THESIS

ROCKY FLATS: A CASE STUDY OF NUCLEAR CONTAMINATION, KNOWLEDGE, AND ENVIRONMENTAL JUSTICE

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ABSTRACT

ROCKY FLATS: A CASE STUDY OF NUCLEAR CONTAMINATION, KNOWLEDGE, AND ENVIRONMENTAL JUSTICE

This thesis seeks to examine the environmental and public health experiences of individuals who live(d) near the Rocky Flats Nuclear Facility in Arvada, Colorado during and after its operation. The data presented for this thesis has been collected as part of MSU-CSU's Rocky Flats Health Study to collect qualitative interview data from individuals who suffer from rare cancers, chronic illnesses, or have had a family member who has passed due to these health outcomes. Currently, there are few health studies related to Rocky Flats Nuclear Weapons Plant, and those that do exist are highly contested (Iversen 2012). In addition to archival analysis of fifteen interviews, oral histories were conducted with fifteen individuals. Oral histories illustrate community perceptions of Rocky Flats, as well as the impact of living in close proximity has had on their health and quality of life. In my findings, I illustrate the political, institutional, and interpersonal aspects of accessing information regarding environmental contamination and subsequent health risks. Findings illustrate that access to information both during and after the facility's operation was severely constrained by structural barriers, conflicting reports of safety, and a culture of secrecy surrounding the site. Understanding the lived, psycho-social experiences of people with contested illness is critical to connecting questions of justice and environmental contamination.

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Chapter One: Introduction

Nuclear contamination is similar to many of the environmental problems we face today; seemingly distant, invisible, and insidious. The atomic bombings of Hiroshima and Nagasaki in 1945, the Three Mile Island accident in 1979, and the Chernobyl nuclear power plant disaster in 1986 each showed that radiation can pose substantial health risks for numerous people and for many years (Ohtsuru, Koichi, Atsushi, Ohtsura, Noboru, Sanae, & Nollet 2015). While the bombs dropped in Hiroshima and Nagasaki and the accidents at Chernobyl and Fukushima are all well-known globally, other important nuclear sites remain just as invisible as radiation itself, though they too have had significant impacts on communities, environmental, and public health. Before Chernobyl and Fukushima came Hanford and Rocky Flats, nuclear production facilities, and with them, the practices that characterize nuclear disasters: prioritizing production at the cost of safety, poor safety and waste management standards, withholding information about accidents, and contesting the health impacts of radiation exposure (Brown 2013).

As we now know, while many die immediately from radiation exposure, the health effects of nuclear exposure persist for years. Victims suffer from delay health consequences of radiation exposure, consequences that include elevated rates of cancer, reproductive disorders, tumors, and abnormal development. In addition to impaired physical health, victims often have psychological disorders and anxiety symptoms caused by concerns of their health, experiences of losing their loved ones and community, and under addressed policies for remediation (Kamiya et al. 2015). Despite decades of scientific and technological improvement, scientists have yet to fully address consequences of both low-

level, long term and high-intensity, short dose radiation exposure (Ackland 1999; Iversen 2012; Brown 2013).

As radiation illness is not a specific stand-alone disease, its symptoms manifest in a multitude of ways that are often masked as another ordinary illness. Radioactive isotopes are known to weaken immune systems, damage organ tissue and arteries, and are liked to causing numerous diseases of the circulation and digestive tract (Brown 2013). Many illnesses related to radiation exposure remain contested by public officials and health practitioners. In this thesis, I examine the health and psycho-social impacts of living near the Rocky Flats Nuclear Weapons Production Facility, which operated in Arvada, Colorado. I utilize Rocky Flats as a case study to generate a broader discussion of contested illnesses, knowledge, and conceptions of justice in the nuclear era.

Rocky Flats Nuclear Production Plant was a former nuclear production plant located near Denver, Colorado (Iversen 2012). Beginning its operations in 1952, Rocky Flats produced plutonium triggers for nuclear bombs for over forty years. Although production was temporarily halted in 1989 for environmental and safety reasons, Rocky Flats' production capacities were not completely halted until 1991 (Ackland 1999) and remediation activities on the site continued into the 2000s. Plutonium, Rocky Flat's defining element, required special handling due to its highly radioactive nature. Plutonium is one of the most toxic materials in existence, and it is accompanied by several risks. If even one microscopic particle is inhaled by humans, it can cause biological damage. Some forms of plutonium ignite spontaneously and less than a pound can cause nuclear reactions that are lethal to anyone in its vicinity (Ackland 1999). Despite this, we now know that at the Rocky Flats facility, cuts were made in production precautions and safety measures in

order to increase profit and quantity of plutonium being produced. Rocky Flats had two large-scale fires, one in 1957 and the other in 1969, which sent toxic plumes throughout the Denver area, both unknown to the public. During its operation, the plant had routinely released plutonium into the air and stored toxic barrels of highly radioactive waste above- and underground. In the late 1950s, hydrochloric acid ate through barrels stored outside on what was known as the 903 pad, causing them to leak plutonium- and uranium-laced oil and solvents into the soil (Iversen 2012). Though scientists hoped that new technologies would be developed to solve the problem of leaking and spreading radioactive isotopes, this technology still does not exist in 2017. What does exist is the occurrence of chronic illnesses and high rates of birth defects, infertility, and rare cancers in communities located near Rocky Flats.

After Rocky Flats closed in 1991, the Department of Energy declared that it would take seventy years and $40 billion dollars to clean up Rocky Flats (Iversen 2012). Yet, this all changed when the reality of remediation set in for responsible parties. This initial lengthy and expensive declaration was modified to an agreement that partially cleaned up only the top three feet of soil and allowed significantly more contamination to remain, particularly below six feet under the surface. In 2005, cleanup was declared complete. At present, the facility still holds 14.2 tons of plutonium. Half of this plutonium could be transformed into nuclear bombs or weapons; the rest is waste. Most of this toxic plutonium has nowhere to go, except offsite if swept away in run-off or in to the lungs and bodies of citizens living in surrounding communities (Iversen 2012). In addition to the contamination from plutonium, the site is heavily contaminated with a plethora of radioactive and nonradioactive materials, including uranium, tritium, nitrate, strontium, cesium, and iodine

(Ackland 1999; Quigley, Lowman, and Wing 2012). More than 1,000 acres of the site are so profoundly contaminated that they can never be open to the public. The rest of the site is slated to open as the Rocky Flats National Wildlife Refuge, which will include public recreation areas for hiking, biking and possibly hunting. Importantly, there are no signs at Rocky Flats to tell what happened there, or why anyone should worry about the deadly legacy that remains.

In addition to the Rocky Flats National Wildlife Refuge, housing continues to be developed south of the Rocky Flats Nuclear Weapon Facility. Since most visual reminders of the facility have been removed, new homeowners and residents are often unaware of its former existence. In the Contiguous Area Report given to residents by Candela developers, there is no mention of plutonium, the elevated incidences of cancers in the area, or the effects that radiation exposure has had on the people in the area (Candelas Glows 2015). Ironically, the development is being framed as a 'green community' with various sustainability standards having been met. What have not been met are safety standards. While the Candelas developers inform residents that they have tested the area for gamma radiation, they fail to test for alpha; what plutonium actually emits (Candelas Glows 2015). Additionally, the remediation of Rocky Flats did not eliminate all contamination in the industrial area where weapons were produced. Although all buildings were demolished and removed, residual contamination remains in core production areas, settling ponds, and two landfills (EPA 2016).

Nearly twenty-five years after the Rocky Flats facility was shuttered, the Metropolitan State University of Denver (MSU Denver) and Colorado State University have begun co-conducting the first health study regarding illness and disease completed by residents. The

health survey seeks to identify if there are identifiable health effects experienced by residents that have lived downwind from the former Rocky Flats Nuclear Weapons Plant, particularly rare cancers and disease clusters. As described by Dr. Carol Jensen, a Principle Investigator of the health study, preliminary findings show that:

> Within the 1,745 completed surveys for the 64-year time period, there were 848 cases of cancer with 414 of those cases being cancers designated as "rare" (less than 15/100,000 people). These rare cancers account for 48.8 percent of the total cancer cases for these survey results as compared to the US rate for "rare" cancers which is 25 percent.

At present, nothing has been done to address or legitimate these high rates of rare cancers. As radiation is invisible to our senses, it becomes easy to mask its existence. The health impacts of living near the Rocky Flats Nuclear Production site therefore remain contested, and community-based health studies remain underfunded. Housing developments continue to be built in the area surrounding Rocky Flats and the "remediated" area is slated to open in December 2017 as the Wildlife Refuge described above. Naturalizing nuclear spaces has become a common practice; Chernobyl, Hanford, and now, Rocky Flats have been transformed in to wildlife refuges sitting atop toxic spaces.

While the MSU-CSU Health Study does not collect medical data or records on those who live(d) near Rocky Flats, it reinforces the need to both quantitatively and qualitatively examine the lived, psycho-social experiences and public health outcomes of living in proximity to Rocky Flats Nuclear Weapons Plant and the subsequent Superfund site. The data presented for this thesis has been collected as part of MSU-CSU's Rocky Flats Health Study to collect qualitative interview data from individuals who suffer from rare cancers, chronic illnesses, or have had a family member who has passed due to these health outcomes. Despite this study, a significant gap in the literature exists. For one, there are few

health studies related to Rocky Flats Nuclear Weapons Plant, and those that do exist are highly contested (Iversen 2012). More broadly, few studies have been conducted that address the lived experiences of people living in the shadow of nuclear production all along the fuel cycle (Malin 2015). This study begins to fill that gap in knowledge. As such, I ask three major research questions:

1) *What environmental and public health experiences do citizens report in relation to living near the Rocky Flats Nuclear Weapons Plant, both during and following production?*

2) What did residents know about the Rocky Flats Nuclear Weapons Plant during and after its operation?

3) *What do residents perceive as environmental justice in this situation?*

Much like the tragedies caused by the small, lethal particles of plutonium, the Rocky Flats story is much larger than it seems. This is a story about a community that was unknowingly exposed to nuclear contamination and radiation for decades, about officials and industry that let poor management and legal loopholes proliferate. It is an all too common story about an industry that sought economic gain and military advancement at the expense of public health. Too often the voices of those who bear the brunt of environmental injustices remain unheard. My hope is these stories, told by the individuals who have been affected by Rocky Flats, will contribute to broader discussions about our nuclear past, present, and future. It is only when we address these toxic legacies that we can move forward.

Chapter Two: A Brief History of Rocky Flats

The Rocky Flats Nuclear Weapons Plant was located in the rural community of Arvada, Colorado, just up the road from Denver, Colorado (Iversen 2012). It created one of the most contaminated, least known, and most obscured sites of environmental contamination and injustice in the U.S. During the Cold War, Rocky Flats Nuclear Weapons Plant was a top-secret nuclear site that smelted plutonium, purified it, and shaped 70,000 plutonium triggers for nuclear bombs (Iversen 2012). Rocky Flats was the only plutonium trigger production site in the United Sites. In the decades that Rocky Flats was producing triggers, it was simultaneously producing nuclear waste with little thought of disposal. Each kilogram of the final plutonium trigger generates hundreds of thousands of gallons of radioactive waste (Brown 2013). The plutonium processing at Rocky Flats created enormous quantities of waste that were put into drums and buried or, at times, stored in the open as with the 903 Area and able to migrate off-site. These controversial production and disposal practices were not known to the public for decades, as the site continued to operate behind a veil of national security. Even today, most Coloradans are unaware of the site. Still, its toxic legacy remains.

With the passage of the Atomic Energy Act in 1946 (with amendments made in 1954), the weapons production complex was turned over to the Atomic Energy Commission (AEC) (Ackland 1999). The AEC included facilities in thirteen states with a staff consisting of 2000 civilian, 4000 military, and 38,000 contracted employees (Ackland 1999). Shortly after the act was passed, the AEC reported to President Truman that lagging plutonium production posed a serious threat to the safety and defense of our country. As a result, the newly formed Department of Defense began a more comprehensive effort to

produce plutonium and utilize it to build a nuclear weapons arsenal to achieve ambitious military and pro-capitalist geo-political goals (Ackland 1999). The AEC and the military concurred that nuclear weapons production should rapidly increase. This goal required a large increase in the production of uranium, the building block of plutonium (Ackland 1999).

The Atomic Energy Act placed an increased demand on the government to create more nuclear production facilities (Iversen 2012). Under this act, all government decisions and action revolving around nuclear production did not have to be disclosed to the public. Often, these details were not even disclosed to workers. It was common for nuclear sites to operate under a security system known as "compartmentalization" in which workers were only told what was necessary to perform their job (Quigley, Lowman, and Wing 2012). This secrecy allowed for officials to deceive the community, pollute the area, and subsequently deny such pollution had ever happened. For decades, communities living alongside nuclear production sites were unaware of the dangers radiation posed to their health and the environment.

In 1943, as a part of the Manhattan Project, the government created a facility which would separate the plutonium from the uranium and other radioactive by-products: Hanford. Hanford, the nation's first domestic plutonium production site, was strategically located near the Columbia River Basin (Brown 2013). It was thought that the surrounding area could be used as a vast sink to deposit hundreds of thousands and essentially billions of gallons of radioactive and toxic waste. Within such a vast territory, scientists assumed that radioactive isotopes would scatter into the air, soil, and water to the point where they would be harmless (Brown 2013). However, other scientists contest this method of waste

disposal, estimating that the soil would absorb radioactive isotopes into the soil and result in dangerous levels of radioactivity in the environment and crops grown on that land (Brown 2013). These complaints were filed away and were not to be acknowledged by the general public for decades.

By 1945, scientists at Hanford were well aware of the consequences of exposure to radioactive isotopes, observing that exposure "caused cancers; resulted in problems in the immune system, the digestive system, and the circulatory system; and accelerated aging and death" (Brown 2013:65). Despite this, Hanford routinely released hundreds of harmful radioactive substances into the environment through a chemical process that separate plutonium and uranium from fuel rods (Quigley, Lowman, and Wing 2012). This release of substances, and the health impacts such exposure posed, was not shared with the general public or their employees. Officials feared that if workers knew the danger, they might quit. If workers quit, production would be halted. Thus, knowledge about radioactive hazards was compartmentalized on a need-to-know basis. Workers were told the bare minimum about effects of working alongside radioactive materials.

From Hanford, the plutonium had to be further processed and shaped in to usable triggers for weapons, which required a new facility that was also in close proximity to uranium processing. The Front Range of Colorado seemed like an ideal location for plutonium production. During and especially after World War II, the government began to switch from importing uranium to domestic production. The federal government believed increased domestic production of uranium would ensure plentiful supplies and avoid vulnerability in a crisis (Ackland 1999). In addition to the abundance of uranium deposits in Colorado, both Colorado senators approved of nuclear production (Ackland 1999). The

metro Denver area had a population of more than half a million people, a large labor pool, an attractive climate, and a plethora of housing for workers amongst other amenities. Although the AEC went through the motions of examining other potential locations, in crafting the ideal site's criteria the AEC based it off of Denver: a dry, moderate climate, attractive living conditions and community facilities, good transportation facilities, and located from strategic invulnerability considerations (Ackland 1999). The perfect place, it seemed, for Rocky Flats Nuclear Weapons Plant.

From the beginning, Rocky Flats was representative of the exercise of power, controlled knowledge, and a misrepresentation of reality. For example, when calculating wind patterns, wind data was drawn from Stapleton Airport, which is over twenty miles from Rocky Flats. If measurements had been done at Rocky Flats, they would have shown that winds exceeding 100 miles per hour blew straight toward Denver and surrounding communities (Ackland 1999), a relatively frequent occurrence given the area's Chinook winds (Iversen 2012). In addition to addressing the wind incorrectly, the AEC neglected to account for environmental or health concerns. What it did account for was the location's privacy and facilitation of secrecy. The AEC report stated that "the relative isolation of this location, on a mesa bout 1,000 feet above Denver in the foothills of the Rocky Mountains and about five miles from any residential area, makes this site very attractive from a public relations standpoint because it will be known that radioactive materials will be handled at the plant (Ackland 1999:61).

When the DOD and AEC announced plans to construct the plant, nearby community leaders were overjoyed. Perry Bartlett, Boulder's mayor at the time, remarked that the plant would be "a wonderful thing for Boulder… it may bring some problems but they are

far outweighed by the advantages" (Ackland 1999:62). These advantages took shape in the form of increased nuclear weapons production, job opportunities, and economic gain for surrounding counties. The social and environmental costs, on the other hand, proved immense over time.

Plutonium posed multiple health uncertainties and risks, given its highly unpredictable and volatile nature. While workers faced a multitude of health problems related to their employment at the Rocky Flats Nuclear Weapons Plant (Iversen 2012; Quigley, Lowman, and Wing 2012) the surrounding community was also at risk for environmental contamination (Iversen 2012; Martell 1969; Johnson 1975; Johnson, Tidball and Severson 1976; Johnson 1977; Johnson 1981; Johnson 1982; Johnson 1987). Risks associated with the plant included radiation exposure, plutonium, tritium, and other forms of contamination, environmental degradation, and polluted watersheds and crops.

While skin contaminated with radiation can often be cleansed through vigorous bleach application, once an alpha particle is inhaled, there is no removing it. Plutonium alpha particles are known for lodging themselves throughout the body and emitting continuous doses of radiation (Iversen 2012). The effect of internal radiation often takes decades to emerge, manifesting as various chronic and terminal illnesses such as cancer. Different kinds of radioactive isotopes behave in particular bodies in different ways, and produce symptoms that are difficult to differentiate from symptoms in a body suffering from a more conventional illness such as pneumonia, anemia, and tuberculosis (Brown 2013). Mistaking a death from radiation for a conventional death, or radiation illness for convention illness is commonplace.

On September 11, 1957, the Rocky Flats Nuclear Weapons Plant had its first nuclear catastrophe. For thirteen hours, radioactive smoke filled with plutonium, americium, beryllium, acids, cleaning solvents, and other toxic contaminants was released into the atmosphere (Iversen 2012:29). Additionally, roughly $20 million worth of plutonium was lost in the fire. The disaster went underreported and thus, was largely unacknowledged and unknown to the public. After the fire, the AEC filed a report that confirmed that forty-one employees endured substantial doses of radiation (Iversen 2012). While officials were aware of the hazards posed by radiation, workers were not allowed access to their personal health records at all. The public was not notified about the fire nor potential risks.

While the 1957 fire was the first acknowledged publicly, fires became routine at the Rocky Flats Nuclear Weapons Plant. From 1966 to 1969, the Rocky Flats own fire department responded to 164 fires (Ackand 1999). While this number seems large, a 1969 document (Ackland 1999: 149) stated that "there is no good estimate of the number of plutonium fires not reported to the fire department". In other words, while there were over 150 plutonium fires responded to in three years, even more went unreported.

In 1969, the Rocky Flats Nuclear Weapons Plant had its second critical plutonium fire. Contaminated smoke escaped from damaged filters, dispersing radioactive particles into the surrounding area (Ackland 1999). After the fire, the Rocky Flats official in charge of emergency planning asserted that there was "no need" for emergency planning as it was "not possible" for serious off-site contamination to occur (Ackland 1999:158). The AEC's Director of Military Application contested this assertion, stating that if the fire had not been contained, hundreds of square miles could have been exposed to radioactive material (Ackland 1999). Still, no emergency plans were made and the public largely went

uniformed about the threats posed to their health and community. The amount of plutonium released was unknown and no effort was made to survey the extent of contamination in off-site downwind area (Quigley, Lowland, and Wing 2012).

Though the 1969 fire remained under-reported, public concerns and interest in the facility was nonetheless intensifying due to a surge in independent research and activism. In 1969, Ed Martell began measuring surface soil samples around Rocky Flats to examine the possible extent of plutonium dispersal. In 1970, scientists at the Colorado Committee for Environmental Information (CCEI) begin to question the operations of Rocky Flats and the dangers it may pose to the local community (Iversen 2012). After initiating an independent investigation, scientists found that nearly all the soil samples collected showed plutonium contamination originating from the Rocky Flats Nuclear Weapons Plant . In some places, the level was 1,500 times higher than normal (Iversen 2012). After presenting these findings to the Department of Health, the AEC sent two of its own scientists to contest their claims. The AEC stated that the amount of plutonium released by the plant was far below the permissible levels and there was no threat to public health (Iversen 2012). One official noted that for plutonium to be dangerous, residents would have to eat large amounts of dirt (Iversen 2012). However, plutonium's most common, and potent, form of contamination is when it is inhaled. Plutonium particles can lodge in lung tissue, the thyroid, and other parts of the body and remain active for decades. According to standards set by the AEC in 1945, one millionth of a gram of plutonium can cause a fatal cancer (Iversen 2012).

In 1972, a study was conducted with soil scientists from the U.S. Geological Survey, the Colorado Department of Health, and the Colorado School of Mines to measure levels of

radioactivity in breathable dust on the surface around Rocky Flats. In contrast to the Department of Health's assessments which measured whole soil, these tests showed concentrations forty-four times higher (Iversen 2012). After the findings were released, as became a consistent pattern, the methodology of the study was critiqued and the study was contested. Housing continued to be built. In 1973, Al Haze of the Colorado Department of Health began sampling water around the plant for tritium, a radioactive isotope of hydrogen (Iversen 2012). Haze found that runoff water from a canal contained tritium; something that should not occur unless there was a criticality at Rocky Flats (Iversen 2012). When the AEC acknowledged the tritium, they stated that the levels are far below what is considered to be harmful (Iversen 2012).

In 1975, Harvey Nichols (1976) found that the air samples set up by Dow Chemical did not effectively detect smaller, airborne particles of plutonium. It is this size which is easily inhaled by humans. Nichols received a grant from the Energy Research and Development Administration to test snow for radioactive particulates in the winter of 1975-1976 (Iversen 2012). Researchers on the project found radioactive particles at all levels (Nichols 1976). Despite this, no action was taken and no threat was seen to public health by official agencies.

