to face the EPA as a group and have a chance to share their stories. The EPA gave people 3 minutes each to talk; they listened and did not comment. Residents could also share their views via letter. Due to the vast volume of letters and responses, the EPA pushed back the collection window multiple times, and in the end, the EPA received over 4,000 letters (U.S. EPA 2018b).

Today, the PRPs are working to create a plan on how best to complete the above plans and remediation is set to begin sometime in the future. Overall, many residents see the removal of even some waste to be a win, even though they would have preferred a full removal. However, residents do not see their work as being over, and are now ready to see that the work is done. They remain committed to the site for the long haul, and still monitor the site closely.

Figure 23. Meeting with EPA March 6, 2018.
Data Source The author

Figure 24. Meeting with EPA March 6, 2018.
Data Source The author

Avenues for Future Research

One avenue for future research simply involves the continuation of data analysis past the 2015 mark and through the remediation process. Remediation often takes years and brings about its own issues and complications. It would be worth exploring how the remediation process takes shape and how residents are able to participate in the process. Facebook was such an important part of residents' day to day lives, especially at the beginning. It would also be worth following what happens next for the Facebook groups.

Just as the landfill today cannot easily be separated from the circumstance in which it was created, so too is the writing of a dissertation. As I sit here in late April 2020, to write out my final thoughts and try to put this landfill into context within the larger scheme of things, I cannot help but be distracted by recent events. My city, my state, most of the nation, and a large number of places across the globe have found themselves under orders of shelter-in-place or something similar. Currently, a lot remains uncertain about Covid-19, a rapidly spreading and highly contagious corona virus, that by all accounts, originated in China sometime late last year (Beaubien 2020). Very little about the virus is known at this time, and many places, including the University, have taken the additional step of closing, in order to not overwhelm the medical system and flatten the curve (Roberts 2020). While this crisis will likely impact almost everyone, it remains to be seen how and what shape this may take. As much remains uncertain, people are struggling with how to manage their risk and/or that of their families. Tensions between the federal and state governments have increased, and the U.S. had stopped funding to the WHO, a move other nations have condemned, which has further increased tensions abroad (Restuccia 2020).

In many ways, the frictions between levels of government in terms of risk and uncertainty are further becoming visible. Under typical circumstances, a disaster of some sort may involve the transferring of resources from places that are not impacted to places that are. Major global catastrophes often lead to an outpouring of support, but in this case, so much remains uncertain. As we are six weeks into the shelter-in-place, the economy has largely crashed. and by all accounts, we will likely be in a deep recession, the likes to which, it is predicted, are the worst we have ever experienced (Ezrati 2020). President Trump has gone on national media outlets both to express his eagerness in re-opening the country, and also to suggest scientifically unproven treatments that are, by all accounts, dangerous (Chiu, et al. 202). He has repeatedly stated that "the cure cannot be worse than the disease" and he means it to suggest that the economic devastation cannot be greater than the health and safety issues associated with the deadly corona virus (Haberman and Sanger 2020:1).

While he is calling for the U.S. to re-open, polling suggests that citizens themselves are worried about doing so (Saad 2020). For many, the risk seems too great to return to business as usual when the future seems so uncertain. What if we open too soon and this is the wrong move? It could, after all, prove deadly to their loved ones. Is it worth the risk to return to work? What if it means that more people may die? Many people have seen their saving dwindle and investments tank, so is it worth it to go into work and then risk your life? You may feel you have already lost too much. Personally, my student status has allowed me to work from home, but that same status comes with inadequate healthcare with high deductibles, which gives me greater pause to be eager to enter public life again without some certainties. People of color are dying from the virus at much higher rates, as are those without a college education, and certain places have been particularly hard hit (Schumaker 2020).

If claims that are not backed by science are seen as more legitimate, and widespread testing is not available, where does it leave people? What/where are the boundaries of risk behaviors in the time of Covid? While trying to be risk avoidant, are people more willing to take risks that they imagine will impact their selves over others? How are some of the individual risk behaviors a reflection of State expectations and assumptions?

There have been several protests, where protesters believe their civil rights are being violated by being asked to remain at home. Do people who engage in these protests believe there isn't a risk and/or do they believe there is, but that they believe civil rights are more important? How will issues of intersectionality shape risk responses? Are the hoarding behaviors the result of selfish and greedy ways to manage risk? Or as evidenced by increases in gun sales, are people disbelieving the State will be able to provide and/or manage control? Questions such as the ones above could go on much longer, but I will stop there.

What does appear to be the case is that risk(s) are at once something that a person much manage themselves with resources and information, but they are also dependent upon institutions and the State. A person has expectations about their environments, their institutions, and the roles that governments play. What this project has shown is that people make decisions with those in mind. What was made visible through this project was the ways in which the social context of the landfill has become a site for knowledge production and contestation. As residents have come together, they forged new subjectivities about risk, health and safety, and the role government occupies within their lives. What is happening now with the Covid crisis is beyond what almost anyone could have imagined, which provides us an opportunity to see the ways in which uncertainty was and is planned for. Like most dissertations, I am left with more questions than answers, but it does seem like some of these issues at the landfill are not isolated and have broader applications at this very point in history; it is my hope that this dissertation is a jumping off point for future work on risk.

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APPENDIX

Interview Guide

1. Are you from this area?
2. How did you first become aware of the situation? (was it the rad waste or the fire)?
3. How much time before you though it was serious?
4. What about this situation attracted you?
5. Smell- why has it been important to track all of this info?
6. How did you go about finding out more information?
   a. Were people taking you seriously?
   b. Creation of the Facebook group
   c. Goals of the group
7. Relationship with the Moms and others
8. How did you go about finding out more information?
9. How do you know who to believe and how do you make sense of all of this data? (science and technology) When did you start making the connections?
10. When was the first time you felt like you were being taken seriously?
11. Safety Plan- Does it make you feel safer?
12. How has this changed your views about government's role?
13. How has this changed your life? Informed your work or next steps?

VITA

Kristen Michelle Kalz was born in St. Louis, Missouri and grew up in both Missouri and Illinois. In 2005, she earned a Bachelor of Science in Psychology and Sociology from Southern Illinois University Edwardsville. She then returned to SIUE to earn her Master of Arts in Sociology in 2009. She worked full-time as a mental health counselor while completing her master's and after graduation she worked as a Career Counselor, Instructor, and ran an Alzheimer's Unit. In 2013 she came to the University of Missouri Columbia to complete her PhD in Sociology and minored in Women and Gender Studies and also earned a graduate certificate in Grant Writing. While at Mizzou, she has taught numerous classes and served in elected positions in the Graduate Professional Counsel. In 2018, she was nominated by a student as an "outstanding mentor." In 2019, she earned the Mizzou's 18 award and in 2020 she was indicted into the Rollins Society, one of Mizzou's secret societies. While she is happy about her time in Columbia and the great friends she has made, she is excited about what is to come. She currently lives with her cats Gonzo and Willie and her dog, Leo.