Carl Johnson's 1976 study, which examined the relation between cancer rates and exposures to plutonium for people living near Rocky Flats, contradicted this claim. Johnson found higher-than-average rates of cancers, primarily leukemia and lung cancer, in areas downwind of Rocky Flats. Before the construction of Rocky Flats cancer rates were below the national average. By 1962, leukemia deaths in children who lived near the plant were twice the average. Johnson also found that males had a 24 percent cancer rate, females a

higher 10 percent higher rate, and ovarian cancer was 24 percent higher (Johnson 1976). However, before the study was printed, officials at Rocky Flats and the Colorado Department of Health attacked his methodology in the *Denver Post* in a successful attempt to diminish his credibility (Iversen 2012).

By 1978, however, Dr. Johnson's research reached the public. In 1978, up to six thousand people protested the Rocky Flats Nuclear Weapons Plant (Iversen 2012). While the numbers declined, protestors stayed at the site for months until their eventual arrest. In 1980, the Environmental Protection Agency publicly announced that it believed the high rates of cancer in the surrounding community were linked to contamination from the Rocky Flats Nuclear Weapons Plant (Iversen 2012). As increasing evidence from these health studies accumulated and an increasing numbers of deaths occurred, workers, families, and community members began to take legal action. In the compensation hearings for workers' compensation claims, government scientists stated that the illnesses suffered by Rocky Flats employees were in no way related to radiation exposure, as the limits of exposure were considered within the DOE standards. Instead, the government scientists pointed to individualized causes for health problems, such as smoking or poor lifestyle habits (Iversen 2012).

Despite corporate and governmental claims of safety, the Rocky Flats Nuclear Weapons Plant was raided by the Federal Bureau of Investigation (FBI) and the Environmental Protection Agency (EPA) in 1989 (Ackland 1999). The raid was conducted to investigate allegations of environmental crimes. As a result of poor waste management policies, poor radiation monitoring, and a nonexistent strategy to meet environmental requirements, production was halted for six months after the raid. That same year, the EPA

added the Rocky Flats Nuclear Weapons Plant to its Superfund list (Iversen 2012). Furthermore, in September 1990, a judge determined that occupational exposure to radioactive elements was the sole cause of a Rocky Flats worker's death (Iversen 2012). It is the first case in the history of the U.S. that directly linked illness to radiation.

Evidence continued to accumulate about the environmental and public health risks related to Rocky Flats, but studies were plagued by lack of funding for community-based studies and by the position of the Colorado Department of Public Health and Environment. In 1996, nurses at the University of Colorado Health Sciences Center conducted a community needs assessment and concluded that community-based epidemiological studies should occur in areas affected by Rocky Flats (N.J. Brown 1996). In 1996, Dr. Richard Clapp found a disproportionate rate of lung and bone cancers in areas around the Rocky Flats Nuclear Weapons Plant (Iversen 2012). Following the study, the Colorado Cancer Registry of the CDPHE released a report that there was no evidence of health effects that could be attributed to living near the site (Iversen 2012). The study stated that the rates of cancer for 10 selected regional statistical areas in the general vicinity of the Rocky Flats Nuclear Weapons Plant from 1980-1989 were comparable to those for the rest of the Denver metropolitan area for the same period.

In 1999, the Rocky Flats Historical Public Exposures Study discovered extreme levels of contamination, despite its reliance on publicly available records and research on past releases of radioactive materials and chemicals (Iversen 2012). The study found high rates on plutonium, carbon tetrachloride beryllium, dioxin, uranium, and tritium. The study also noted radioactive materials was present in water samples and in soil. Despite this, the study claimed that the risk of getting cancer was minimal and all remaining contaminates

in the air, water, and soil did not exceed safe levels of exposure. Despite ongoing requests from citizens for further health testing and monitoring, the DOE and CDPHE said that it was not feasible to perform an epidemiological study of residents around Rocky Flats due to "population changes, low levels of exposure, and the fact that no disease can be attributed solely to plutonium" (Iversen 2012: 305).

In 2005, sixteen years after the FBI and EPA raid on the plant, *Cook v. Rockwell International Corporation* finally went to trial. Filed on behalf of nearly thirteen thousand residents, the case stated that Dow and Rockwell were "reckless in handling radioactive materials known to be dangerous, allowing plutonium to escape the boundaries of the plant, and that much of the defense was an attempt to spin the facts of what happened at Rocky Flats and its effect on local communities" (Iversen 2012:313). The Grand Jury's verdict was that the DOE, Dow Chemical Company, and the former Rockwell International Corp. were negligent and damaged properties surrounding the plant and concurred that indictments should be granted for guilty parties. Punitive damages were assessed at $554.2 million in total. The clean-up of Rocky Flats was initially assessed at $36 billion, an amount that is much more than the DOE was willing to pay. Instead, a deal was negotiated with Congress that the clean-up could not exceed $7 billion (Iversen 2012). In the end, only seven percent of the budget went to soil and water clean up. The remainder of the budget went to the relocation of weapons grade material, removal of bomb production waste, and demolition of buildings.

Though the area is now slated to open as a national wildlife refuge which is open to the public for recreational use, the model of cleanup is based on a wildlife refuge worker; an individual who would only spend a few hours a week on the site and have limited

exposure to the air, water, and soil (Iversen 2012). The equation doesn't take into consideration refuge visitors, nearby communities, and vulnerable populations such as children. Importantly, visitors will also not be informed of the refuge's toxic history and signs will not be posted. Off-site soil will not be cleaned, and in fact, will continue to be developed for residential use. Roughly one third of the site's center, which still remains on the EPA's Superfund list, will be permanently fenced off due to high levels of contamination (Iversen 2012).

In 2007, clean up was declared complete. More than 1,000 acres of the site are so profoundly contaminated that they can never be open to the public. At present, 2,600 pounds of plutonium are still missing. In 2010, Cook v. Rockwell International was overturned (Iverson 2012). The basis of the overruling was that the presence of plutonium on properties at best posed a risk and cannot be attributed to threatening the health of residents or their properties. The panel wrote that "plaintiffs must necessarily establish that plutonium particles released from Rocky Flats caused a detectable level of actual damage" (Iversen 2012:328). However, the case was reopened and settled in May 2016. The lawsuit, which included 15,000 homeowners in an area largely encompassing neighborhoods surrounding Standley Lake, was first filed in 1990 (Aguilar 2016). The plaintiff class includes all those who "as of June 7, 1989" — the day after the FBI raided the plant — owned property in the affected area. Anyone who sold their property before that date and anyone who purchased property after that date does not qualify for the settlement . The settlement accounts for lost property value, but not lost lives.

In 2011, independent testing was funded by local residents and the Rocky Flats Peace and Justice Center. This testing found plutonium at two locations near Rocky Flats.

In 2016, at the request of community group Rocky Flats Downwinders (RFD), Metropolitan State University of Denver, in partnership with Colorado State University sociologists, began conducting a health study that examines the relationship between residents who lived downwind of the former Rocky Flats Nuclear Weapons Plant and have unusual illnesses, such as rare cancers. At present, the survey is still being completed. In conjunction with the Rocky Flats Downwinder Health study, my thesis seeks to examine the environmental, public, and psycho-social health impacts of living near Rocky Flats Nuclear Weapons Plant and the remaining Superfund site.

Chapter Three: Literature Review

In order to understand the demand for nuclear production and its implications on environmental and community wellbeing, significant background research was conducted to develop a strong empirically informed based from which to conduct my research, Communities that exist in close proximity to toxic facilities, such as in the case of Rocky Flats, are communities that bear the burden of contamination. Often, these communities are also unaware of the health and psycho-social impacts and dangers of radiation exposure. What community members did, did not, do, and do not know about the Rocky Flats Nuclear Weapons plant and related risks is a case study of the politics of knowledge and environmental justice. It is important to be aware of the role that access to information plays in shaping and perpetuating social and environmental injustice. In order to achieve real environmental justice, we must first understand the mechanisms, ideologies, and practices that perpetuate cases of environmental injustice.

Environmental justice (EJ) seeks to refine environmental issues as reflective of broader systems and cycles of oppression. Starting in the 1990s, EJ scholars produced more nuanced literature on the intersection of race/ethnicity, socioeconomic class position, and distribution of environmental risks (Brulle & Pellow 2005). As the majority of those who live(d) near the Rocky Flats Nuclear Weapons Plant were white, race/ethnicity was not the most significant variable in understanding the patterns of inequitable distribution of risk, pollution, and toxins. Socio-economic status, class positions, and power differentials have been key, however, and are also vital concepts in EJ (Mohai et al 2009). As my research questions revolve around the health impacts of living near the Rocky Flats Nuclear

Weapons Plant, I further engaged with literature on environmental health problems, knowledge, contested illnesses, and popular epidemiology.

In a society that continually produces, and inadequately disposes, toxic waste, the potential of exposure continues to rise. As such, it was critical to examine the power dynamics that undergird contested health problems in order to understand the ways in which meaning and knowledge is constructed in an increasingly contaminated world. What we know, and thus what we do not know, stems from institutions, structures, and patterned beliefs that shape the way we view the world. Because justice is closely interlocked with understanding how residents make sense of cases of EJ, I examined contemporary theories of procedural justice based in political philosophy and theory. These theories of justice helped me shape an inquiry into the responsibilities of the state, economy, and the public in cases of environmental injustice.

The Structural Role of the U.S. Capitalist Political Economy

The relationships between EJ, political-economic ideology, and distribution of environmental risks are deeply intertwined in the U.S. (Harrison 2011). Here, capitalism has been the historical, foundational political-economic system, with neo-liberal capitalism dominating since the 1980s. Capitalism is a system of economic and social relations marked by private property, private ownership of capital, the commodification of labor power, the exchange of goods and services by "free" individuals participating in "free" markets, and the use of market mechanisms to control the production and distribution of those goods and services (Muller 2013).

In the late 1970s and early 1980s, the neoliberal state emerged which further stratified social classes and perpetuated the distribution of risks. While its definition and

application is often contested, neoliberalism can best be understood as "as a diverse and interlinked set of practices that reflects a heightened, evolved, and destructive form of capitalism" (Malin 2015:16). Neoliberalism is expressed through policy discourse such as privatization, marketization, state deregulation, market-friendly reregulation, and the creation of self-governing individuals (Malin 2015). Neoliberalism's main tenets which contribute to cases of environmental injustice are environmental deregulation, privatization of resources, shrinking of the state's capacity to regulate and provide social safety nets (Harvey 2005; Malin 2015). In the neoliberal era, the norms of market-based logic have become deeply embedded within our society.

As capitalism and neoliberalism promote a rhetoric of individual responsibility and accountability, it provides a powerful construction of justice and social action, or lack thereof. While personal and individual freedom is promoted in the market place, individuals are held personally accountable for their health, safety, and wellbeing (Harvey 2005). This relates to one main contradiction of neoliberalism; as often, the deregulation of industry leads to poor methods of toxic waste disposal. The exposure to these dangerous substances severely impacts both human and environmental health with no entity to hold responsible due to a lack of liabilities occurring outside of the marketplace. When organizations and corporations are held responsible, solutions occur in the market, i.e, frequently paying a small cost for clean up without changing the practices which created the problem (Fletcher 2010).

Importantly, as neoliberal ideology promotes the individual, health impacts of exposure to toxic waste are individualized. Individuals who suffer from exposure to environmental contaminants and toxins not only pay the health care costs, but are also told

that such diseases are a product of poor lifestyle habits. This individualization of responsibility for environmental, health, and social problems shifts blame from State elites and powerful producer groups to the individual (Maniates 2001). The individualization of responsibility found in neoliberal ideology characterizes environmental problems as the consequence of destructive individual choices. When responsibility for environmental problems is individualized, there is little room to ponder institutions, the nature and exercise of political power, or ways of collectively changing the distribution of power and influence.

In order to build alternatives to neoliberalism and capitalism and secure a more ecologically and socially just world, we must both articulate the causes and effects of our current economic system's power to produce socioecological violence. Capitalism and neoliberal ideology compel businesses, industries, and corporations to reap profit at all cost. As such, cases of environmental justice such as Rocky Flats emerge from the prioritization of profit and de-regulation of such industries. When corporations hold themselves accountable for safety standards, it is often the host community who bears the burden. In the state's quest to generate profit and increase production, it has failed to adequately represent or protect the needs of marginalized social groups. As a result, cases of environmental justice such as Rocky Flats continue to occur and little to no state action is taken to hold polluting corporations and industries accountable.

Environmentalism and Environmental Justice

Historically, mainstream U.S. environmental movements focused largely on preserving or conserving the natural environment, and thus neglected social inequality, movements for social justice, and their intersections with environmental issues (Pellow

2015). The Environmental Justice (EJ) movement emerged as a critique to mainstream environmentalism, challenging the environmental movement's lack of regard to the unequal distribution of environmental hazards and the social inequalities that hinder procedural equity and people's roles in solving environmental inequities (Harrison 2011). Mainstream environmentalism has been criticized as reproducing inequalities by focusing on wilderness and endangered species, thereby sidelining environmental issues facing poor communities and people of color. Even today, mainstream environmental organizations do little to remediate social and economic inequalities (Brulle and Pellow 2005). As Beck (1986:81 cited Brulle and Pellow 2005) poignantly states, "environmental problems are fundamentally based in how human society is organized". Thus, environmental problems are also social problems. EJ scholars view the creation and perpetuation of environmental inequality as outcomes of the social patterns, institutions, and dynamics of our society (Brulle & Pellow 2005). In order to understand the origins of environmental inequality, they propose that we must situate such phenomena within broader patterns of social inequality and the mechanisms that drive it forward.

The EJ literature examines patterns of inequitable distribution of risk, pollution, and toxins in communities. In the early 1980s, three key case studies and reports (US GAO 1983; UCC 1987; Bullard 1990) began investigating the links between race, class, and exposure to environmental toxins as a result of African-American communities mobilizing to prevent waste facility siting. Expanding from those early analyses, EJ studies have focused on three main components: environmental racism, environmental (in)justice, and procedural equity. In the following years, EJ studies emerged as an interdisciplinary body

of work that focused on documenting the inequitable impacts of environmental pollution of different social classes and racial/ethnic groups (Mohai, Pellow & Roberts 2009).

Alongside racial/ethnic components of environmental injustice, socio-economic status and aspects of class have emerged as key factors in environmental injustice and procedural inequity. Indeed, despite difficulties in locating a singular cause of environmental disparities, economic, sociopolitical, racial/ethnic, spatial and other factors play often multiplicative roles in environmental (in)justice. In a capitalist political economy, industry seeks to maximize profits through high rates of production and thus selects areas for production, extraction, or waste disposal that reduce the cost of doing business (Mohai, Pellow & Roberts 2009). EJ communities are targeted as sites for extraction, production, or waste disposal because the cost of land is cheap, there is less economic development and diversity, residents are desperate for economic opportunity, and/or residents are unlikely to resist (Lerner 2010; Szasz and Meuser 1997). Where one can afford to live, and where one does live, has a significant impact on the nature and extent of exposure to toxic pollutants (Lerner 2010). Industries place facilities where land is cheap and where inexpensive labor is bountiful; it is in these areas where we also find large proportions of working class, poor, and minorities.

Sociopolitical explanations invoke the idea that industry and government seek the path of least resistance when siting new hazardous waste or polluting industrial facilities (Mohai, Pellow & Roberts 2009). Poor communities are seen as easy targets because they have fewer resources, are not well represented in decision-making, and/or have constrained economic opportunities. Often, these communities are also spatially isolated and thus lack access to basic social services and opportunities, welcoming potentially

hazardous industries (Malin 2015). Industry continues to marginalize communities, constrain economic opportunities, and limit peoples' abilities to challenge the effects of the natural resource development (Malin 2015). Even when individuals begin to notice the social, biophysical, and mental impacts of living near hazardous pollutants, their voice often remains unheard due to a lack of capital and political power.

Over decades of research, hundreds of scholars have come to a similar conclusion: toxic facilities tend to be located in vulnerable communities that lack the social, economic, or political capital to fight back (Mohai et al 2009; Hurley 1995; Lerner 2010; Malin 2015). Sites of environmental injustice are sites that have been systematically selected by various industries. While the debate continues whether race or class plays a more critical role in identifying distribution environmental harm, these outcomes are truly intersectional and involve race, class, and other variables (Brulle & Pellow 2005). In addition to the mixed results of many of these studies, the race versus class debate masks much of the complexity surrounding race and income in the United States. All systems of oppression are intersectional. Where we find social inequalities, we also find environmental and health inequalities. While we cannot undermine the importance of race and class in EJ studies, we must move beyond such distinctions and focus on the social patterns and institutions that reproduce inequality.

Nuclear Environmental Justice

Environmental justice cases occur as a result of various polluting industries and processes; such as natural resource extraction, poor waste disposal from large corporations, air pollutants, and, of particular interest here, the environmental, health, and social impact of nuclear facilities. Beginning with the Manhattan Project in World War II,

the United States created an immense new nuclear industrial complex with new sites of extraction, processing, testing, and research (Quigley, Lowman, and Wing 2012). These facilities and nuclear sites exemplify cases of environmental injustice, as sites were strategically chosen and developed. These facilities and sites have contaminated the communities that hosted them; sickening and ultimately killing an undocumented amount of people. Examples of environmental injustice in the siting of nuclear reactors and nuclear waste include the Happy Jack Mine in Monticello, Utah (Malin 2015), the Hanford Site in Benton County, Washington (Brown 2013), and the Rocky Flats Nuclear Weapons Plant in Arvada, Colorado. Companies often strategically choose communities with a "small rural population with stable residency, a relatively low income, a majority of residents having no more than a high school degree, and a conservative voting record" because of a perceived lack of ability to mobilize in protest (Sherman 2011:81).

Many of these facilities operated in secrecy (Brown 2013; Iversen 2012; Quigley, Lowman, and Wing 2012), exposing residents to large amounts of radioactive material through local water, soil, and air pollution. As radiation is not detected by our six senses, it was easy for these facilities to fail to inform residents about the health consequences of such exposures, as well as when exposures happened. Much of the literature on the atomic bombings of Hiroshima and Nagasaki (Schull 1995), the Chernobyl disaster of 1986 (Yablokov 2009), and Three Mile Island (Wing, Richardson, Armstrong, and 1995), as well as studies of populations living near normally operating nuclear sites, focuses on cancer rates and other physical health impacts (Brown 2013; Alexis-Martin 2015; Quigley, Lowman, and Wing 2012). Most of the illnesses suffered by residents who lived downstream and downwind of nuclear facilities remains contested. It is critical, perhaps

now more than ever with the rise of nuclear power facilities, to examine the links between environmental health, knowledge production, and environmental justice.

Environmental Health and Contested Illnesses

An important literature has emerged alongside EJ research, examining how residents of low income and ethnic minority communities experience and conceptualize related environmental health issues (Auyero and Swistun 2009; Burby and Strong 1997; Couch and Kroll-Smith 1991). In a market-based political economic system, health is shaped by social, political, and economic inequalities. A growing body of literature suggests that disparities in health arise from a combination of poverty, discrimination, political disenfranchisement, environmental exposures, and individual biological factors (Pellowski, Kalichman, Matthews & Adler 2013). This challenges the claim that disease is caused by a specific biological agent and instead, proposes that disease is also linked to social, economic, political factors (CIRG 2012; Brown 2007; Berkman and Kawachi 2000).

These inequalities often are exemplified through place. Place is a context in which we can see the role broader socioeconomic and political structures play in the lived experiences of residents (Coburn 2003). Individuals who live closer to hazardous facilities unsurprisingly bear a larger proportion of the health burden from exposure to such toxins. Residents in these areas experience elevated rates of "respiratory disease, cancer, reproductive disorders, eye problems, birth defects, learning disabilities, psychiatric disorders, headaches, nosebleeds, skin rashes, and early death" (Lerner 2010:6). Exposure to environmental toxins contributes to long term illness, psychological trauma and a reduced quality of life, yet its role in environmental health problems remains contested (Brown 2013, Iversen 2015, Eckland 1999).

In the case of Rocky Flats, cancer rates increased dramatically during the plant's operation (Eckland 1999; Iversen 2015), all while the public was told by officials that the site bore no threat to their health. In Moore's (2011 cited in Quigley, Lowman, and Wing 2012:15) account of Rocky Flats, an individual investigating health records stated that "for more than forty years, assessment of health risks of radionuclides has been controlled by a vested interest establishment that contrived to minimize or ignore adverse effects of all sources of human exposure to ionizing radiation". Contested illnesses, then, often exemplify the extent to which government agencies and corporations go to avoid accountability.

As Coburn (2003) suggests, science and politics are interdependent and often interlocked in cases of contested illness. Contested illnesses involve "major scientific disputes over environmental causes of illness" (Brown et al. 2001:41-42). Given the implications for corporate and governmental entities, cases of contested illness are often characterized by a denial of responsibility. Contested illnesses are political because the sources of illness are often linked to environmental pollution that occurred at the hands of a corporate or governmental entity. As Brown et al. (2000:9) explains,

> Virtually all diseases and conditions that can be attributed to environmental causes are highly contested and the source of considerable conflict, anger, and resentment. Precisely because environmental diseases are often linked to the production and consumptive practices of modern societies, acknowledging these diseases and taking actions to reduce them is more often the result of political action than medical intervention.

Technical limitations of scientific research, constraints of scientific norms regarding uncertainty, and the profoundly complex and dynamic nature of exposure to pollution thus work in the favor of the industry (Harrison 2011; Brown 2007; Coburn 2003). As such, the

illnesses and diseases of individuals who have been exposed to environmental toxins are often contested.

There is a critical need to integrate research on the impacts of environmental inequality into existing and future studies of environmental health problems and health disparities. Environmental contamination is a complex, social and technical problem that remains unsolved by medical and environmental scientists. Currently, the ways in which environmental toxins move through, changes in, and interacts with the body and environment is poorly understood (Harrison 2011). As toxins interact with the human body, they contribute to a collection of health problems. Brown (2007: 7) defines environmental health problems as "health effects causes by toxic substances in people's immediate or proximate health surrounded (soil, air, water, food, household goods)". Furthermore, environmental health problems are often characterized by their contested nature, as it remains incredibly difficult to demonstrate a causal link between environmental contamination and human health (Tilt 2013). Epidemiological data on the linkage of cancers to environmental exposure, for example, are limited because "occupation and environmental exposures have been under addressed" (Fonthom 2010). This is reflective of that cancer-related environmental research funded at the National Institute for Environmental Health Sciences has been stagnant since 1999 (Reuben 2010).

Starting from the early twentieth century, health care practitioners and officials began to increasingly trace illness at the individual level, rather than linking illnesses to the environment in which we are embedded in (McCormick 2009). On a daily basis, individuals are exposed to plethora of chemicals, from the products they put on their body, to the food they eat, the water they drink, and in the air that they breathe. In 2003 alone, more than

thirty-four million metric tons of chemical substances were produced, or imported into, the United States each day (Schwarzman and Wilson 2009). However, this chemical exposure in largely not incorporated or included in the dominant biomedical health model.

Scientists conduct epidemiological research at the level of large populations to eliminate or greatly reduce sampling errors in the data, which often masks the individual and community level reality of environmental illness (Tilt 2013). As a result, individual illnesses are often treated as "anecdotal" and links between their symptoms and exposure are not often made. Additionally, exposed individuals often do not report their illnesses because they do not attribute their symptoms to toxic exposure. Much of the pollution and hazardous material found in these communities is insidious and undetected by our six senses. For those who do report their illness, practitioners often fail to make link between environmental contaminants and individual illnesses (Harrison 2011:37). Lifestyle choices are frequently utilized to explain health problems of residents living in communities exposed to environmental toxins and pollutants.

Allen (2003:137) notes that

> The lifestyle excuse for poor health in the region, which is economically depressed, directs attention away from research [on] issues such as poor health and water…. [Instead the poor are told] they are responsible for their own health problems and what is needed is health education to counsel minorities (and the poor) to eat better, exercise more, smoke and drink less, be less violent, seek health care earlier for symptoms and in general be better health-care citizens.

This individualization of responsibility is a common explanation for the health consequences of toxic exposure. As such, environmental health problems remain at the individual level and links to such illness and exposure to toxins and pollutants remains contested. The dominant biomedical health model shifts the blame from industry to the

individual and profoundly shapes how people perceive, experience, and cope with the risks associated with living in a hazardous community.

For the past thirty years, risk has been the dominant frame of analyzing environmental health (Fiorino 1989). Risk assessment is the process of identifying hazards, assessing their toxicity to humans, estimating individual's exposure to the hazard, and extrapolating potential harm (Coburn 2003). In order to identify a hazard, scientists determine whether a substance is linked to a particular human-health or environmental effect through existing data to access a dose which is minimally harmful to humans (Coburn 2003). Biomedical monitoring is also often used to identify current levels of toxins present in exposed individuals and investigate health outcomes (Cordner and Brown 2014). When assessing the substance's toxicity to humans, scientists extrapolate effects that could occur in humans from data on health effects observed in rodents who are given relatively high doses (Wildasky and Levenson 1995). From there, scientists attempt to identify what proportion of a population will be exposed to the toxin (Coburn 2003). To characterize the risk, scientists then multiply the dose assessment by the number of those who are expected to be exposed (Kamen and Hassenzahl 1999). As one can imagine, risk assessment has been greatly criticized for its use of extrapolation and estimation in its statistical methods (Coburn 2003; Cordner and Brown 2014). Because the suspected health effects of toxic exposure take years, if not decades, to emerge, scientific uncertainty is inevitable in epidemiological work on chemical hazards (Cordner and Brown 2014:5). Risk assessment also focuses on one toxic chemical, rather than examining the risk present with a multitude of toxins, pollutants, and carcinogens (Kuehn 1996). The assessment also does not take into account spatial and temporal differences in distribution; some areas may be

exposed in greater levels than others and thus, face more risk (Coburn 2003). By assuming that are all humans are equally exposed to toxins, risk assessment fails to account for disparities in the multiple risks and hazards faced by vulnerable populations, such as low-income and racial and ethnic communities.

However, as environmental health problems rise, so does the rejection of the biomedical model. Social movements and research emerging from contested illnesses are driven by "growing public awareness about the limited ability of medical science to solve persistent health problems that are socially and economically mediated, the rise of bioethical dilemmas in scientific knowledge production, and the collective drive to enhance democratic participation" (Brown 2007:15). These social movements challenge the dominant epidemiological paradigm, or the ideologies surrounding a disease and its causation that are held by science, government, and the private sector (Brown et al. 2006). These ideologies shape the individual's experience and knowledge of the disease as they enter into the formal healthcare system.

In order to connect rates of affliction, disease, and death, community members participate in *popular epidemiology*. Popular epidemiology is a tool utilized to contest recommendations and decisions made by scientists and those in power. Brown (1992: 269) defines popular epidemiology as the process where residents "gather scientific data and information and also direct and marshal the knowledge and sources of experts in order to understand the epidemiology of the disease". Popular epidemiology utilizes a combination of local knowledge and scientific methods to conduct on-the-ground community investigations into environmental health problems that residents link to various environmental exposures.

It is critical to understand the lived, psycho-social experiences of people with environmental illness. It is these lived experiences which make it possible to begin challenging traditional scientific conventions of knowledge. However, we must understand the limitations of popular epidemiology. For every community that proves the link between health problems and toxins, there is a community whose voice is still struggling to be heard. In many EJ cases, the burden of proof is placed on the citizens and not industry. Residents often pay out of pocket to the air and or water for pollutants, an option that is not available for all who suffer at the hands of environmental injustice. After all, if it is low-income community who are affected most by environmental contamination, it is also low-income communities who often lack the capital to fight back. For most, activism is a fulltime, unpaid job. Building a hypothesis of harm through popular epidemiology takes an immense amount of time, energy, and resources.

Psycho-Social Impacts of Nuclear Exposure

While natural and man-made disasters impose a substantial burden on mental health, events involving radiation are particularly pernicious. As a result of the medical and environmental invisibility of nuclear contaminations, a considerable amount of uncertainty about the health effects of exposure still exists. Exposure to toxic waste can cause cancer, birth defects, genetic damage, neurological damage, liver and thyroid problems, and/or numerous other health problems (Gill and Picou 1998). Furthermore, the ambiguous nature of nuclear contamination allows for different conclusions about the health effects of exposure to be reached. As Bromet (2012) pointed out, disasters involving nuclear radiation – such as the ones occurred in Chernobyl or in Fukushima, for example – are particularly difficult to manage. In nuclear disasters, the contaminating agent is

invisible and pandemic, and causes lasting threatening consequences not only for physical health but also for mental health. As a result of the unknown impacts and consequences of radiation exposure, those who have been exposed often feel powerless and fear cancer (Bromet 2014). For those who are diagnosed with cancer, the link between contamination and health problems remains contested.

In addition to individual and community health being severely impacted from radiation exposure, mental health and psychological well-being are also significantly impacted. The psycho-social impacts of nuclear exposure include; but are not limited to, depression, headaches, dizziness, fatigue, poor concentration, memory loss, irritability, mood swings, anxiety, sleep disorders, high blood pressure, dysphoria and lack of libido post-traumatic stress disorder (PTSD) (Alexis-Martin 2015). After nuclear disasters, exposed individuals experience heighten vulnerability, including the intangible nature of radiation exposure; the inherent horror associated with radiation exposure (Slovic 1987); widespread rumors about adverse health effects and bizarre effects on plants and animals; distrust of and hostility toward government authorities and the scientific community; fears about health effects in future generations; chaotic health monitoring by government agencies; ecological and socio-economic disruptions; and most importantly, lack of resolution about the actual amount of exposure received and potential risks to the population at large (Brown 2013; Bromet 2014).

Concerns about their personal safety, as well as safety for future kin, induce anxiety and feelings of powerlessness (Quigley, Lowman, and Wing 2012). These effects are often long term and associated with fears about developing cancer (Bromet 2014). Additionally, community members who were told that the site was safe may justifiably feel deceived by

their government (Quigley, Lowman, and Wing 2012). Individuals who have been exposed are often stigmatized (Goffman 1963). As a result of their radiation exposure, those who have not been exposed often fear that radiation is contagious and can spread through bodily contact and interaction.

Additionally, workers at nuclear plants also suffer from a different sort of stigmatization. Workers are marked as participating in the practices that contributed to the community exposure (Brown 2013); and they may face community backlash. Community ties, then, are also significantly impacted after a nuclear disaster. Decades later, divisions may persist between community members who face severe, contested health impacts of radiation exposure (Quigley, Lowman, and Wing 2014). Due to incomplete, conflicting, and unintelligible disclosures by authorities about radiation and about what occurred at and outside the nuclear plants, as well as contradictory reports by the media, individuals are unsure what or who to believe (Bromet 2014). A central feature of community conflict in environmental controversies centers on the contested nature of illness claims (Brown, Zavetoski, Mayer, McCormick and Webster 2002). In the case of Rocky Flats, the majority of those who were interviewed remarked that it was difficult to approach the topic with friends and neighbors. Because of the legacy of secrecy and misinformation surrounding the facility, information and illnesses remain contested.

Knowledge Production

Much like the existing gaps in linking environmental health problems to industry and environmental contamination, there are significant gaps in how these communities conceive of environmental health risks, their sources of knowledge about the issue, and their subsequent action. There are thousands of contaminated sites in the U.S., sites

unknown to most Americans. The American Lung Association's 2016 report found that more than half (52.1%) of the U.S. population live in counties with unhealthy levels of either ozone or particle pollution. At present, there are over 1300 sites (EPA 2017) on the National Priority List, which is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. Despite these alarming numbers, much of the public is unaware of the toxic environments they find themselves living in.

While much has been done regarding knowledge (Schutz 1932; Berger 1966; Foucault 1971; Harding 2006; Goldman 2006; Reed 2011), little has been done in anti-epistemology, the study of not knowing. If we are to understand how knowledge is produced, we must also understand the practices that account for a lack of knowledge. Smithson (2008:159) states that ignorance is an essential part of human relations, culture, organizations, and that it is "a pervasive and fundamental influence in human cognition, emotion, action, social relations and culture". Ignorance, then, far from being a simple condition of not knowing, is better understood as an ongoing social outcome (Michaels 2008), affected by one's positionality in relation to various power structures. As Tuana (2004:195) states, ignorance is frequently linked to issues of cognitive authority, doubt, trust, silence, and uncertainty. Tuana's (2006) taxonomy of ignorance provides a useful framework to understand the different forms of ignorance. Her taxonomy details four modes of ignorance: 1) knowing that we do not know yet not caring to know; 2) not even knowing that we do not know; 3) not knowing because privileged others do not want us to know; and 4) willful ignorance.

Like knowledge, ignorance is often the result of the ways in which power, and access to related forms of knowledge, are each distributed and accessed in society. Knowledge is rendered secret for a variety of reasons; from national security to corporate interests. Under the Atomic Energy Act, all government decisions and action revolving around nuclear production did not have to be disclosed to the public (Iversen 2012). As a result, much of the operations of the Rocky Flats Nuclear Weapons Plant were shrouded in secrecy. Companies and facilities such as Rocky Flats are often fully aware of the dangers they pose to the local community but consciously construct and sustain public ignorance to protect themselves. Murphy (2006) details the occurrence of "known unknowns" in which chemical companies contest the effects of chemical exposure. Under these configurations of interest, knowledge deemed by those in positions of power to pose too significant a risk, to be unimportant, or to be threatening is subsequently contested, and perhaps even underfunded in situations where related research would be instructive. John Proctor's (1996) examination of the "cancer wars" in the U.S. argued that political factors have increased the climate of doubt surrounding cancer research, deliberately creating confusion and uncertainty about the carcinogenic risk of products. By producing conflicting information about illnesses, corporations are able to resist accountability and the public remains ignorant about risk.

However, it is important to note that ignorance is not only a tool of oppression wielded by those in power; it can also be a strategy of those who do not want to know. Willful ignorance is an ignorance that must be continually maintained and is sustained as it appears to be in one's best interests (Tuana 2006). Information that individuals find to be frightening, and the mechanisms used to avoid confronting such information, reinforces

one another to constitute willful ignorance. Willful ignorance, then, is also strategic. Strategic ignorance (McGoey 2007) allows both governors and the governed to deny awareness of things it is not in their interest to acknowledge. Zerubuvel (1997) emphasized that through social norms, society socializes us into what to pay attention to and what to ignore. Community social norms shape what residents collectively pay attention to, as well as believe, and act upon (Norgaard 2006). As such, ignorance is an occurrence that cannot be prevented. However, we must also ask ourselves the consequence of ignorance in our lives and the lives of others. Our knowledge and our ignorance have an enormous impact on who will live and who will die, who will benefit and who will be harmed.

As more toxic sites such as Rocky Flats continue to be developed, we must understand the mechanisms which obfuscate knowledge from the communities who host them. Additionally, it is critical to examine the modes and arenas in which individuals living in toxic communities begin to acquire knowledge. With knowledge often comes a demand for justice.

Procedural Justice

The EJ movement can be understood as connecting questions of social justice with environmental problems. Justice, in the realm of contemporary political theory, has been almost exclusively concerned with the question of distributional equity of social rights and goods. While theories of justice focus on the processes and ideals of just distribution, they can also be used to inform our understanding distributional injustice. If issues of environmental injustice are informed by social, cultural, economic, and political processes, discussions of justice need to include the institutions which shape such practices.

Inequality, and thus injustice, is often seen as the inevitable product of capitalist, market-based societies like the U.S. While some individuals are afforded more opportunities for social mobility, others face limitations, risks, and subordination. Procedural theories of justice are useful when examining historic patterns of distribution, rationalizations of inequality, and can frame our understanding of social change and progress.

An important component of environmental justice, as well as theories of justice, is the idea of justice as a process (Schlosberg 2003). Procedural equity is the extent to which rules and regulations, enforcement, and international treaties and sanctions are applied in a nondiscriminatory way (Cutter 1995). Public participation is a critical component to achieve both political recognition and distributional equity (Schlosberg 2003). Institutions, as well as public policy, have distributed social goods and risk inequitably. If justice is to be achieved, the distributional impacts of environmental risk must be considered as well as the decision making processes in which such risks are allocated. In order to avoid siting and zoning decisions which prioritize certain communities at the cost of others, individuals need to be able to participate fully in the political sphere and play a role in decision making (Young 1990).

Young (1990:3) states that justice "refers not only to distribution, but also to the institutional conditions necessary for the development and exercise of individual capacities and collective communication and cooperation". Those who are oppressed are inhibited in their ability to exercise their capacities, express their needs, thoughts, and feelings and engage in meaningful participation in decision making. As oppression is systematically reproduced in major economic, political, and cultural institutions (Young 1990), we must go further than redistributing goods. Similarly, when addressing cases of environmental

injustice such as Rocky Flats, we must understand the institutions, policies, and ideologies that contribute to its toxic legacy. Thus, justice requires recognizing and readdressing various forms of socio-cultural oppression in order to make procedural equity possible. Social structures that oppress certain groups must be recognized and challenged. Because questions of justice intersect with whose voice is heard, and whose voice matters, justice theorists argue that justice requires participatory parity (Harrison 2011).

Procedural theories of justice provide us with a vision of a just or fair society and as such, can be used to shape an inquiry into the responsibilities of the state, economy, and the public when examining questions of EJ. It is by disregarding justice that powerful actors are able to shift environmental burdens to the people who are least able to contest them (Harrison 2011). Environmental inequalities stem not only from a lack of knowledge, care, or political will but also from powerful institutional actors' failures to do the right thing (Harrison 2011). While social practices play a critical role in perpetuating environmental violence, the construction and maintenance of ideologies maintain inequalities (Pellow 2015). In the case of Rocky Flats Nuclear Weapons Plant, production, industry profit, and military advancement took precedence over the wellbeing and safety of the surrounding community. As a dominant ideology in our society promotes economic growth, often at the cost of the environment, it greatly framed the policies, information, and practices surrounding Rocky Flats.

For decades, residents were uninformed of the dangers posed to their health and their community. For decades, economic prosperity and growth took precedence over community citizens' wellbeing and safety. While the area is now considered "remediated", community members willing to acknowledge the site and its legacies of risk feel as if justice

has yet to be served. Residents and even former community members continue to fear for their safety in the nuclear era. For those who suffer from the health impacts of radiation exposure, their illnesses remain contested. Similar to other cases of environmental health problems, governmental organizations such as the Department of Energy and Department of Health continue to dominate the conversation of the health and social impacts of Rocky Flats. As such, information and knowledge surrounding Rocky Flats remains contested, disputed, and outside the realm of public discussion. I hope that this examination of the narratives of individuals who have faced the consequences of being unwillingly, and often, unknowingly exposed to radiation and nuclear contamination can help lead us into a new direction of justice.

Chapter Four: Methods

The methodology utilized in this project is based in community-based and qualitative research methods, which emphasize the meanings, experiences, and views of all participants in order to make sense of the phenomena in question (Pope, Mays and Popay 2005). Three main research questions drive this project:

1) *What environmental and public health experiences do citizens report in relation to living near the Rocky Flats Nuclear Weapons Plant, both during and following production?*

2) What did residents know about the Rocky Flats Nuclear Weapons Plant during and after its operation?

3) *What do residents perceive as environmental justice in this situation?*

Qualitative research methods were utilized to conduct oral histories of individuals who currently live, or lived, near the Rocky Flats site in Arvada, Colorado. Qualitative research case studies are conducted to seek detailed knowledge of an event, experience, or situation (Ragin, Nagel, and White 2004). Instead of drawing from a large sample of an entire population, qualitative researchers seek to acquire intimate and personal information from a small group of individuals (Ambert, Adler, Adler, and Detzner 1995). Qualitative methods can, and do, enrich our knowledge of health and lived experiences of those who face environmental contamination (Brown and Mikkelsen 1992; Brown 2007). I employed qualitative techniques of in-depth interviews and archival analysis for this study to provide a description and understanding of the health impacts of living near a nuclear production facility.

Data was collected using in-depth interviews with residents, as well as an archival analysis of a sample of interviews collected through the Maria Rogers Oral History Program. The Maria Rogers Oral History program has more than 150 interviews with Rocky Flats workers, managers, regulators, protestors, and people in the surrounding community. Interviews in this collection were collected between 1998 to 2011. During primary data collection for this project, interviews were conducted over a period of three months in 2017. There has never been a direct health study or medical monitoring of people who live in areas contaminated with plutonium released from Rocky Flats. While this study does not seek to medically monitor those who live near Rocky Flats, it seeks to further reinforce the need for a large-scale study through collecting qualitative data on the lived experiences and environmental, public health, and psycho-social outcomes of living in proximity to Rocky Flats.

Positionality and Emotion Management

In most qualitative research, the investigator is the primary data collection instrument and thus shapes findings in a very direct way (Ambert, Adler, Adler and Dentzel 1995). As a social researcher, my own social position influences my approach and interpretation of the data, as well as the reality that my understanding will only capture a partial view of the Rocky Flats nuclear production site (Haraway 1988). My own beliefs, behaviors, and understanding of the evidence are inherently a part of the claims advanced in my data analysis chapter. As a white, middle-class, liberal educated female from New England, my perspective was often different than those I interviewed. It was important for me to remain as neutral as possible while conducting interviews with those who face environmental health problems and have suffered from environmental injustice. At times,

listening to the narratives of these individuals was deeply saddening, painful, and often, hard to hear. Recognizing my role and position as a researcher, and the phenomena under examination, allowed for reflexivity in my analysis. As Ambert et al. (1995) writes, "researchers' orientations are considered part of the process of doing qualitative research… their epistemologies are frequently made explicit in their writings". As epistemic modes "dictate the conceptual method by which theory is brought into contact with evidence" (Reed 2011: 7), an interpretative epistemic mode was used. In the interpretative mode, everything can be subject to meaning. Interactions are seen as arrangements of signification and representation, which layer social meaning and shapes human experiences (Reed 2011:10). In the interpretative mode, researchers must push beyond surface reports of actors in order to grasp the deeper set of meanings found within interaction. Because narratives are rich with significance, the interpretative epistemic mode helps identify the processes in which social structures and agency shape meaning.

In addition to recognizing my positionality as a social researcher, it is important to note the emotional labor required when researching sensitive topics. Sensitive research is defined as "research which potentially poses a substantial threat to those who are or have been involved in it" (Dickson-Swift, James, Kippen, and Liamputtong 2009:62). As researchers, sensitive research can often evoke strong reactions and as such, it often becomes necessary to manage emotions. Hochschild (1998:9) defines emotion management as "an effort by any means, conscious or not, to change one's feelings or emotion". Emotion management often requires researchers to maintain an outward "presentation of the self" (Goffman 1959) which contradicts inward feelings. As the ability to be empathetic is one of main skills needed to undertake qualitative research (Dickson-

Swift et al. 2009), outward displays of emotion and feelings must often be managed to maintain credibility and professionalism. Qualitative researchers must initiate a rapport-building process with the interviewees in order to facilitate participant disclosure (Dickson-Swift, James, Kippen, Liamputtong 2007). As Hubbard et al. (2001:134) acknowledges, "if it is important for the research project to encourage respondents to 'open up' about sensitive issues, then researchers need to find strategies to manage emotion". In cases such as this study, when residents are detailing their lived experiences and contested illnesses in relation to living near a nuclear production site, emotion management often became difficult. While providing a space where individuals could talk about experiences which were often incredibly painful emotionally was a critical component of the research, it also became evident that such a space evoked emotion management as a researcher.

Data Collection

Through interviews, it became possible to learn about people's experiences, perceptions, and psycho-social impacts of living near a nuclear production site. The qualitative narratives provided by respondents offered an important way to gain a more holistic view of the impact of Rocky Flats on the community (Ragin et al. 2004). Because many of these stories were, and have yet to be, included in the official story of Rocky Flats, it is critical to bring under-represented voices into the conversation and public record on Rocky Flats. These stories are situated within the broader context of "official" explanations of the impact, or lack thereof, of living near a nuclear production site. As qualitative research emphasizes meaning and meaning making processes, the multiplicities of reality, and context, it can help us understand the lived experiences of participants.

Semi-structured interviews were used to gain insight into the lived experiences of Rocky Flats residents. In semi-structured interviews, the interview guide is a list of topics to be covered which encourages participants to speak freely and address topics and experiences that the participant feels as relevant to be included (Lofland, Snow, Anderson, and Lofland 2006). In this study, our interview questions revolved around the respondent's personal history, his/her relationship to Rocky Flats (knowledge about its existence, lived or own land near the facility), specific experiences in relation to the site, and how Rocky Flats affected their daily life, physical health, and emotional and psycho-social well-being. Participants were also asked about the accessibility of information about Rocky Flats, their knowledge of health studies about Rocky Flats, and what their perception of justice would be in this situation. Interviews varied in length, but typically lasted a little over an hour. I conducted in-depth interviews with seventeen individuals who currently live, or lived, near Rocky Flats. Of these seventeen individuals, four were men and thirteen were women. Participants ages ranged from mid-forties to mid- eighties.

Sampling

As I was interested in individuals who fit set criteria for inclusion (current or past residents living near the Rocky Flats nuclear production site; activists involved in the shutting down of Rocky Flats), purposive or network sampling (Creswell, Klassan, Plano Clark and Clegg- Smith 2011) was used to identify and select 14 archived interviews from the Maria Rogers Oral History Program. After going through the one hundred plus histories in the collection, interviews were divided into categories by role (plant workers, activist plant workers, plant professionals, activist plant professionals, professionals, activists, quasi group, and community members), which were then further divided by gender.

Women were oversampled as they were under-represented in the archive. Activists were also oversampled, in order expand my qualitative interview sample which largely consisted of community members. Interviews were then randomly sampled from these categories to generate my archival sample, using randomized numbers. My archival sample contained five community members, one activist, one plant professional activist, four professionals, two plant worker activists, and one plant worker. Out of this, six respondents were female and eight were male.

After analyzing these interviews, the initial participants for in-depth interviews were recruited from the Rocky Flats Downwinders, the community organization that requested this community-based research and that advocates for residents living downwind from Rocky Flats. In addition to reaching out to individuals who had expressed interest in the study to the director of the Rocky Flats Downwinders, a message detailing the study was posted on group's Facebook page to generate more participants. These participants are also a part of the ongoing health study conducted by the Metropolitan State University of Denver and CSU that is investigating relationships between residents who lived downwind of the former Rocky Flats Nuclear Weapons Plant and rare illnesses. Additional individuals were then recruited through network sampling techniques, in which interviewees were asked to recommend friends, neighbors, and colleagues who met the criteria for inclusion. Network sampling is particularly useful when the research topic is on a sensitive issue and this requires the knowledge of insider to locate people (Biernacki and Waldorf 1981). This chain referral process allowed me to reach a population that is relatively hard to access due to limited data collected on individuals who lived near Rocky Flats while the site was in operation. While network sampling has been criticized as having

limited representativeness of a population, as well as issues associated with verifying the accounts of those interviewed, these were not substantial limitations in this study. As I was concerned with understanding the lived experiences of residents exposed to the site and their perceptions, psycho-social experiences, and processes of meaning making, I was not aiming to generate a randomly selected sample or a generalizable result. Additionally, my original convenience sample of participants (recruited through Rocky Flats Downwinders) varied across demographic groups and thus facilitated my ability to reach different networks.

My final sample consisted of 12 females and 3 males who had lived near the Rocky Flats Nuclear Facility during the facilities operation, both during the operation and after the facility closed, and only after the facility had closed. Participants ranged in age from 40 to mid 80s. All participants had either been diagnosed with an illness, or had a loved one diagnosed with an illness, that they linked to living in close proximity to the Rocky Flats Nuclear Weapons Facility. Diagnoses ranged from cancer, autoimmune disorders, fertility issues, and blood diseases.

Field Work

During the months of my fieldwork, residents and community activists shared their narratives and stories about growing up near Rocky Flats. I met people who were still on the verge of connecting either their own illness or the passing of their loved one to radiation exposure, and others who felt very strongly that their illness was connected to Rocky Flats. Individuals shared stories of what their childhood was like, what they knew about Rocky Flats as a child, and how that knowledge shifted with time. I spoke with people who had vastly different perspectives on justice and if the area should continue to be

developed. While some felt justice in that situation was the ability to make an informed decision, others felt as if the area should be closed and those who had suffered from health impacts should be symbolically and economically acknowledged. The variety of these perspectives allowed me to expand upon my own conceptions of environmental justice, and with great care, I detail their own opinions and beliefs in latter chapters.

Their stories both touched and angered me. Interviews were deeply personal, and while most remarked that sharing their story felt cathartic, it was also mentally and emotionally taxing to recount their experiences. All of the respondents remarked that it was important to do such work, that they felt as if their voice was finally beginning to be heard. Through sharing their stories, I hope that we can begin to address the historical legacies of injustice surrounding toxic spaces.

Data Analysis

Interviews took place at a location of the participant's choosing, with the most frequent place being in the participant's home. Each interview was audio-recorded on a digital recorder with the permission of the participant, transcribed in full using Express Scribe software, and then coded thematically. After completing all interview transcriptions, all interviews, archival interviews, and analytic memos were entered into NVivo for coding. Nvivo is a qualitative data analysis software that allows researchers to condense all data into one document and create codes, called "nodes", that assist in thematic and conceptual analysis.

As coding is the process of "defining what the data are all about" (Charmaz & Emerson 2001: 340), interviews were read and reread numerous times to deepen my understanding of the lived experiences of participants. I then utilized open coding to

identify initial concept indicators I found to be informative. As concept indicators "help stimulate an idea, process, or concept by the researcher" (Glaser and Strauss 1967), these indicators were critical in the developing my coding scheme. These concept indicators were words, phrases, and sentences that occurred frequently across interviews. Under each concept-indicator, I utilized excerpts of the text to form descriptions of different concepts. By moving from the unique experiences of each individual's experience as well as similarities and difference to experiences of other individuals, patterned relationships between concepts emerged. In axial coding, I was able to explore to the interconnections between my initial variables. As axial coding is oriented around thinking comparatively between my concepts, I identified concepts which seemed related. In selective coding, a set of categorized observations that is theoretically saturated and centrally relevant is generated. Thus, moving from my axial coding scheme, I was able to generate the central themes of narratives: health impacts, knowledge, and conceptions of justice. After identifying themes, I created a Word document and pasted corresponding excerpts from interviews. This allowed me to further reorganize my data and identify subthemes. After identifying subthemes and rereading through the quotes multiple times, I began selecting quotes which I felt captured the theme at hand. These themes informed, and largely make up the bulk of, my data analysis.

Chapter Five: Findings and Analysis

When I began learning about the case of Rocky Flats, I couldn't help but wonder how community members did not know about the facility. How could a nuclear facility, and the consequences of living in close proximity to it, be invisible and unknown to the local community? After fifteen interviews, conducted a decade after the facility was officially shut down, it became more apparent. Much of life is chaotic, filled with abstract risks and dangers, frightening possibilities we do not like to think about, circumstances that often feel out of our control. We are taught that the government protects us and thus, often, do not perceive the risks that exist in our environment. This was especially true for Americans growing up during the Cold War, when secrecy around nuclear sites was protected fiercely as a matter of national security.

Environmental risks permeate daily life in America, then and now. Yet, a tension exists between people's individual experiences of environmental risks and public acknowledgement of those risks. While workers faced negative health consequences related to their employment at the Rocky Flats Nuclear Weapons Plant (Iversen 2012; Quigley, Lowman, and Wing 2012), the surrounding community was also at risk for environmental contamination and subsequent environmental health problems (Iversen 2012; Martell 1969; Johnson 1975; Johnson, Tidball and Severson 1976; Johnson 1977; Johnson 1981; Johnson 1982; Johnson 1987). Risks associated with the plant included radiation exposure, plutonium, tritium, and other forms of contamination, environmental degradation, and polluted watersheds and crops. However, these risks were largely unknown to local community members due to conflicting reports about plant operations, leakages, and safety, as well as a lack of readily available information regarding the health

impacts of exposure to such risks. As one might expect, information available to the public strongly influences knowledge that can be gained by individuals. While risks from Rocky Flats became known to individuals after they faced health complications, much of the broader community still remains unaware of the environmental contamination surrounding Rocky Flats.

Further, currently, health officials with the CDPHE, developers, and city officials continue to assert that the site is as remediated as possible and is safe for various activities, from new housing developments to recreation on the surface. In sharp contrast, all community members interviewed suffering from illnesses believe that their illness was acquired as a direct result of their exposure to toxics from the facility and site. Today, the conflicting reports from independent scientists and government officials perpetuate uncertainty surrounding the site. Importantly, across historical eras, interviewees expressed a lack of transparency regarding the risks surrounding the facility. Decades after the site's closure, public reports of the contamination in the area and potential health impacts of living in close proximity remain limited.

In my findings, I highlight the political, institutional, and interpersonal aspects of access to information, knowledge, and environmental health problems in relation to living near the Rocky Flats Nuclear Weapons Facility. I describe and analyze the experiences of participants, as well as the subsequent shifts to their lives in relation to their diagnoses, to begin to uncover some of the as-yet invisible health and social impacts of living near a nuclear facility. First, I utilize archival interviews to illustrate what was known about Rocky Flats during its operation. As nuclear weapons production is part of the national security state, it is highly secretive and public disclosures of risk typically come decades

after exposures of civilian populations, if they come at all. As illustrated in contemporary interviews, the culture of secrecy continues. After addressing what was known by community members about the Rocky Flats site and related risks - and how such knowledge was constrained by structural barriers - I discuss my respondents' reported health implications of living near the facility during and after its operation. Much like the knowledge surrounding Rocky Flats, knowledge about environmental health problems remains obscure. A common narrative throughout interviews was the discovery of the facility's history *after* diagnosis and then subsequently engaging in considerable work accessing and gathering related information. Although all respondents knew at some level of the site's existence, they did not know the gravity of the site until they faced health complications.

Over sixty years have passed since the Rocky Flats Nuclear Weapons Plant opened its doors to plutonium processing. Community members who were exposed during the plant's operation are still fighting to gain federal recognition and compensation for the area's high rates of rare cancers, childhood disease, blood and reproductive disorders, amongst other chronic and debilitating, and often, terminal illnesses. All interviewees linked these illnesses to exposure to plutonium; a link which has failed to be made by governmental officials and departments.

Despite significant improvements in environmental regulation and policies in the past decades, communities exposed to toxic chemicals continue to fight for federal recognition and justice (Malin 2015; Lerner 2012; Malin and Petrzelka 2010, 2011; Mohai et al. 2009). In addition to two fires in 1957 and 1969 that sent toxic plumes of plutonium over Denver and the surrounding area, nuclear waste was stored in underground barrels

that seeped into the soil and local waterways. Despite the frequent occurrences of environmental contamination, as well as studies conducted by independent scientists that connected high rates of cancer to such contamination, the government continues to deny citizens were exposed to environmental contamination.

While all participants linked their health problems with living near Rocky Flats, federal and state officials contest residents' perceptions that their rare diseases, and especially rare cancers, are linked to exposure to plutonium, tritium, and other pollutants found on and around the Rocky Flats site. Unfortunately, contested illnesses and the rejection of such claims by those in power is an all too common occurrence for communities that exist in close proximity to toxic facilities (Brown 2007; CIRG 2012). Different paradigms, the biomedical model and the environmental health model, compete for validity – and it is often the individual-centered biomedical model that dominates in diagnostic situations (Brown 2007). As such, establishing the parties responsible for related social and health impacts from exposure to toxic chemicals at Rocky Flats remains an inherently controversial task. In the findings section, I detail participants' conceptions of justice in relation to their health experiences. In order to move forward, we must understand the notions of justice held by those who were most affected by Rocky Flats.

Findings: Section One.

Archival Analysis: Looking Back Before Moving Forward

Rocky Flats Nuclear Production Site; a site that has been seemingly erased from collective memory. While the plant was in operation for over forty years, producing over 70,000 plutonium triggers for bombs, all visual reminders of its existence have been destroyed. Even during the plant's operation, the surrounding community was largely unaware of what it produced and the potential environmental and social consequences of

such production. Here, I share the stories of activists that helped lead the initial anti-nuclear movement in Colorado and successfully shut down Rocky Flats Nuclear Weapons Site. Drawing on a sample of archival interviews collected through the Maria Rogers Oral History Project, I detail the ways in which access to information eventually helped enhance people's knowledge of the site's potential risks; the subsequent environmental justice activism against Rocky Flats; and the procedural equity, or lack thereof, realized during the clean-up of Rocky Flats.

External Threats and Internal Contamination

For decades, the public was unknowing and unwillingly exposed to environmental contamination caused by poor safety procedures at Rocky Flats. Interestingly, for participants who lived near the site during its operation, risk was often associated with the nuclear weapons production of other countries. As nuclear weapons had been framed as a deterrent and necessary for the safety of the United States in the Cold War, our domestic production of nuclear weapons largely went unquestioned. In fact, it was lauded and its secrecy deeply guarded. Because Rocky Flats was framed as a facility that was necessary for winning the Cold War, concerns for safety were more tied to the risks posed by Russians or nuclear annihilation. As the production of nuclear weapons had been normalized and legitimized through state rhetoric, respondents who lived in the area during the facility's operation thought about domestic nuclear weapons sparingly, and then in strong support of U.S. efforts to beat Russia in the decades-long race to stockpile the most nuclear weaponry. Archival interviews reveal that when people did contemplate nuclear weapons, individuals felt powerless to challenge their production. As nuclear weapons were framed as a deterrent, they were not questioned. Across oral histories,

respondents reported that their sense of risk related to the facility, at the time, was associated with outside forces, not internal contamination. Concern about external threats allowed people to be willfully ignorant and ignore internal threats to their environment.

In this context, participants often did not contemplate the ethics of nuclear production, including the plutonium triggers being assembled at Rocky Flats. Rex*[1], an employee of Rocky Flats who worked his way up from a janitor to a material analyst, viewed nuclear production as necessary. He explains:

> I just felt that they just didn't really know the whole story about what was happening out there and why were we doing this. We were trying to deter – it was a good deterrent about building nuclear weapons. I think it was a good deterrent. I think we had to have it, but I never did want them to use it. I mean, that's my feeling. I'm just not the type. I just hope that we could settle it on a more peaceful thing. But I think we had to have it at that time. I think it was necessary.

Nuclear weapons were seen as a necessary evil; without the weapons, people believed that the United States would be in a vulnerable position and potentially get attacked. Despite contamination, the production of nuclear weapons was seen as necessary. Reflecting on the potential health impacts of working at Rocky Flats, Rex acknowledged that contamination could negatively impact those who worked there. As he recalled during the interview: "There were a few people I worked with that died while I was there. I felt bad about that, but that's life, that's water under the bridge."

Importantly, though, even in these interviews people often utilized more biomedical, individual-centered observations than they did observations about systemic problems or collective illness experiences. For example, while Rex did acknowledge that some workers got sick, he chalked it up to their personal behaviors and choices. Rex

[1] All participants named have been changed in order to ensure anonymity.

blamed the individual victim, a common theme across archival interviews. Workers who were ill or died were workers who did not adequately protect themselves. As such, Rex found that the protection offered by producing nuclear weapons far outweighed the cost of individual lives. By justifying nuclear weapons production as a deterrent, injustice was rationalized as the outcome of poor personal decision-making by affected individuals.

As most community members who were not activists were unaware of the extent of contamination, as well as the health implications of radiation exposure, the area was perceived as safe. One community member felt less safe after the site was shut down, remarking "if you want your country safe, you're glad they're here. When they close it down, you worry a little bit because the country is not so safe anymore". As threats were associated with Cold War political conflict and promises of Mutually Assured Destruction, not internal contamination, the shutting down of Rocky Flats worried some community members.

However, for others interviewed in the Maria Rogers archives, accessing more information about the environmental and social risks associated with nuclear weapons, made them seem less like a deterrent and more like a threat. As the perception of nuclear weapons shifted, so did the perception of Rocky Flats as a necessity for national security. David Wilson, a self-identified activist who became involved in the anti-nuclear movement after he was exposed to information in college, commented on the moment of "awakening" he had when considering the utility of nuclear weapons production:

> Balancing the need to provide us with the protection, with the weapons, and then to have this be total neglect of the environment and the community around Rocky Flats. Who were we protecting? What were we being protected from?...We had our nuclear protection, but then: What did we gain in that? We didn't gain anything. We just had the people exposed.

The archives show that others echoed similar questions. Knowledge about picocurie limits, exposure, and risk were driving forces in activism. As individuals became more educated on the risks associated with nuclear weapons, their desire to get involved in anti-nuclear movements grew. Rocky Flats activists saw parallels between their involvement in shutting down the plant and their knowledge of nuclear weapons and their inherent risks, including radiation exposure.

Other activists identified the importance of their own education when learning more about Rocky Flats. As a lot of information available about the site was incredibly dense and filled with jargon, meaning that a background in science and mathematics was critical to transferring knowledge to the broader community.

Importantly, in cases of environmental injustice, inadequate transparency, communication, and/or inaccessible information often complicates or perpetuates perceptions of risk. Interviews with community members about their individual knowledge and subjective experiences with Rocky Flats illuminated patterns related to the inaccessibility of information about the facility and officials' inadequate communication to community members about related risks. For example, community members relied almost solely on their personal experiences to assess the consequences of the site, joking that because they "never glowed in the dark", they perceived little risk associated with Rocky Flats. One activist remarked that most individuals in the community were unaware that there was a connection between Rocky Flats and nuclear production as it was called an "industrial plant". As Melinda Kassen, the lawyer associated with the clean-up remarked,

> For the people who lived around these facilities, even to the extent that the economies were tied to the facilities, to all of a sudden find out that there's tritium in your drinking water or there's plutonium in the soil, I mean, people were upset. And this—you know, you went from— the country went from knowing nothing about the nuclear weapons complex over

> the course of the '80s and these lawsuits to seeing the nuclear weapons complex on the front page of *The New York Times* on a weekly or at least monthly basis over the course of a ten-year period.

Activists played a critical role in shutting down the site, which resulted in increased publicity and coverage of environmental contamination associated with Rocky Flats. Through public displays, large-scale protests, and handing out informational brochures, activists brought Rocky Flats into the public arena.

The movement brought together a range of people; including people opposed to nuclear weapons for moral reasons, environmentalists, workers concerned about their own health and job security, neighbors of the plant concerned about their health, and social justice advocates. Through bringing people together, and publicly protesting for years, activists were successful in their mission of closing down the facility. One activist saw the activism as directly leading to FBI raid and the subsequent shutdown of the facility, stating that:

> A lot of things the FBI raid was looking for evidence-wise was exactly what the peace and environmental community had been talking about over the previous five years, and even the previous two decades. The concerns that activists had all showed up in the concerns about what the FBI was looking for. There would be no FBI raid if there had been no Rocky Flats movement, for sure. They're too interconnected.

Due to persistent activism surrounding Rocky Flats, both the broader community and government was informed about the health and safety risks related to the facility. Prior to the surge of activism, respondents commented that not many people knew that Rocky Flats was a "nuclear bomb factory". Activism, then, played a key role in educating the public about the facility, as well as the potential consequences of living in close proximity. Largely

due to the rise of social activism in the late 1980's, the facility was shut down for environmental and safety reasons.

However, because knowledge is relational, it differs across time and place. While information was more readily available due to the rise of activism in the 1980s and 90s, activism has decreased, and with it, knowledge. With clean up, has come a destruction of all visual cues to tell the history of the site. As a result, individuals who are new to the community or were not exposed to information communicated by activists are unaware of the risks that remain.

Remediation Efforts and Procedural Equity

After Rocky Flats was closed down in 1992, activism centered on the remediation, or environmental clean-up, of Rocky Flats. Although activists had varying levels of involvement after the facility shut down, those who were involved in advisory councils were unsatisfied with the mechanisms of public participation for determining adequate and appropriate levels of remediation for the site and surrounding areas. As Rocky Flats was on the National Priority List, there were certain responsibilities under Superfund to have public participation, particularly a Site Specific Advisory Board. Despite various groups creating the space and mechanisms for residents to voice concerns about the clean up process – groups such as the Rocky Flats Local Impacts Initiative and the Rocky Flats Monitoring Council – activists felt that their voices remained unheard. LeRoy Moore, an academic who first became involved to end production at Rocky Flats in 1978, felt that their efforts to advocate for the most stringent clean-up possible were unsuccessful due to structural barriers. As he stated in his archival interview: "We, the public, thought we were

being invited to help design the house of the cleanup, but really what we were being invited to do is to rearrange the furniture a bit".

Although activists had a seat at the decision-making table, so to speak, they were unable to participate meaningfully in land use decisions and specific decisions about the remediation process. The staff coordinator of Rocky Flats Citizens Advisory Board, for example, stated that citizens' voices and concerns often were ignored in budget priorities for Rocky Flats. Because the budget was done without citizen or activist input, the perpetuation of 'not having enough money' to monitor health, amongst other citizen requests, continued. Ken Korkia, who began working as a technical assistant to the Rocky Flats Cleanup Commission in 1990, and was later hired as staff coordinator for the Rocky Flats Citizens Advisory Board, felt that money dominated conversations regarding clean-up. As such, Korkia remarked that the public's concerns remained unaddressed by those in charge of the remediation. He observed:

> When it comes to cleaning up the facilities, when it comes to paying attention to what the public has said it wants, 'There's not enough money, there's not enough money!". When it comes to studying the public health of people around Rocky Flats, there's no money for that.

Despite operating under the guise of public participation, those involved in the council and other groups felt as if their suggestions were not acknowledged. Importantly, this was largely a foregone conclusion, given the structural barriers, specifically budgetary limitations, which made these sorts of requests impossible to fulfill, as if by design.

While negotiating the site remediation, another activist noted that a Department of Energy employee told citizens that they were limited by available funds and would not be able to get the kind of clean-up they wanted. While negotiating clean-up, another activist

noted that a DOE employee told citizens that they were limited by available funds and would not be able to get the kind of clean-up they wanted. The lack of transparency in reaching a clean-up agreement, without knowing a pre-determined timeline and budget had been set, further undermined processes of procedural equity. Structural barriers and bureaucratic policies limited the public's ability to contribute in decision-making. Procedural equity, then, was flawed in its implementation.

While participation in public forums was encouraged, activists felt as if their voices remained unheard and decisions were not made transparent. As a result of bureaucratic policies and agreements made behind closed doors, such as the budget cap for site remediation, activists were not able to participate meaningfully in decision-making, which created a lack of procedural equity. While the activism surrounding Rocky Flats led to its federal investigation and ultimate closure, activists were unable to meaningfully participate in decision making prior to and during clean-up, leaving their voices out of the final plan. In the end, the site remediation policy for Rocky Flats was contested and not ultimately adhered to by contractors cleaning the site. While the Department of Energy declared that it would take seventy years and $40 billion dollars to clean up Rocky Flats (Iversen 2012), the proposal was later modified to an agreement wherein only the top three feet of soil were partially cleaned and which allowed significantly more contamination to remain below the surface. In fact, soil below six feet from the surface was not remediated at all.

As plutonium is invisible, the links between health and environmental implications are often contested and perceived to be more abstract threats. While participation was made possible through various public forums and meeting groups focused on the clean-up

of Rocky Flats, community members and activists involved felt as if their input was not recognized in policies and procedures. As the enduring impacts of those exposed to radiation were not included during the decision-making process for the clean-up agreement, there has never been a budget for a health study of current and future Rocky Flats area residents. As funding was not allocated to a health study of citizens, there has been no data collected about the consequences of living near Rocky Flats.

Additionally, as there is neither signage detailing what happened at the site, nor information given to new homeowners in the area, a lack of public dialogue about the site persists. This mirrors previous historical imbalances regarding citizens' access to information about Rocky Flats when the site was operational, during remediation planning, and during the clean-up phase. Despite the attention drawn to the site through activism in the 1980s and 1990s, Rocky Flats Nuclear Weapons Plant remains largely invisible to the public eye. As a result, individuals spend their entire lives living near the remnants of a nuclear facility with little to no knowledge of the health implications. In the next section, I draw on contemporary interviews conducted with fifteen community members to frame a broader discussion of two historical eras: one revolving around the site's operation and the latter after Rocky Flats was shut down. Both eras share commonalities in terms of information access, lack of transparency regarding the risk surrounding Rocky Flats, and exposure to environmental contamination. As we shall see, while all visual signs of Rocky Flats have been destroyed, its toxic legacy lingers.

Findings: Section Two.

"They Told Us It Was Safe So We Believed Them": Access to Information and Procedural Equity

The Rocky Flats Nuclear Weapons Plant was one of the most contaminated and most obscured sites of environmental contamination and injustice in U.S. history. As Rocky Flats produced plutonium triggers for atomic bombs even as surrounding residents remained unaware of its true purpose; some even thought they were simply making dish soap at the facility. Despite living near such a dangerous facility, respondents remarked that they "never really thought about it". Rocky Flats was normalized, naturalized; a guarded facility that sat at the foothills of the Rocky Mountains, pumping toxic waste into the area, storing it underground, and leaking it in local watersheds – but quietly, without the knowledge of its nearest neighbors. Because no one talked about the site, the operations and safety procedures were not questioned. Even after the FBI raid in 1989, community members were not fully aware of the site's toxic history. This pattern continues.

Because the culture of secrecy surrounding the site was normalized; people report doing little to investigate the purpose of the facility or risks related to it. Especially during the early years of the facility's operations, there was certainly little knowledge of or discussion about the potential impacts of plutonium production for community members, given that national security dictated no one discuss Rocky Flats. While deeply impacted by individuals' positionality, people's lack of knowledge and inability to access to information about the Rocky Flats site and its potential risks cannot simply be dismissed as laziness, lack of curiosity, or other individual-level dispositions. Instead, significant structural barriers existed to accessing information, not the least of which were multiple layers of federally-mandated secrecy surrounding nuclear technologies and production sites such as

Rocky Flats. Just like knowledge, willful ignorance can be put in place through communicative practices and spread across social settings, cultivated and nurtured intersubjectively; it can circulate through social networks and activities (Steyn 2012). As much of what we know emerges from the relationships and interactions we have with others, policies and cultural practices encouraging secrecy, non-transparency, and inaccessibility of information perpetuated ignorance about Rocky Flats. Due the culture of secrecy that surrounded the facility and its activities, the public had little reliable information about the risks associated with the site.

On the reportedly rare occasions when information was disclosed during the sites operation, the information offered was unclear or unreliable. Conflicting reports during the plant's operations about rate of risk from fires, toxicity, and the subsequent health impacts of exposure further obscured the implications of nuclear radiation for residents living near Rocky Flats. As a result, community members were both unaware of and unable to access such information. Before there was the Internet, newspapers provided the bulk of knowledge to citizens. As such, if it was not covered in the paper, events went unknown to local community members.

Trust in the Government

Across interviews, individuals who lived near Rocky Flats during its operation echoed a sentiment of initially trusting the government to warn them of related risks. While some were unaware of what the facility was producing, those who were aware of the site's operations did not perceive or research the risks of living near such a facility precisely because they trusted that the federal government to warn them if they were at risk.

William*, who also spent his childhood and early adult years living near Rocky Flats, first became aware of the facility in the 1960s. Now in his late sixties, he details how his trust in the federal and state governments reassured him and his family, but ultimately encouraged their ignorance regarding the risks associated with Rocky Flats.

> We knew about it, we knew roughly what and where it was. But at the time, the government was all, 'You're safe, there's no problem here.' I remember the releases of radiation in 1969 from Rocky Flats. I also remember them saying, 'Well, that was too minute, and there was no real release of plutonium, so you don't have to be worried.' It was just smoke.

For decades, William trusted that the government was providing accurate information and did not consider the possibility that the government could be obscuring or withholding information about Rocky Flats. He explained that this trust and willingness to believe officials about the site was not simply his individual behavior, but something he noticed in local perceptions of the site's risks:

> Sure, the government wouldn't hurt you. Nobody would put an atomic trigger factory, a bomb factory, in the one of the most beautiful places in the world. And, oh by the way, in a place where the winds are such that it can take any problem and spread it as far as it possibly could. Nobody. I guess the absurdity is that everybody bought [that] the government wouldn't do that. They wouldn't be that stupid. Would they?

Due to the perception that the government would never willingly and knowingly hurt its citizens, individuals such as William did not question the operations of Rocky Flats. Like other respondents I interviewed, they were told by federal and state officials that the facility was safe, they did not have or seek other information, and they were thus unaware of the health risks.

Connor* and Mary*, an elderly couple who had to sign a waiver acknowledging awareness of Rocky Flats to purchase their house while the facility was in operation, remarked that their trust in the government overshadowed the risks outlined in the

waiver. Despite signing the waiver in the 1980s, and recalling demonstrations which sought to close the facility, Connor and Mary remarked that the "risk didn't feel real". When questioned about their level of knowledge about Rocky Flats during its operation, Mary remarked that:

> People used to kid about it and say 'Well, your teeth are going to glow.' But, you know, so many of us thought well, the government would never have housing in a dangerous area. We just joked about it.

As displayed here, due to people's trust in the government at the time, the risks associated with living in close proximity to Rocky Flats during its operation were largely downplayed and often, even to the point of being joked about by local residents.

Because family members, neighbors, and friends did not widely talk about the site, or only joked about radiation exposure, a culture of secrecy was normalized while a culture of critical investigation of Rocky Flats was discouraged, even ridiculed through humor. Willful ignorance became the collective norm. All participants in this study remarked that they did not think about it until they were diagnosed with an illness. Because the facility was perceived to be safe, information that countered governmental claims was not sought out by respondents until decades later. Trust in the government, then, played a critical role in individuals deciding not to seek out information about Rocky Flats during its operation.

But trust in government has receded for interviewees, especially in families suffering rare or numerous cancers. Now, with all five family members suffering from various diagnoses such as thyroid cancer, breast cancer, and chronic lymphatic leukemia, Connor and Mary have begun to question the safety of the facility. When asked about their decision to sign the waiver and move into the house, Connor questioned why they did not seek out more information:

> There's some cover up on their side and then there's also some lack of diligence on our side, do you think? Do you think we could have been more diligent as far as looking into the possibility before we bought our house, for example? Should we have watched what was going on?

Mary, on the other hand, felt that even if they had been more diligent, information would not have been easy to access. The lack of transparent and accessible information available during the operation of Rocky Flats prevented participants from understanding the potential environmental health problems associated with living in the area. During the site's operation, trust in the government created and maintained a façade of safety and security.

Access to Information

While the particular experiences of interviewees differed, the common thread across interviews was their lack of access to information. Brian* lived near Rocky Flats from 1962 to 1981; at 19, he was diagnosed with a rare bone cancer called osteosarcoma. He had spent the first two decades of his life unaware of the facility's purpose and certainly unaware of the health risks of living near a nuclear facility. In fact, a budding track star, Brian often ran the perimeter of Rocky Flats when training for races. Even when he became aware of what the facility produced, the familiarity of the site discouraged him from asking in-depth questions about plutonium's effects. Brian explained how lack of access to information made him unaware of the site in multiple ways over time:

> Amazingly enough, I never really knew about what they were producing. I did know about Rocky Flats and a number of kids, more in high school, because kids I was in high school with, their parents worked there….A lot of kids who went to Arvada West had parents in the area because they were working at Rocky Flats. The plutonium triggers, I want to be honest here. I knew what plutonium was in high school. I never made much out of it.

While Brian reported feeling shocked that he spent the majority of his life unaware of what Rocky Flats producing, he also mentioned that he knew on some level what plutonium was. Despite his knowledge of plutonium, and close proximity to a nuclear facility that was producing it, he did not conduct any research on the risks associated with exposure. As he mentioned later in the interview, he wasn't at a place in his life where he was critically thinking about it. As a young boy and teenager, Brian was focused on "living his life" and trusted the government to keep him safe. Now, however, Brian's perception of the government and the risk associated with Rocky Flats has changed. After learning about the facility's designation as a Superfund site in the 1990's, Brian began to question the link between his own cancer and Rocky Flats. In his interview, Brian recalled a conversation with his family practitioner that, looking back, confirmed his suspicions --- "I've always been haunted by my family practitioner telling me that he had seen four cases of osteosarcoma in the last year". Now, with his knowledge of the site, he has reached out to numerous local news outlet to inform them of his experiences and perspectives. Yet, despite his insistence about the causal link between high rates of cancer in the area and Rocky Flats, he felt both dismissed and discouraged by news reporters. Media coverage of the toxic legacy of Rocky Flats remains limited. Just like Brian, other interviewees felt that the state was failing in its duty to inform citizens of the risk, both then and now.

Misinformation, justifications, and conflicting reports provided a sense of safety to the general public while the reality of contamination simultaneously remained obfuscated. Additionally, while Rocky Flats was known to be a nuclear facility, trust in the government at that time kept community members complacent. Trust in the government obscured the disparate access of information between state and federal officials and community

members. For all interviewees, health experiences shifted trust in the government due to a lack of transparency and conflicting information about risks related to Rocky Flats.

In cases of environmental injustice, community members often feel as if a lack of communication about operation and subsequent risks occurs. Power, after all, involves the ability to control the scope of information others can access as well as what individuals pay attention to. Trust in the government played a pivotal role in perpetuating the idea of safety and thus, diminished the need for individuals to investigate Rocky Flats. During the site's operation, individuals did not know about the risks associated operation of the facility due to secrecy associated with the Cold War and need for national security precautions at nuclear facilities. As public reports detailed the success of the clean-up, both new and old residents were unaware of the threat the site might pose to their health. Despite some increased awareness of the site currently, lack of certainty, continuing problems with accessible information, and contested illnesses still characterize people's experience of Rocky Flats, even after its closure and remediation.

"Well, They Cleaned That Up": Conflicting Information and Cover-Ups

Due to the lack of media coverage or reliable government data during the site's operation, as well as in the years that followed the site's closure, community members remain unaware the implications of living near the former site. Interviewees became aware of the debate surrounding the remediation's thoroughness only *after* they began investigating Rocky Flats on their own. Donna*, who moved to the Arvada area in the 80's, and whose husband was diagnosed with a rare bone cancer at age 26, began researching Rocky Flats thirty years after her husband died. What she found about Rocky Flats shocked

her. Donna felt that both her and her family were cheated by the lack of safety precautions taken by Rocky Flats.

> You can't protect yourself from dying. But when you think someone was basically killed because of leaving out barrels of radioactive waste and putting 6 feet of dirt over the top like it's going to fix it, it just blows my mind actually. What they should have used to clean it up, they didn't use. It blows my mind.

As the death of loved ones was seen as preventable, a profound sense of anger and distrust towards the government resulted. Like other interviewees, Donna expressed low trust in industry and government officials due to the lack of safety measures taken to reduce the distribution of risk and contamination in the community. As she discussed her increasing role in public activism, she reflected on how her perception of the clean-up had changed over time, in part because she became more critical about the information she could access about the site and more aware of the limited opportunities for transparent and authentic participation. She reported:

> I feel like they keep trying to bury it, like trying to hide things. My perception is they really did more of a clean-up. The more I started getting involved, the more I realized how little they did and how little the public did to make sure that they followed safe procedures. We just assumed that they were cleaning up when they said that they were cleaning up. Even today, you ask somebody about Rocky Flats and they say, 'Well, they cleaned that up.' I have a daughter that lives right off of 130. I didn't really like her moving there. But even then, I didn't know how little they cleaned up.

Now, with a daughter living in close proximity to the remediated area, she worries about the future health of her daughter and grandchildren. If more information about the site had been available, and the operations made more transparent, Donna felt that both she and her daughter would have made different decisions about buying property. She explained:

> If I had known as much as I know now, back then I would have been 'Hell no'. But there was nothing when she bought the house. You didn't sign anything saying there's risks. That's why I'm into this [activism]. It's more about signage for me. If people want to live there and

> it's [with] full knowledge, that's up to them. But when they think it's safe, and that they're fine out there, that's when I get upset. That's when I think it's criminal.

The ability to make informed decisions was, and continues to be, greatly hindered by conflicting reports about Rocky Flats, its operations, site clean-up, and risks posed to the broader community. For Donna, the lack of transparent information, and thus a reduced capacity for residents like herself to make informed decisions, is injustice perpetuated by the state. Participants referenced both Rocky Flats and the government in terms of blame and accountability; feeling that the government did not do enough to regulate safety measures at Rocky Flats and led to what were seen as preventable deaths. Interviewees reported feeling their ability to make clear and uncompromised decisions about significant life choices, such as buying property, was hindered by structural barriers to accessing information and by the unreliability of the information that could be accessed. Respondents felt that if they had known more accurate information about risks, they would have made different decisions about buying property, as well as more proactive and preventative medical testing.

A False Sense of Security: Access to Information and Environmental Health

For others, despite observing patterns of illness amongst their neighborhood and friends, those who were aware of the facility's existence still did not question the connection between the plant's environmental contamination and health problems, in large part because reassurances from neighbors proved more convincing than contested information about rare cancers. Ellen*, who lived in two different houses downwind of the facility, described the lack of information about Rocky Flats throughout her interview. After finding about the site when building a new house with her husband, neighbors reassured

her that the area was cleaned up and there was no problem, despite the high incidence of neighborhood illness. As illness began to affect more and more people in the neighborhood, however, both she and husband grew suspicious. Ellen explained:

> When we moved there, I thought, it's a new subdivision. We didn't know that we were going to be moving there to witness a horrible death. And everyone else around us was sick. We kind of kept thinking 'Why are all these people sick? Why do all these people have illnesses?'.

When she discovered that an eleven-year-old boy who lived in their subdivision was diagnosed with the same rare cancer as her husband, her and her husband sold their house. As Ellen gained awareness of the correlation between neighborhood cancer and Rocky Flats, she tried to inform others. Ellen remarked that neighbors were not receptive to her story and were happy when she moved away. Descriptions of friends and neighbors avoiding, and even denying, the reality of potential environmental contamination was common across interviews.

For people exposed to environmental toxics, the thought of knowing the health impacts or body burdens of such exposures can be daunting. Understandably, then, even some of those who connected their illnesses to Rocky Flats reported that they remained wary of learning more about the site. "Do you really want to know? Like when you die or how you're going to die? Some people I guess do and other people don't. This is a piece of that," one woman reflected. Other community members echoed this sense of knowing but not knowing, of having information but not wanting to learn more. Donna, who we met above, spent many years limiting her knowledge about the site.

> It was one of the things that was also in the back of my mind that I knew was there but I didn't really (hesitates)…I don't know if I didn't want to research too much about it because it scared me, you know. The more you know, the more you're going to get sick or something.

> I kind of kept it in the back of my mind but didn't really think about how it was impacting me directly.

The topic was deeply troubling but also not completely know-able; thus, it was an issue that other people such as Donna preferred to avoid thinking about in-depth. Much like Donna, responses of other community members, family members, and friends when confronted with information about illness and contamination illustrated the collective avoidance of learning more about the site. Sarah*, who lived in the area while Rocky Flats was in operation, and has been diagnosed with thyroid, bone, and kidney cancer, details the experience of discussing the connection with her family:

> I did alert my mom and dad and sister about it, just to see, you know, what they had to say. And they didn't really react. They knew what was there but they…I don't know if it's denial or they don't want to believe something like that could happen… That their decision to live in that area is the cause of my cancer disease. I'm sure it's pretty heartbreaking to think about for them because you know, they were parents trying to provide for their children and one of their children is very sick. So they really didn't say anything. My mom said she didn't think that was the cause of my three cancers.

Other respondents felt that the willful ignorance of family members was a result of escaping blame and maintaining denial. Shannon*, a woman in her mid-forties who spent her childhood seeing the lights of Rocky Flats from her bedroom window and horseback riding near the facility, encountered denial from her father after discussing the connection between her thyroid tumors and their family home.

> My dad could never admit that it was a problem. He'd have to admit that he moved us here when the HUD notice was given out. It said the property you live in is within 10 miles of Rocky Flats and has been exposed to plutonium contamination and you could have problems from it. He moved us in. He saw that.

Often, individuals block out or distance themselves from information that threatens their perception of reality, as well as their identity (Norgaard 2006). As Shannon's father was

contracted by Rocky Flats, denying the impact of Rocky Flats on his daughter's health maintained an illusion of ignorance and thus blamelessness.

As illustrated above, the lack of adequate, accessible information thus also diminished residents' abilities to participate in decision-making in an equitable fashion – regarding their own health or risks from the site. Because of the lack of information provided about the risks of contamination, participants were unaware of the possible health impacts living near the facility. In part, though, interviewees became braver about accessing otherwise intimidating information once they received diagnoses; abstract fears about illnesses they might get were replaced by curiosity about how to identify and fight the diseases with which they had already been diagnosed. In turn, as interviewees learned more information about Rocky Flats, concerns about increased development and community denial in the area mounted.

Increasing Development and Community Denial

To date, despite rising rates of cancer in the area, the area is largely seen as safe and open for development opportunities. As the area continues to experience record rates of in-migration, new housing continues to be developed and property values increase. As a result, new housing developments are being built in close proximity to the site, including Candelas. Located on what is formerly a protective no-build zone on the border of the facility, Candelas is one of Colorado's largest new suburban developments. Importantly, the disclosure report provided by the developers of Candelas fails to inform new homeowners of the high rates of cancer in the area, the lingering environmental contamination in the area, and the possibility of plutonium exposure. While the developers conducted soil tests, it was for Gamma radiation (Candelas Rocky Flats 2013 Soil Reports). Let it be noted that

plutonium is an Alpha emitter. Information disclosure, then, is skewed to assure new homeowners no risks exist. By providing deceiving information to new homeowners, their ability to make an informed decision about the safety of the area is hindered.

Candelas, and the lack of disclosure to new residents living near the site, emerged as a central concern for all respondents. Sam*, a breast cancer survivor who grew up in Arvada, reflected on conversations she has had with realtor friends in the area about practices of disclosure.

> The realtors I talk to say they don't have to [disclose the site's history]. A sale is a sale. I don't think that they truly believe there is any harm there. I think that we're all just so incredibly ignorant about it and in denial about it and think that that was just decades ago. Why focus and be concerned about it now? It's cleaned up.

Through withholding information necessary to making informed decisions, power remains in the hands of the "knowers" who are often those who deny the risk surrounding Rocky Flats. Reluctance to publically acknowledge the threat of contamination in the area proliferates amongst developers and real estate agents, groups that stand to lose the most if the land becomes stigmatized. In a society that prioritizes economic development, individual safety is a secondary concern.

Interviewees expressed that residents, not only developers, also played a role in denying the risk associated with the area. Respondents related the lack of recognition and reluctance to discuss Rocky Flats as somewhat motivated by protecting home property values. If individuals were to acknowledge and act upon the reality of contamination, property values would suffer. Sam, whom I introduced above, felt that property values overshadowed the threat of contamination for friends.

> I have two girlfriends that still live close to it and have built their new homes by it. And they don't want to talk about it. They worry I think more about their property value than anything.

After Sam was diagnosed with breast cancer, she reached out to a friend who was building in Candelas to alert her about the possible dangers.

> One of my best friends was building a home the year I was diagnosed in Candelas. I called her when I started to think about Rocky Flats more and my diagnosis. I said 'Please don't move into that home. I don't think it's going to be safe.' She was very dismissive and very upset that I would hamper her dream home. It was shocking to me. She's since moved in and lives there and is really very close to the facility. We've had some heated discussions since about it. She just doesn't care, and I just find that shocking.

Even after providing her friend with information about risk, the perceived causal connection between her cancer and environmental contamination, as well as the history of toxic releases in the area, Sam felt as if her concerns were dismissed by her friend in order to pursue the construction of her dream home. Now, the friendship suffers due to differing perspectives of the remediated facility, surrounding land, and their potential risks to new homes in the area. While residents such as Sam's friend are provided with the information about contamination, and thus have the ability to make an informed decision, other new residents in the area are not provided with information necessary for decision making.

As information surrounding the risks associated with living in close proximity to the site is contested, community denial is perpetuated. Health problems remained contested and obscured; government reports continue to question independent findings that supported residents' observations about environmental health problems. Maintaining community denial about environmental contamination through a lack of transparency and information serves state, corporate, and institutional interests.

Perception of Risk

In addition to expressing concern over the new housing developments, respondents questioned the safety of the Rocky Flats Wildlife Refuge. Although 1,000 acres of the site are still listed as a Superfund Site, and not open for the public access, the rest of the site will be used for public recreation beginning in 2018. Across interviews, respondents questioned the safety of the site, as well as the image the site portrayed. The site has been publicly portrayed as fully remediated, and the Wildlife Refuge portends to exemplify the success story of Rocky Flat's clean up. However, in numerous interviews, participants felt that the image of safety was both deceptive and unjust. Because the wildlife refuge reinforces the state's claims of a successful clean-up, participants worried that the risks associated with the site would be further minimized and dismissed by the federal state and Colorado officials. For Donna, the lack of information about the history of the site perpetuates the refuge's façade of safety.

> It's one thing to know we made horrible mistakes and had horrible spillage. But… to actually actively encourage people to walk on it and to go there and bring their children and not have any kind of signs telling them is wrong. They're basically telling the world that it's safe really upsets me.

By promoting the site as safe and open for hiking, biking, and public recreation, the possibility of spreading knowledge about the toxic legacy of Rocky Flats seemed less likely to respondents. Participants questioned the motivation behind the wildlife refuge, remarking that "to call it a wildlife refuge is putting a smiley face on a really bad situation". Naturalizing toxic spaces presents an image of safety; further reinforcing the idea that the cleanup was successful and the area poses no harm to visitors or community members.

Through framing the site as natural and limiting information about the site's history, the pattern of those in power controlling the information disseminated to the public continues.

Patterns of development, community denial, conflicting information, and individual reluctance to engage in research illustrate important connections between knowledge and power. Developers and real estate agents often willfully ignore the importance of disclosing information to people. Ignoring something, though, is often more than simply failing to notice it. Ignorance is quite often the result of structural patterns which encourage individuals to actively disregard it. Interviewees expressed that the community pattern of avoiding or denying information was related to decisions to protect property values. Others saw ignoring information or failing to seek it out was related to fear about health. However, the experience of environmental health problems, and their subsequent contested nature, shifted participants' perceptions of risk and information.

New Knowledge and Shifted Worldviews

Accepting that you have been exposed to toxics, which may or may not negatively impact your quality of life and lifespan, shifted interviewees perspectives on other societal issues. Ellen, who connects her husband's rare heart cancer to living in close proximity to Rocky Flats is detailed above, discussed her shift in worldview:

> I've looked back so many times and thought, 'Why did we buy a house in Five Parks? Why didn't we build a house?' It was just comfortable and we were, just, you know, status quo. But I'm just, this whole thing has made us more paranoid. It's shifted my view of, I mean, I look at foods and I'm thinking, 'They tell us these foods are healthy and we're killing ourselves.' Everything we do, it's shifted my, you know, view on news. Somebody is on TV and they're talking about, they did research on that survey and it really didn't prove anything. We did our own survey, health survey for there and it really, there's not much difference in cancer rates and I'm thinking 'Yeah right.' I'm angry. It's changed my life. It's changed my kids' life, because we're more paranoid about things. We're more skeptical of government stuff because I really think that we're just, we're just out there and they just lead us off a cliff and we'll just follow them. Oh, it's fine.

While she once lived in what she described as "la la land", her husband's diagnosis and his ultimate death changed her perspective on societal issues and information provided by the government. New knowledge about the state's patterned secrecy and withholding of important information led to subsequent distrust of the state, increased tensions with community members who refused to acknowledge the potential impacts of living near a nuclear facility, and shifted worldviews amongst respondents.

Social location, or the position a person occupies in society, affects how individuals construct meanings of social problems, opportunities, and collective identities (Taylor 2000). Because most participants were unaware of cases of environmental injustice, and even that they were perhaps a part of one, the experience of environmental health problems in their own daily lives subsequently shifted their view of the government's trustworthiness. Bob*, a retired veterinarian who lived in Arvada during the plant's operation, first began to observe high rates of cancer in dogs at his veterinary practice in Arvada. After his concerns were dismissed as being normal rates of cancer, Bob did not think about Rocky Flats until years later when both his daughter and son-in-law were diagnosed with terminal brain cancer. Bob attributes both deaths to Rocky Flats as his daughter had worked in banking for Rocky Flats and their house was located close to the facility. Now Bob expresses anger towards the government for continuing its pattern of contamination and lack of transparent information for those living in the area.

> The government is irresponsible. Rocky Flats is just one place in the country and there's more of it going around in other places. The dangers are out there and people should know. The same thing is going around up in Washington and the contamination from another nuclear development. The government is not in the best position in my mind. I don't trust the government. None of them [governmental officials] take responsibility… the government has to acknowledge it, and they're in denial that they're responsible. They're covering it all up and they're not taking any responsibility. How do we stop people from

> being able to do this? The local government, like in Arvada and Broomfield, all over those towns around there, they're all letting this development going on.

A few participants such as Bob recognized that sites like Rocky Flats continue to exist all over the country, and as such, the pattern of environmental contamination and misinformation continues. When considering the perpetuation of environmental injustices across the country, interviewees questioned the lack of responsibility taken by the state. Because the state is often not held accountable for contamination, while also frequently unable to hold corporations responsible for their own environmental failures, interviewees felt as if government was being negligent. The federal government failed to hold Rocky Flats operators accountable for the facility's contamination, so interviewees often turned to social activism to educate the surrounding community about risks, then and now.

When the system people once trusted loses legitimacy, people who were fatalistic begin to demand social change, and as such, often find and exercise a new sense of political efficacy. After experiencing the health impacts of nuclear contamination, about two thirds of the interviewees began to reach out to local community organizations such as the Rocky Flats Downwinders and the Rocky Flats Right to Know. Both community organizations seek to educate the community about the risks associated with Rocky Flats. To date, former residents are often unaware that they have been exposed to hazardous nuclear waste. Without knowledge of this exposure, residents are unable to be proactive about their healthcare and early detection. For new and old residents, the Rocky Flats Right to Know advocates for permanent signage around the site, particularly around new developments such as Candelas, and to improve the transparency of information regarding Rocky Flats. Interviewees expressed hope that with the advocacy of Rocky Flats Downwinders and

Rocky Flats Right to Know, public transparency, awareness, and recognition of the lived experiences of those who have suffered the health impacts of living near Rocky Flats will become possible.

As illustrated above, community members' abilities to participate in decision-making was hindered both by their trust in the government to keep them safe and a lack of access to information. Discovering the extent of contamination in the area, then and now, shifted participants' perspectives on the state, health, and the increased development in the area. In the next section, I detail the health experiences of participants. From diagnosis to questioning the role Rocky Flats played in their illness, participants illustrate a shifted worldview and knowledge. As illness was the tipping point for participants to begin questioning the living near Rocky Flats, understanding the intersection between knowledge and illness is key.

Contested Illness and Nuclear Contamination

During the facility's operation, residents were exposed to a plethora of radioactive materials, toxins, and chemicals. Exposure to nuclear contamination is associated with bone, liver, breast, thyroid, and lung cancer, leukemia, lymphoma, birth defects, and nonmalignant tumors (Cable, Shriver, and Mix 2008). While all participants had, or currently have, some sort of illness, their diagnoses varied. Commonly reported diseases from participants were thyroid, bone, breast and lung cancer, amongst other autoimmune disease and rare cancers. However, because environmental health problems linked to Rocky Flats remain contested, information exploring such links remains largely out of reach for much of the public, again leading to problems of inaccessible information. All of the participants interviewed in this study believe that the health problems they suffered

were associated with living near Rocky Flats – even though, given dynamics analyzed in the previous section, it was often not until their diagnoses that they begin to question the facility's operations and effects.

A common narrative throughout interviews was the discovery of the facility's history *after* diagnosis and then subsequently engaging in considerable work accessing and gathering related information. Although all respondents knew at some level of the site's existence, they did not know the gravity of the site until they faced health complications. Marissa*, a respondent who has lived most of her life in the Broomfield and Arvada area, echoed this pattern. Marissa suffered from a plethora of medical conditions for years such as a partial hysterectomy/endometriosis; sarcoma with large margin removal; gallbladder removal; fibromyalgia; thyroidectomy; chronic bladder infections; kidney stones; "mini tumors" all over her lungs which, after having a portion of her lung removed for a biopsy, suffered from a paralyzed vocal cord and a severely reduced lung capacity that impacts her quality of life. In her interview, Marissa reflected on the pattern of dismissal by health practitioners:

> Well, it's been, honestly even from the way beginning with the endometriosis. Because when I was first diagnosed with it [endometriosis], that wasn't something that people were diagnosed with. It was hard to get that acknowledged. I was telling them all of this pain I was having, and I even had one tell me it was in my head. When they diagnosed it for me, it was still not very well known. A lot of doctors did not recognize it, they would not talk to you about it and they would not treat you. They thought it was all in my head or I could do something different.

Over time, Marissa began to research the link between environmental contamination and her illnesses. While Marissa attributes her plethora of illnesses to living near Rocky Flats and drinking from a reservoir that had been contaminated with tritium and uranium, her concerns remain under addressed by her doctors. Here, she details the response given:

> I don't care what anybody says, it's not a coincidence to me. As I was going to different doctors, if I ever mentioned Rocky Flats, that was it. They didn't want to talk about it because they didn't know to do about it. They didn't want to hear it. They didn't want to be involved and so they basically say, "Well, why are you here today? How can I help you today with the symptom?". Not to say, let's look at this whole picture and see why you might have this or what else we can do.

Marissa's experience is unfortunately one that is all too common in cases of environmental health problems. The lack of a diagnoses, or misdiagnoses, perpetuate Marissa's feelings of dismissal by the medical practitioners who have treated her in the past few decades.

The delegitimization of the environmental nature of their illness from medical practitioners led all participants to express feelings of frustration. Similar to Marissa's experience, Ellen, who we met above, felt dismissed by health practitioners when trying to identify if Rocky Flats was the root cause of her husband's heart cancer. Ellen's husband, for example, had a rare heart cancer that only occurs .03 times per 100 people. Yet, a young boy in her neighborhood was diagnosed with the same rare cancer as her husband. When she brought this up to her doctor, he replied that it was "really weird" but did not inquire further; dismissing her claim of its importance. Although participants such as Ellen and Marissa knew that they were sick, and felt that something in their environment made them sick, there was little to no acknowledgement of their claims of from physicians. When participants did mention Rocky Flats, they felt that doctors didn't acknowledge their concerns and redirected the conversation.

While the majority of study participants believed that Rocky Flats led to their health problems, others were not convinced. As more than one participant put it, the community was in denial about the hazardous operations of Rocky Flats and in a state of "amnesia". As illustrated in the previous section, community denial and a culture of secrecy surrounding

Rocky Flats occurred during and after its operation. Because information is not readily available, or accessible to individuals, much of the site's toxic history was and continues to unknown to the general public. This lack of accessible information further contributed to their illnesses being delegitimized and contested as being environmentally induced. While the diseases varied, participants' experiences were similar. As their illnesses were contested, participants felt dismissed by medical practitioners and as if their concerns were unheard. Additionally, due to the unknown nature of their disease, participants remarked that they felt "powerless" and "feared for the safety of their family".

Some participants had raised children near the facility, meaning that they had unknowingly exposed their family to the very same contamination that they perceived to be at the root of their illness. They felt that they had been deceived and ill-informed about possible risks and levels of contamination in local lakes and soil – which made them subsequently expose their families to the toxics as well. Beth*, a teacher whose children spent the first few years of their lives living near Standley Lake, was shocked when she discovered the risks she had exposed her family to. In 2010, Beth began to experience extreme exhaustion. After consulting with multiple doctors, she was diagnosed with a rare autoimmune blood disorder. After going through various rounds of prednisone and steroids, her spleen was removed to bring her platelet levels up to normal. A year after moving away, Beth's daughter, a sixth grader, was diagnosed with the same blood disorder. After having undergoing significant genetic testing which came back as negative, Beth attributes both her and her daughter's blood disorder to Rocky Flats. She recalled:

> I literally had no idea the extent of contamination in the area. It really angers me because my kids actually waded into Standley Lake. I mean, that's how much I didn't know. I have pictures of them wading into Standley Lake. We were down on that little beach washout area a lot. We were outside a lot. So, you know, it just makes me wonder.

Further, when participants tried to learn more about the environmental component of their disease, they found a lack of transparent and accessible information. Very little information was, and is, made available about the causal link between environmental contamination and increased cancers rates in the area. The sense of ambiguity surrounding their disease left participants feeling not only betrayed by the government, but hopeless about their personal health. While some participants discussed their beliefs that their diseases were connected to Rocky Flats, others did not mention it to their doctors. When questioned, these interviewees remarked that "there was no point"; they did not think doctors would do anything about it. Internalizing the contested nature of their illness, then, emerged as doubt in the medical establishment.

The Individualization of Responsibility

Across interviews, upon receiving diagnoses, participants sought out root explanations for the cause of their illnesses. Participants often engaged in considerable investigation to discover what is wrong with them; searching through books, the media, the Internet, medical research and so forth. After discussing with friends and researching potential causes, participants began to question the environmental factors that may have contributed to their diseases. As all participants had a rare cancer, or cancers, they expressed that Rocky Flats was the link between their seemingly healthy lifestyle and subsequent illness.

For participants who had no history of cancer and thought of themselves as leading a "healthy" life, and as such, the discovery of disease was shocking. Sarah*, a mother to two sons in their early twenties, was on a weight loss journey prior to her diagnoses with the first of her three cancers during a bowel obstruction. After losing a hundred pounds, Sarah

felt as if she was on track to having a healthy life. Two years later, she was diagnosed with Stage 4 bone cancer.

> That [getting diagnosed with stage four cancer] was pretty shocking. And then getting a month to live with no treatment and a year with treatment. And it was during that time of, you know, doing some research and trying to figure out…well, that came out of the blue and the kidney cancer was out of the blue. Where did these come from? I was talking with some childhood friends, that's how I became aware more of Rocky Flats and the Downwinders. And then I just started doing research to see what kind of causes. Because you know - Did I do something? Was it something that I ate? Was it the environment?

While little is known about the way plutonium interacts within the body, participants such as Sarah questioned if it was something that they had done to induce the disease such as losing weight, thus triggering the release of contaminates stored in body fat.

> Other than being so heavy, I didn't have any other [medical] things going on. Here I am, thinking I am getting healthy but you know, disease is growing in my body. That's been a thought in my mind too. You know, by losing weight, I was losing fat. By doing that, did that trigger everything to be activated? So, you feel like you're damned if you do, damned if you don't.

As Sarah was overweight, and in the process of losing weight, she wonders if her attempt at getting healthy caused the onset of her three cancers. This individual level of responsibility, in which interviewees questioned their lifestyle before examining the environmental correlation was apparent in interviews.

The individualization of responsibility is common in cases of contested illness; as diagnosed individuals are continually told by health practitioners that their diseases were caused by lifestyle factors and personal health habits. However, despite connecting their diagnosis to Rocky Flats, health practitioners and the Colorado Department of Health continue to point to individualized causes of disease such as lifestyle habits. Through contesting the environmental cause of illnesses, and framing illness as the culmination of individual behaviors and genetics, accountability is evaded. Participants felt that the

contested nature of diagnoses was directly related to preventing the government from being held responsible and accountable for the medical costs incurred by individuals due to the environmental contamination they were exposed to. Clearly, governmental interests and then subsequent interests in developing the former site have served as intervening variables in acknowledging and recognizing links between extensive contamination at Rocky Flats and high rates of certain cancers in the area.

Contested Illness and Access to Information

While most of the participants in the study were able to tell their story, others were no longer here to do so. Spouses and children participated in interviews on behalf of their loved one who had passed. As the causes of their loved one's illnesses, and ultimate deaths remained contested, participants felt powerless, dismissed by health practitioners and governmental officials. As their experiences ran counter to scientific knowledge presented by officials, they distrusted the information presented by experts. In both diagnosis and death, finding meaning of the disease emerged in learning more about Rocky Flats and spreading awareness to others.

In experiencing unusual health problems connected to environmental contamination, participants began to observe patterns of disease in the community. From noting high numbers of birth defects, disabilities, and disease amongst neighbors, friends, and family members, participants engaged in popular epidemiology in which they hypothesized that high numbers of disease is related to pollution in the area. Using their own lived experiences, participants began to counter the claims made by health officials that individualized the cause of their illness. For some, these hypotheses translated into getting involved in community activism to spread information about the environmental

and health risks associated with living near Rocky Flats. Tiffany Hansen, the founder of Rocky Flats Downwinders, a community organization that advocates for residents living downwind from Rocky Flats, traced the origin of her organization as emerging from her own health problems and discovery of environmental contamination in the area.

While those who have faced health problems in relation to Rocky Flats continue to gain knowledge and spread awareness, community denial and contested illnesses persist. As such, participants reflected on the importance of shifting community perceptions regarding the risk of exposure. In this section, I detailed the contested nature of illness claims, as well as the political and interpersonal nature of such claims. It is critical to understand the lived, psycho-social experiences of people with environmental illness. It is these lived experiences that make it possible to begin challenging traditional scientific conventions of knowledge. Across my interviews, the link between environmental contamination surrounding Rocky Flats and the health problems experienced by community members remains contested. Due to incomplete, conflicting, and unintelligible disclosures by authorities about radiation and what occurred at and outside of Rocky Flats, new and old residents were exposed to an invisible risk. Similar to other cases of environmental health problems, governmental organizations such as the Department of Energy and Department of Health continue to dominate the conversation of the health and social impacts of Rocky Flats. As such, information and knowledge surrounding Rocky Flats remains contested, disputed, and outside the realm of public discussion.

Section Three: Analysis

What's the Justice in Environmental Justice?

Hazardous waste, particularly nuclear waste, creates important legal, ethical, and political questions of societal impacts and justice. As plutonium has a half-life of over

24,000 years, future generations must be taken into account when evaluating its production and disposal. Nuclear production has important implications in examining how and which benefits and burdens will be distributed amongst present and future generations. As such, justice must be considered in hazardous waste production and removal. While calls for justice have gained increasing attention in political science and social movements (Schlosberg 2003), little attention has been given to identify what exactly "justice" entails in the context of magnificently contaminated sites such as Rocky Flats. In this section, I examine participants' views of justice in this situation. Given the participants' health experiences, as well as the lack of transparent information regarding the risk of living near Rocky Flats, my interview respondents characterized their notions of justice in three distinct ways: acknowledgment and recognition by the government; monetary compensation for health problems; and the belief that justice cannot be achieved.

Acknowledgement and Recognition

As we saw in the previous section, participants who were exposed to hazardous waste material and emissions from Rocky Flats experienced negative health consequences as a result. While their illness ranged from auto-immune diseases, various types of cancer, and rare blood disease, their experience in having their illnesses contested by the Department of Health and medical practitioners was similar. Based on the legacy of secrecy surrounding the site, participants felt that the first step to actualizing justice was to lift the veil of silence surrounding Rocky Flats. In doing so, the government was seen the entity who held the most responsibility and thus, was the most accountable. However, governmental recognition of the impact of exposure to environmental toxins was seen as unlikely to participants.

As a result of the contested nature of their illnesses, participants expressed low levels in trust in the government. Prior to discovering the extent of contamination in the area, and the role it played in their illness, participants remarked that they trusted the government to keep them safe. However, trust in the government receded as knowledge about Rocky Flats increased. Participants continuously stated that it was "not right" that the government did not disclose information to residents during the sites operation and after Rocky Flats was shut down. Due to the government's negligence, participants felt that the government "has to be held responsible in some way". As the government was seen as not considering the safety of residents, as well as not informing them of the risk, all participants spoke of the government in terms of blame and accountability. William, who had spent his entire life living near Rocky Flats and is now suffering from a rare blood disorder, blamed the government directly for not assessing or acting on the risk posed by Rocky Flats. He explained:

> It blows my mind how much lack of regard our government had, how little regard they had for the people living out there. They knew there was a problem. [Rocky Flats] became operational in 1954, and they had the first public leak in 1959. They knew by 1959 that they had a huge problem but they did absolutely nothing to mitigate. They just made it worse. They went blithely on… la la la. So by 1969, ten years later, they knew they had something wrong and they failed to act. What caused the problem in 1969 and what made it worse were the problems that they knew of on the first release. They refused to do anything about it. They made it worse.

William felt that as the government had been aware of the risks and leaks occurring at Rocky Flats, they should have addressed the problem immediately. Instead, the leaks kept occurring and safety procedures were kept as minimal. The government, then, was seen to have failed in its obligation to regulate industry and protect citizens. Instead, the government favored the continuing production of plutonium triggers despite increasing

environmental hazards. In an era where private capital greatly influences local political structures, government remains reluctant to impose restrictions and regulations on industry (Schnaiberg, Pellow, and Weinberg 2000).

Although Rockwell International, who was the entity in charge of Rocky Flats at the time of the investigation, was charged an $18.5 million fine at the time (Iversen 2012), the fine did little to alleviate the existing environmental damage and compensate local community members for the often invisible risks they had been exposed to. In the state's quest to continue plutonium production prior to the FBI investigation, it was seen as failing to adequately represent or protect the needs of the community. Participants felt as if the government had favored the various corporations in charge of Rocky Flats and had not adequately penalized those who were seen as the perpetrators in the lawsuit. Brian, who we met earlier, felt passionately about the lack of responsibility taken by those in charge of Rocky Flats.

> Whoever was working out there everyday and in charge of the plant knew that stuff was going on. I can promise you the person in charge of Rocky Flats was probably… making a half million, million dollars a year. They're being paid to be responsible and they're not. A lot of people paid a really heavy price for that. They broke the law. I mean, they literally broke the law. If they could ever prove that there is some multi-million-dollar CEO that knew what was going on and willingly tried to cover it up… that fucker should be hung. They should find those people. There's no penalty that's too bad for that kind of reckless treatment of human life.

He later continued:

> My best guess is that the people who are truly responsible are high level executives that retired a long time ago and they're probably out playing golf or passed away. The real people that caused this to happen are never going to be able to be held accountable.

Brian's conception of justice was one that others echoed; feeling that holding corporations and the government legally accountable in environmental crime is unlikely to happen

based on precedence. While Rockwell had to pay a multi-million dollar fine (Iversen 2012), the fine was minimal in comparison to the profits reaped during Rocky Flat's operations. Additionally, the 1989 lawsuit did not address the potential health consequences that would occur due to the high rate of environmental contamination in the area. As such, interviewees felt that true justice had not been achieved by the 1989 lawsuit and more legal penalties were required to address existing environmental contamination and health concerns. However, participants questioned how both the government and those in charge of Rocky Flats would be held responsible due to statutes of limitations. That said, for some participants, taking responsibility emerged in looking to the future and ensuring that the area is safe for new and old residents.

Decades after Rocky Flats ceased operations, contamination and a lack of transparency was a major concern for participants. As such, the opening of the Wildlife Refuge and the continuing development in the surrounding area posed concern. When considering justice, all participants remarked that the area should be tested for contamination prior to opening the Wildlife Refuge and information should be readily available about the site's history to visitors and new residents. In terms of testing, participants did not trust the government to accurately assess the threat posed to the community due to its historical legacy of favoring industry in the area and being seen as part of the initial problems regarding environmental contamination. As participants felt deceived by the testing and information provided during the site's operation, as well as during the clean-up, independent agencies were seen to be more trustworthy in evaluating the safety of the site. Distrust towards the government was especially pronounced amongst participants who had lived near the facility during its operation, as participants felt that

poor safety practices were largely to blame for their community's pollution and the subsequent health impacts of such pollution.

Across interviews, participants acknowledged that neither government nor industry had proven trustworthy. Hence, they sought government intervention while recognizing that neither business nor government would accept responsibility without public pressure. For most people, this meant grassroots community activism to demand health studies on residents. Despite more frequent accounts of environmental health problems, there has yet to be a complete health study of residents. A rigorous examination of the health issues associated with living in the area was seen to be a key component of government recognition and acknowledgment of the risks directly related to Rocky Flats. Interviewees felt that the government should provide information to the community about the health risks and allow individuals to make informed decisions regarding their health care. By providing more information to residents, respondents felt that early detection of cancer was more likely. Melina*, a participant who spent her entire life living near Rocky Flats and was diagnosed with late stage cancer, expressed her desire to know more about the other cancers associated with radiation exposure in the interview. For Melina, knowing what other cancers were common meant that she took extra caution and had medical exams more frequently. Unfortunately, if Melina has not done research into existing health studies on Rocky Flats after her diagnosis, she too would be unaware of the health risks.

Demands for government recognition and acknowledgement included allocating funding for independent testing of the area, publically acknowledging the environmental contamination that was caused during Rocky Flat's operation and continues to linger, and legitimizing the health experiences of residents. Recognition is critical to begin addressing

cases of environmental injustice. Implicit in recognition is the deconstruction of the cultural and political institutions, beliefs, and practices that make cases of environmental justice both possible and invisible. Recognition, though, cannot stand alone. With recognition must come a focus on making practices of political participation available to the public. According to Schlosberg (2003), public participation is often seen as the tool to accomplish both equity and political recognition. Inclusive, participatory decision making processes and institutions are at the center of most demands for justice. Through public participation individuals may gain political recognition, thus allowing them to be involved, in some shape or form, in decisions affecting environmental outcomes in their communities.

Medical Care, Coverage, and Compensation

For decades, participants had been uninformed about the risk surrounding the facility. For years, the causes of participants' ailments had been individualized; their concerns about Rocky Flats contested; and all the while, their medical bills increased. The government publically acknowledging the environmental causation of their illnesses were especially important to participants when conceptualizing justice. Acknowledging the environmental contamination that was caused by Rocky Flats also meant acknowledging the role it played in the increased cancer rates in the area and offering monetary compensation for those who had suffered. In a capitalist society, conceptions of justice often emerge as market-based solutions. As such, interviewees felt that offering comprehensive medical care, insurance, and covering medical bills was a key component of actualizing justice.

While Rocky Flats *workers* are able to gain up to $150,000 compensation for health problems, and have comprehensive coverage if diagnosed with 1 of 22 cancers identified by the government (Draper 2014), the same opportunity was not afforded to *citizens*. As such, interviewees felt that if justice were to be realized, they should receive the same medical benefits as workers. If justice is to be achieved, the distributional impacts of environmental contamination need to be considered when allocating benefits to those who have been exposed. A key reason why community members have not received compensation is the conflict between their lived experiences and the medical explanations for their illnesses that neglect to include environmental factors. As a few participants felt strained financially due to their medical care, medical coverage seemed to be "the right thing for the government to do". Melina, who supports herself singing and teaching jazz, felt the impact of her diagnosis on a financial level. As an independent woman, the cost of her treatment meant that she had to continue teaching jazz even during chemotherapy. As such, justice to Melina meant compensation:

> Justice would be people who come down with cancers who lived in that area, that the government could pay for it. Something that simple. Pay for all of the treatment in keeping people alive. That would probably be good compensation.

Aside from the obvious psychological and physical effects of battling cancer, Melina suffered financially due to her decreased ability to teach and the increase in medical bills. Considering the lived experiences of participants in critical when understanding their conceptions of justice. For interviewees who had faced high medical costs, justice emerged in monetary compensation. For others, while compensation was seen as potentially making their life less stressful, it was not seen to be justice.

Money Doesn't Change What Happened: Justice Is Impossible

While some participants felt that the government should pay for their medical care, and compensating their families was justice, others felt that the monetary compensation would never be able to truly compensate them for their ailing health and the losses they suffered. As oppression is systematically reproduced in major economic, political, and cultural institutions (Young 1990), monetary compensation was not seen adequately changing the practices which had led to the unjust exposure of citizens. Connor and Mary, who, in their family all five members have health issues, displayed this in their observations:

> It's a huge problem to fix now. In a lot of ways, it's impossible. Basically, there are things that have been done and there is nothing to do. Even if you could pay them off for their loss, their life, health, or property or whatever it meant be, it wouldn't bring their health back. It wouldn't fix the problem.

Money, then, was not seen as solution. For Connor and Mary, justice was seen as something that was impossible to achieve. Likewise, Brian felt that getting "paid off", so to speak, would do little to fix the crime.

> What's a pair of legs costs? I can add up what I've paid, but what does my lifestyle cost? What does the pain I feel cost? What about having to go up and put on this leg everyday? I've never gone a day without this leg on yet. It will happen someday but it hasn't happened yet. And man, there have been some painful days. What are those days worth? What's not getting married worth? I don't have any kids. I don't know what those things are worth. That's not for me to judge.

Calculating the price of his life, of lost opportunities, of the every day struggle of having a prosthetic was seen to be a capitalistic solution that did little to incorporate his lived experiences into the equation. As such, money was not seen to change the altercation of his life as a result of the cancer that took his leg forty years ago.

Others also felt that justice was impossible to achieve based on the perpetuation of contamination across generations. As the toxic history associated remains largely out of the realm of public discussion, history repeats itself. With the influx of development in the area, as well as the construction of the Wildlife Refuge, interviewees felt that it was too late. Because the site has been contaminated for decades, and clean-up remains contested, interviewees worried that contamination had spread to a point of no return. William, when conceiving of justice, felt that it had gone on for too long for anything to change. Here, he details why he does not believe that justice cannot be achieved:

> It's gone on for so long. It's perpetuated itself. A whole new generation of individuals have been affected. They could have stopped it at that generation, at my generation. They could have stopped it but no, now your generation is affected by it. And future generations. It's gotten worse, not better because it's exponential as it spreads out. Because of their denial, they're going to expose another generation of children to this. So, you understand why now I say that the progression has gone so far that there is no justice. There will be no justice. The only thing that we can hope is that some point in time, someone says stop.

Based on the generational exposure to contamination associated with Rocky Flats, William feels that it is too late for justice. Instead, he hopes that eventually someone will put a stop to development in the area and cease the opening of the Wildlife Refuge. While he finds this to be critical to reducing the rate of exposure, he does not see it to be justice based on the number of people who have already been affected. While things can get better and the area could potentially be remediated to a high level of safety, it will and cannot change the past.

Beyond the health risks surrounding nuclear weapons production and subsequent environmental contamination are intergenerational justice implications. Subsequent generations will have to deal with highly radioactive wastes with technologies that currently don't exist, revealing how nuclear technologies shift health, environmental, and financial burdens into the future. To overcome the environmental justice issues associated

with sites like Rocky Flats, it is critical for the government to take accountability and responsibility for mistakes made and provide full disclosure of potential risks, as well as offer medical care for those who suffer the health impacts. As long as the public remains excluded from decision making, justice will continue to be undermined. Given the history of secrecy and denial at Rocky Flats, justice remains elusive and to some, impossible.

Chapter Six: Conclusion

Revisiting the Research Questions

Although the United States stopped producing new nuclear weapons over twenty years ago in the aftermath of the Cold War, nuclear war is a threat that appears more and more ominous in our recent political climate (Alexis-Martin, Malin, Iversen, Sullivan & Blell 2017). During the build-up to the Cold War, the U.S. government called upon a handful of factories and research centers to help develop nuclear weapons and other forms of atomic energy (Brown 2013; Ackland 1999). At many sites, this work left behind residual radioactive contamination that still requires government clean ups – many of which are still occurring. While nuclear technology may have advanced during since the Cold War, safety standards and technology for nuclear waste removal remain under-addressed and underdeveloped (Ackland 1999; Iversen 2012; Brown 2013).

Rocky Flats is just one story of environmental contamination, public health consequences, and a lack of governmental transparency. While health impacts of nuclear disasters such as Fukushima and Chernobyl have been given attention in the literature (Ohtsuru et al. 2015; Brown 2013; Kamiya et al. 2015), the consequences of other important nuclear sites such as Rocky Flats remain just as invisible as radiation itself. Despite people's perceptions about elevated rates of cancer in the area, the Colorado State University Health Survey is the first survey to conduct a community-based ethnographic health study. Health impacts of living near nuclear contaminated sites are often limited to epidemiological data, neglecting to incorporate qualitative data that details the lived experiences of community members. The focus on oral histories in this study provides a

unique lens to examine community perceptions of Rocky Flats, as well as the impact living in close proximity has had on their health and quality of life.

Decades after Rocky Flats ceased operation, environmental and public health consequences still materialize. The narratives captured in this study just begin to tell the story of Rocky Flats – but I have learned valuable sociological lessons, which I describe and analyze below. In this study, I examined the environmental and public health experiences of citizens living near the Rocky Flats Nuclear Weapons Plant, both during and following production. As we have seen, access to information was severely constrained by structural barriers, conflicting reports of safety, and a culture of secrecy surrounding the site. In the following section, I provided an overview of my findings in direct relation to my research questions; from the contested nature of illnesses experienced by residents, to their shifted knowledge of the facility, to their notions of justice.

What environmental and public health experiences do citizens report in relation to living near the Rocky Flats Nuclear Weapons Plant, both during and following production?

During the facility's operation, a plethora of radioactive materials, toxins, and chemicals were released into the surrounding community (Ackland 1999; Iversen 2012; Quigley, Lowman, and Wing 2012). From storing barrels of radioactive waste underground to two fires, environmental contamination proliferated during Rocky Flat's operation as a result of poor safety standards and increased rates of production (Ackland 1999; Iversen 2012; Quigley, Lowman, and Wing 2012). Most of these leakages went largely unknown to the public. However, while interviewees were unaware of the implications living near Rocky Flats Nuclear Production facility, their knowledge shifted over time as they experienced health problems. Every individual interviewed suffered rare and devastating

health consequences themselves or watched a love suffer. Commonly reported diseases included; but were not limited to, bone cancer, lung cancer, autoimmune diseases, blood diseases, thyroid cancer, and breast cancer. Over time, as interviewees investigated potential causes of disease, they discovered the extent of environmental contamination in the area both during and following production.

While interviewees linked their illnesses to environmental contamination, their concerns remain under addressed and were often dismissed dismissed by doctors and state health agencies. The delegitimization of the environmental nature of their illness from medical practitioners led participants to express feelings of frustration. Furthermore, when participants tried to learn more about the environmental component of their disease, they found a lack of transparent and accessible information. Due to the lack of information regarding both environmental contamination in the area and subsequent health consequences of exposure, communication with others about their experiences often created tension in interpersonal relationships. As a result of incomplete and conflicting disclosures by authorities about what happened at Rocky Flats, community members are unsure of what or who to believe (Bromet 2014). As such, because of the legacy of secrecy surrounding the facility, interviewees felt that approaching the topic with friends and family was difficult.

Despite feeling dismissed by health practitioners, interviewees spoke with certainty of the link between their disease and living in close proximity to Rocky Flats. While interviewees connect their diagnoses to Rocky Flats, health practitioners and Colorado Department of Public Health & Environment officials continue to point to individualized causes of disease, such as lifestyle habits. Through individualizing illness, institutional

accountability is evaded. Contested illnesses exemplify the extent to which government agencies and corporations go to avoid claiming responsibility and accountability as the production of knowledge surrounding disease is viewed through the lens of the biomedical model and takes place within institutional patterns, cultural belief systems, routinely accepted ways of knowing, and vested interests – realms in which already powerful institutions are able to define the parameters of discussion about environmental health (Brown 2007). In experiencing unusual health problems that countered claims of the Colorado Department of Public Health & Environment that pointed to individualized factors, interviewees distrusted information presented by the experts. As such, participants directed concerns to local non-profits, universities, and community organizations working towards an epidemiological health study of residents.

What did residents know about the Rocky Flats Nuclear Weapons Plant during and after its operation?

In this project, I interviewed individuals who lived near the Rocky Flats Nuclear Weapons plant across all phases of production. Interviewees shared varying experiences of living near Rocky Flats Nuclear Production Plant, from seeing the lights from their bedrooms during its operation to others feeling as if they moved into homes in the shadow of an invisible risk.

For those who lived near Rocky Flats during its operation, as well as those who moved to the area after the site had been closed and cleaned up, knowledge was limited due to the culture of secrecy surrounding the site. As such, their ability to make informed decisions about where they bought land, took their children to play, or even where they played themselves as children, was severely constrained.

As illustrated by the narratives of residents living near Rocky Flats, both during and after its operation, nuclear production is often veiled and hidden from citizens under the guise of national security. In fact, for years, community members thought Rocky Flats was producing bathroom products (Iversen 2012). While citizens gradually came to learn that Rocky Flats was producing plutonium triggers, the environmental and social impacts of nuclear exposure remained under addressed in public reports. Residents trusted the government to keep them safe, and as such, did not inquire beyond what was reported in local newspapers. Interestingly, during the facility's operation, some of the residents even perceived Rocky Flats as *keeping* them safe from external threats and nuclear attacks. The production of nuclear weapons was framed as essential to protecting American democracy, and as such, having a nuclear facility in their backyards was seen as ensuring the safety of our country. External threats, particularly during the Cold War, diminished the threat of environmental contamination and radiation exposure. Trust in the federal and state governments, as well as rhetoric that portrayed nuclear production as an essential deterrent, both reassured interviewees and encouraged their ignorance of issues related to Rocky Flats during its operation.

However, with the 1957 and 1969 fires, information about safety issues at Rocky Flats slowly began leaking to the public and countering claims of safety. Yet, with each study conducted by independent scientists (Martell 1969; Johnson 1975; Johnson, Tidball and Severson 1976; Johnson 1977; Johnson 1981; Johnson 1982; Johnson 1987) came a study funded by the state to counter those claims. Time after time, residents were provided with conflicting reports of safety and risk. Interviews with individual community members illuminated patterns of inadequate transparency, poor communication, and inaccessible

information during Rocky Flat's operation and beyond. Across interviews, participants remarked that access to information related to Rocky Flats was severely limited; perpetuating a sense of safety while obscuring ongoing issues with environmental contamination. Even after the FBI raid in 1989, community members were not fully aware of the risks of plutonium production, nor were they aware of how such risks would come to shape their lives. This pattern continues as new residents move in to developments such as Candelas.

For both new and old residents, individual investigation of the site's history, as well as learning about the ongoing debate surrounding site remediation, came *after* they had been diagnosed with a disease. After discovering the extent of contamination in the area, participants felt deceived by the government and felt as if they had been sacrificed under the guise of making the world a safer place. In addition to the lack of adequate, accessible information regarding contamination in the area, little to no information about the causal link between exposure and health consequences exists. To date, this link remains contested by health practitioners and the government. As such, interviewees struggled with having their illnesses legitimated; not only by officials, but by family, neighbors, and friends. Thus, the lack of access to transparent information acted as a significant barrier to what residents could learn about the site, even when they invested much time and energy.

Importantly, the lack of research surrounding health consequences of living in the area perpetuates community denial and facilitates increasing rates of housing development and in-migration to the area. Interviewees felt as if the community-wide culture of secrecy obscured levels of risk they faced and, without accessible or trusted information from the state, led people and state institutions to make questionable decisions to protect property

values. As the area continues to receive an influx of in-migration, and subsequently continues to expand housing development, reluctance to publically acknowledge the area's nuclear history proliferates amongst builders/developers, real estate agents, and community members. In addition to an increase in housing developments located near the site, the site is now slated to open as a National Wildlife Refuge in 2018. The opening of the wildlife refuge reinforces the state's claims of a successful clean-up, while countering other groups' claims of continued contamination in the area. Signs regarding the site's history will not be posted; further diminishing the ability for newcomers to the area and visitors to make informed decisions regarding risk.

Patterns of state secrecy, inaccessible information, and conflicting reports have continued even after nuclear production was ceased at Rocky Flats. At present, information about Rocky Flats remains out of reach for community members. Yet, people's accounts of Rocky Flats illustrate not only a potential for spreading community awareness, but a warning of what a nuclear future could hold. It is when powerful state actors, corporations, and institutions disregard residents' rights to reliable, valid, and accessible information that cases of environmental injustice proliferate. Understanding the processes through which community ignorance and denial are created and maintained by powerful institutional actors can help us shape an inquiry into the importance of access to information and transparency. When residents are provided with accessible and accurate information about risks, they are able to make informed decisions regarding their health. Without that knowledge and information, public health can indeed suffer.

What do residents perceive as environmental justice in this situation?

Through the stories of fifteen community members who were unknowingly exposed to nuclear contamination and suffered health consequences as a result, notions of justice can be identified. Given their health experiences, as well as the lack of transparent information regarding the risk of living near Rocky Flats, interview respondents characterized notions of justice in three distinct ways: 1) acknowledgment and recognition by the government; 2) monetary compensation for health problems; and 3) the belief that justice cannot be achieved.

While conceptions of justice ranged across interviewees, interviewees felt that citizens should be provided with the information necessary to make informed decisions about their health and their properties. Based on the culture of secrecy surrounding the site, all participants spoke of the state in terms of accountability and responsibility. Nuclear weapons that supposedly protect our democracy simultaneously destroy it, as they require secrecy in order to exist. In the state's failure to regulate industry and inform the community of risks, the government was seen as failing in its duty to protect citizens. As such, some interviewees conceived of justice as being realized through governmental recognition. Demands for governmental recognition included requesting public releases of information about environmental contamination in the area and related health risks. In acknowledging the causal link between environmental contamination and disease, health consequences experienced by residents would be legitimated. Recognition is seen to be one of the first steps of addressing environmental injustice through a public admittance of the practices which created the issue at hand (Schlosberg 2003). With recognition, must come opportunities for citizens to meaningfully engage in political participation. In order to

achieve procedural equity, the opportunity for citizens to be a part of the decision-making process regarding existing and potential new nuclear facilities is critical.

In addition to a public acknowledgement and admittance of wrong doing, and thus symbolic recognition, a few interviewees expressed the importance of monetary compensation. As citizens had been unknowingly exposed to environmental contamination and had experienced subsequent health consequences, interviewees asserted that justice could be realized more fully if people had access to comprehensive medical care, insurance, and support in helping cover their medical bills. Almost all of my interviewees identified this as an importance aspect of achieving justice. The conflict between lived experiences and medical explanations for interviewees' diseases shows the ways in which the dominant biomedical model allows medical institutions to continue to neglect the role of environmental factors in disease. As such, participants were unjustly charged with paying for diseases causally associated with radiation exposure, but in contexts where the environmental natures of their diseases remained contested and illegitimated. As decisions revolving health have become increasingly scientized and politicized, debates surrounding the costs, benefits, and risks associated with industrial production are often separated from the communities which host them (Coburn 2003; Brown 2007). Being not only compensated but meaningfully *involved* in the processes to identify what 'just' compensation consists of is important when considering the intersection between procedural justice and environmental health problems.

For others, monetary compensation was seen to be a market-based solution that failed to change the reality of their illnesses and the institutional practices that led to their exposure to Rocky Flats contamination. As multiple interviewees put it, money can not and

will not bring back their health. As injustice is produced through economic, political, and cultural institutions (Young 1990), monetary compensation fails to adequately address the practices that lead to an unjust distribution of risk and exposure to hazards. Importantly, not only was monetary compensation seen as failing to correct past injustices, but also failing to address ongoing issues related to Rocky Flats. As information surrounding the site, particularly the success of the remediation, continues to be contested, uneven, and incomplete, interviewees feared that contamination has spread to a point of no return. This, the influx of housing development in the area and the opening of the National Wildlife Refuge brings with it intergenerational implications for justice.

While notions of justice varied across participants, it is clear that in order to move forward, the toxic legacy of Rocky Flats must be acknowledged. The government must take precautions when opening the Wildlife Refuge and make information more accessible for newcomers to the area, as well as provide healthcare for those whose health has been impacted. Perhaps, it is too late for justice to be achieved. However, it is not too late to end the culture of secrecy and cycles of sickness and environmental contamination. Local community organizations such as the Rocky Flats Right to Know and the Rocky Flats Downwinders have played a key role in their attempts to end the secrecy surrounding the toxic legacy of Rocky Flats; from hosting community meetings, to demanding a health study of residents, and as of May 2017, filing a lawsuit to prevent the opening of the Rocky Flats Wildlife Refuge and requesting rigorous independent testing of contamination in the area.

In an era where cases of environmental injustices continue to mount, we must continue to press for ways to hold government and corporations accountable for protecting public health and the environment. Far too often, those who have suffered at the hands of

poor industry safety standards remain out of the domain of public conversation. It is only when we begin to hear their stories and act upon them that we can address toxic legacies and create a better future for all.

Contributions, Limitations, and Suggestions for Future Research

This study begins to fill a gap in knowledge related to the experiences of residents who lived near Rocky Flats Nuclear Weapons facility during and after its operation. Currently, there are few health studies related to Rocky Flats Nuclear Weapons Plant, and those that do exist are highly contested (Iversen 2012). More broadly, few studies have been conducted that examine the perspectives of individuals whose lives have been changed by nuclear production (Malin 2015; Iversen 2012; Brown 2013). While the impacts of Hiroshima, Nagasaki, Chernobyl, and Fukushima on citizens have been given attention in the literature, other sites of nuclear contamination such as Rocky Flats remain understudied and under addressed (Ohtsuru et al. 2015; Brown 2013; Kamiya et al. 2015; Alexis-Martin 2015). While evidence continues to accumulate about the environmental and public health risks related to Rocky Flats, studies remain plagued by lack of funding for community-based research.

As we now know, the effects of nuclear exposure persist for many years (Kamiya et al. 2015; Brown 2013). Yet, stories like Rocky Flats remind us that little has been done in cases of nuclear contamination to address or legitimate cases of illness. Importantly, there are significant gaps in the literature regarding how communities conceive of environmental health risks, their sources of knowledge about the issue, and their perspectives of justice (Schlosberg 2003; Brown 2007; Harrison 2011). While research has been done on

environmental justice, very little research asks those who have been affected about their notions of justice (Harrison 2011; Malin 2015).

In this research, I illustrate the political, institutional, and interpersonal aspects of accessing information regarding environmental contamination and subsequent health risks. Understanding the lived, psycho-social experiences of people with contested illness is critical to connecting questions of justice and environmental contamination. The lived experiences of individuals living in a contaminated community can help us understand how to meaningfully engage individuals in developing, implementing, and enforcing effective environmental laws, regulations, and policies. As such, examining these narratives of individuals who have faced the consequences of being unwillingly, and often, unknowingly exposed to radiation and nuclear contamination can shape a broader discussion of justice.

Limitations and Suggestions

Limitations for this study derive from sampling and time. As this project was a Masters thesis, and given the parameters of my research, my sample was limited to those who were part of the Rocky Flats Downwinders Facebook page or who had reached out to key individuals working on projects related to Rocky Flats such as Kristen Iversen (author of *Full Body Burden*). Residents who have not suffered rare health consequences, or had a loved one suffer from rare health consequences, were not interviewed due to the limited parameters and funding available for this study. Additionally, my sample was largely composed of women. This could alter the findings as men could perceive the link between illness and nuclear exposure in different, gendered ways. Thus, while the data included here are certainly robust enough for my thesis, the larger project requires additional data points to be collected before definitive conclusions are drawn and published.

At present, though, interviews are being conducted. These interviews can contribute to future research on this topic and aid in gaining a deeper understanding of the environmental and health experiences of citizens who live(d) near the Rocky Flats Nuclear Weapons Plant. In addition to the ongoing collection of oral histories of those suffering from rare cancers and diseases, future researchers could interview those who have not been diagnosed with a health issue to compare perspectives of site safety. As illustrated in my findings, knowledge about the site was often closely linked to experiencing health problems. Additionally, as the rate of development continues to increase around the area, interviews with new residents could provide a deeper look in to how individuals perceive related risks and access information about the site's history.

References

Ackland, Len. *Making a real killing: Rocky Flats and the nuclear west*. UNM Press, 1999.

Allen, Barbara. *Uneasy Alchemy: Citizens and Experts in Louisiana's Chemical Corridor Dispute*. MIT Press, 2003.

Aguilar, John. "Payouts to property owners in long-running Rocky Flats suit should start in 2017." The Denver Post. http://www.denverpost.com/2016/08/08/rocky-flats-payout-property-owners/ (accessed March 7 2017)

American Lung Association. "State of the Air." (2016). http://www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2016-full.pdf

Ambert, Anne-Marie, Patricia A. Adler, Peter Adler, and Daniel F. Detzner. "Understanding and evaluating qualitative research." *Journal of Marriage and the Family* (1995): 879-893.

Auyero, Javier, and Débora Alejandra Swistun. *Flammable: environmental suffering in an Argentine shantytown*. Oxford University Press, 2009.

Babbie, Earl R. *The basics of social research*. Cengage Learning, 2013.

Beck, Ulrich. *Ecological enlightenment: essays on the politics of the risk society*. Humanities Press Intl. (1995).

Berger, Peter. "Identity as a problem in the sociology of knowledge." European Journal of Sociology/Archives Européennes de Sociologie/Europäisches Archiv für Soziologie 7, no. 1 (1966): 105-115.Biernacki, Patrick, and Dan Waldorf. "Snowball sampling: Problems and techniques of chain referral sampling." *Sociological methods & research* 10, no. 2 (1981): 141-163.

Bromet, Evelyn J. "Emotional consequences of nuclear power plant disasters." *Health physics* 106, no. 2 (2014): 206.

Brown, Kate. *Plutopia: Nuclear families, atomic cities, and the great soviet and American plutonium disasters*. Oxford University Press, USA, 2013.

Brown, NJ, JA Barton, KE Bjork. *Rocky Flats community needs assessment final report*, Denver: UCHSC School of Nursing, 1996.

Brown, Phil. "Popular epidemiology and toxic waste contamination: lay and professional ways of knowing." *Journal of health and social behavior* (1992): 267-281.

Brown, Phil, Zavestoski, Stephen, Mayer, Brian, Mccormick, Sabrina and Webster, Pamela. "Policy issues in environmental health disputes." *The ANNALS of the American Academy of Political and Social Science* 584, no. 1 (2002): 175-202.

Brown, Phil, Stephen Zavestoski, Sabrina McCormick, Brian Mayer, Rachel Morello-Frosch, and Rebecca Gasior Altman. "Embodied health movements: new approaches to social movements in health." *Sociology of health & illness* 26, no. 1 (2004): 50-80.

Brulle, Robert J., and David N. Pellow. "Environmental justice: human health and environmental inequalities." *Annu. Rev. Public Health* 27 (2006): 103-124.

Bullard, Robert D. *Confronting environmental racism: Voices from the grassroots*. South End Press., 1993.

Burby, R. J., & Strong, D. E. Coping with chemicals: Blacks, Whites, planners, and industrial pollution. *Journal of the American Planning Association*, *63*(4), 469-480. (1997)

Candelas Glows. https://candelasglows.com/. (Accessed March 7, 2017).

Charmaz, Kathy, and Robert M. Emerson. "Contemporary field research: Perspectives and formulations." (2001): 335-52.

Coburn, Jason. *Street science: community knowledge and environmental Health.* MIT Press, 2003.

Colorado State University. Department of Animal Sciences, J. E. Johnson, and Sharon Svalberg. *Study of Plutonium in Aquatic Systems of the Rocky Flats Environs: Final Technical Report*. Colorado State University, 1974.

Conrad, Peter, and Kristin K. Barker. "The social construction of illness key insights and policy implications." *Journal of health and social behavior*, (2010): S67-S79.

Couch, S. R., & Kroll-Smith, J. S. (Eds.). *Communities at risk: Collective responses to technological hazards* (Vol. 3). Peter Lang Pub Incorporated, 1991.

Creswell, John W., Ann Carroll Klassen, Vicki L. Plano Clark, and Katherine Clegg Smith. "Best practices for mixed methods research in the health sciences." *Bethesda (Maryland): National Institutes of Health* (2011): 2094-2103.

Cutter, Susan L. "Race, class and environmental justice." *Progress in human geography* 19, no. 1 (1995): 111-122.

Dickson-Swift, Virginia, Erica L. James, Sandra Kippen, and Pranee Liamputtong. "Doing sensitive research: what challenges do qualitative researchers face?." *Qualitative research* 7, no. 3 (2007): 327-353.

Dickson-Swift, Virginia, Erica L. James, Sandra Kippen, and Pranee Liamputtong. "Researching sensitive topics: qualitative research as emotion work." *Qualitative Research* 9, no. 1 (2009): 61-79.

Environmental Protection Agency. "Superfund Site: Rocky Flats Plant (USDOE) Golden, CO". https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0800360 (accessed March 7, 2017)

Fiorino, Daniel J. "Environmental risk and democratic process: a critical review." *Colum. J. Envtl. L.* 14 (1989): 501.

Fontham, Elizabeth. Quoted in Reducing Environmental Cancer Risk: What Can We Do Now". Washington, DC:U.S. Department of Health and Human Services. (2010).

Foucault, Michel. "Orders of discourse." Information (International Social Science Council) 10, no. 2 (1971): 7-30.

Foucault, Michel. "The discourse on language." *Truth: Engagements across philosophical traditions* (1972): 315-335.

Foucault, Michel. "Discipline and punishment." (1977).

Fried, M. (2000). Continuities and discontinuities of place. *Journal of environmental psychology*, *20*(3), 193-205.

Gill, Duane A., and J. Steven Picou. "Technological disaster and chronic community stress." *Society & natural resources* 11, no. 8 (1998): 795-815.

Glaser, Barney, and Anselm Strauss. "The discovery of grounded theory. 1967." *Weidenfield & Nicolson, London* (1967): 1-19.

Goffman, Erving. "The presentation of self in everyday life." *Garden City, NY: Anchor* (1959): 1-17.

Goldman, Michael. *Imperial nature: The World Bank and struggles for social justice in the age of globalization*. Yale University Press, 2004

Haraway, Donna. "Situated knowledges: The science question in feminism and the privilege of partial perspective." *Feminist studies* 14, no. 3 (1988): 575-599.

Harding, Sandra. "Two influential theories of ignorance and philosophy's interests in ignoring them." Hypatia 21, no. 3 (2006): 20-36.

Harrison, Jill Lindsey. *Pesticide drift and the pursuit of environmental justice*. Mit Press, 2011.

Hasegawa, Koichi. "Facing nuclear risks: Lessons from the Fukushima nuclear disaster." *International Journal of Japanese Sociology* 21, no. 1 (2012): 84-91.

Hochschild, Arlie Russell. "The sociology of emotion as a way of seeing." *Emotions in social life: Critical themes and contemporary issues* (1998): 3-15.

Hubbard, Gill, Kathryn Backett-Milburn, and Debbie Kemmer. "Working with emotion: issues for the researcher in fieldwork and teamwork." *International Journal of Social Research Methodology* 4, no. 2 (2001): 119-137.

Hurley, Andrew. *Environmental inequalities: Class, race, and industrial pollution in Gary, Indiana, 1945-1980*. Univ of North Carolina Press, (1995).

INPO "Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station". Institute of Nuclear Power Operations INPO, (2011): 97 www.nei.org/resourcesandstats/documentlibrary/safetyandsecurity/reports/special-report-on-the-nuclearaccident-at-the-fukushima-daiichinuclear-power-station

Iversen, Kristen. *Full body burden: Growing up in the nuclear shadow of rocky flats*. Broadway Books, 2012.

Johnson, Carl J.. *Recovery of plutonium from incinerator ash at Rocky Flats*. No. RFP--2520. Atomics International Div., (1976).

Johnson, Carl J. *Recovery of plutonium from incinerator ash at Rocky Flats*. No. RFP--2520. Atomics International Div., (1976).

Johnson, Carl J. "An evaluation of brain cancer, melanoma and respiratory cancer of employees of the Rocky Flats nuclear weapons plant in Jefferson County, Colorado." In *Proceedings of the Annual Meeting of the American Association for the Advancement of Science, in Toronto, Canada*. (1981).

Johnson, Carl J. "Cancer incidence in an area contaminated with radionuclides near a nuclear installation." *Ambio* (1981): 176-182.

Kamiya, Kenji, Kotaro Ozasa, Suminori Akiba, Ohstura Niwa, Kazunori Kodama, Noboru Takamura, Elena K. Zaharieva, Yuko Kimura, and Richard Wakeford. "Long-term effects of radiation exposure on health." *The Lancet* 386, no. 9992 (2015): 469-478.

Kawachi, I., & Berkman, L. Social cohesion, social capital, and health. *Social epidemiology*, (2000): 174-190.

Kuehn, R. "The environmental justice implications of quantitative risk assessment". University of Illinois Law Review. (1996):103–172.

Lerner, Steve. *Sacrifice zones: the front lines of toxic chemical exposure in the United States*. Mit Press, 2010.

Lofland, J., D. Snow, L. Anderson, and L. H. Lofland. "Analyzing Social Settings: A Guide to Qualitative Observation and Analysis (Belmont, CA: Wadsworth/Thomson Learning)." (2006).

Malin, Stephanie A. *The Price of Nuclear Power: Uranium Communities and Environmental Justice*. Rutgers University Press, 2015.

Marion, Young Iris. "Justice and the Politics of Difference." *New Jersey: Princeton* (1990).

Mays, Nicholas, Catherine Pope, and Jennie Popay. "Systematically reviewing qualitative and quantitative evidence to inform management and policy-making in the health field." *Journal of health services research & policy*. (2005): 6-20.

Marx, K. *Capital*, vol. 1. (B. Fowkes, Trans.) New York: Vintage, 1977.

Marx, K. *The German ideology: including theses on Feuerbach and introduction to the critique of political economy* (with F. Engels). New York: Prometheus Books, 1998.

McGoey, Linsey. "The logic of strategic ignorance." The British journal of sociology 63, no. 3 (2012): 533-576.McLellan, David. *Ideology* (pp 1-18). Minnesota: University of Minneapolis Press. (1986).

Mesch, G. S., & Manor, O. (1998). Social ties, environmental perception, and local attachment. *Environment and behavior*, *30*(4), 504-519.

Michaels, David. Doubt is their product: how industry's assault on science threatens your health. Oxford University Press, 2008.

Mohai, Paul, and Bunyan I. Bryant. "Environmental racism: reviewing the evidence." (1992): 163.

Mohai Paul. Environmental justice or analytic justice? Social Science Quarterly. (1996). 77:500–7 17.

Mohai, Paul, David Pellow, and J. Timmons Roberts. "Environmental justice." *Annual Review of Environment and Resources* 34 (2009): 405-430.

Muller, Jerry Z. "Capitalism and inequality: What the right and the left get wrong." *Foreign Affairs* 92, no. 2 (2013): 30-51.

Murphy, Tim, and Murray E. Jennex. "Knowledge management, emergency response, and Hurricane Katrina." International Journal of Intelligent Control and Systems 11, no. 4 (2006): 199-208.

NEI "Fukushima, Chernobyl and the Nuclear Event Scale". Nuclear Energy Institute NEI, (2011)

https://www.nei.org/News-Media/News/News-Archives/fukushima-chernobyl-and-the-nuclear-event-scale

Nesterenko, Alexey V., Vassily B. Nesterenko, and Alexey V. Yablokov. "Chernobyl's radioactive contamination of food and people." *Chernobyl* (2010): 289.

Brown, N.J. "Rocky Flats community needs assessment final report". Denver: UCHSC School of Nursing. (1996)

Nichols, Harvey. *Some aspects of organic and inorganic particulate transport at Rocky Flats*. University of Colorado, Institute of Arctic and Alpine Research, 1976.

Norgaard, Kari Marie. ""We Don't Really Want to Know" Environmental Justice and Socially Organized Denial of Global Warming in Norway." Organization & Environment 19, no. 3 (2006): 347-370.

Ohtsuru, Akira, Koichi Tanigawa, Atsushi Kumagai, Ohtsura Niwa, Noboru Takamura, Sanae Midorikawa, Kenneth Nollet et al. "Nuclear disasters and health: lessons learned, challenges, and proposals." *The Lancet* 386, no. 9992 (2015): 489-497.

Pellow, David Naguib, and Robert J. Brulle. "Power, justice, and the environment: toward critical environmental justice studies." *Power, justice, and the environment: A critical appraisal of the environmental justice movement* (2005): 1-19.

Pellow, David Naguib. *Total liberation*. University of Minnesota Press. (2015).

Pellowski, J. A., Kalichman, S. C., Matthews, K. A., & Adler, N. (2013). A pandemic of the poor: social disadvantage and the US HIV epidemic. *American Psychologist*, *68*(4), 197.

Proctor, Robert. "The Nazi war on tobacco: ideology, evidence, and possible cancer consequences." *Bulletin of the History of Medicine* 71, no. 3 (1996): 435-488.

Quigley, Dianne, Amy Lowman, and Steven Wing, eds. *Tortured Science: Health Studies, Ethics, and Nuclear Weapons in the United States*. (2012).

Ragin, Charles C., Joane Nagel, and Patricia White. *Workshop on scientific foundations of qualitative research*. National Science Foundation, 2004.

Rayner, Steve. "Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses." Economy and Society 41, no. 1 (2012): 107-125.

Reed, Isaac Ariail. *Interpretation and social knowledge: On the use of theory in the human sciences*. Chicago, 2011.

Reuben, Suzanne. "Reducing Environmental Cancer Risk: What Can We Do Now". Washington, DC:U.S. Department of Health and Human Services. (2010).

Satchell, Michael. "A Whiff of Discrimination?" U.S. News and World Report 11 2. (1992): 32-5.

Schlosberg, David. "The justice of environmental justice: reconciling equity, recognition, and participation in a political movement." *Moral and political reasoning in environmental practice* 77 (2003): 106.

Schnaiberg, Allan, and Kenneth A. Gould. "Environment and society. New York: st." (1994).

Schnaiberg, Allan, David N. Pellow, and Adam Weinberg. "The treadmill of production and the environmental state." In *The environmental state under pressure*, (2002). pp. 15-32. Emerald Group Publishing Limited.

Schull, William J. Effects of Radiation: A Half-Century of Studies from Hiroshima and Nagasaki. New York: Wiley-Liss Inc. (1995).

Schutz, Alfred. "The Phenomenology of the Social World*[1932]." Contemporary sociological theory (1967): 32.

Slovic, Paul. "Perception of risk". *Science*. (1987). 236:20–285.

Smithson, Michael J. "Social theories of ignorance." (2008).

Steyn, Melissa. "The ignorance contract: recollections of apartheid childhoods and the construction of epistemologies of ignorance." *Identities* 19, no. 1 (2012): 8-25.

Szasz, Andrew, and Michael Meuser. "Environmental inequalities: Literature review and proposals for new directions in research and theory." *Current sociology* 45, no. 3 (1997): 99-120.

Tilt, Bryan. "Industrial pollution and environmental health in rural China: risk, uncertainty and individualization." *The China Quarterly*, (2013): 283-301.

Tuana, Nancy. "Coming to understand: Orgasm and the epistemology of ignorance." Hypatia 19, no. 1 (2004): 194-232.

Tuana, Nancy. "The speculum of ignorance: The women's health movement and epistemologies of ignorance." Hypatia 21, no. 3 (2006): 1-19.

US Gen. Account. Off. 1983. Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities. Washington, DC: US Gov. Print. Off

Wildavsky, A., and Levenson. 1995. Do rodent studies predict cancer in human beings? Pages 247–273 in A. Wildavsky (ed.), But is it true? a citizen's guide to environmental health and safety issues. Harvard University Press, Cambridge, MA, 574 pp.

Wing, Steve, David Richardson, Donna Armstrong, and Douglas Crawford-Brown "A Reevaluation of Cancer Incidence Near the Three Mile Island Nuclear Plant: The Collision of Evidence and Assumptions." Environmental Health Perspectives (1997). 105(1): 52-57.

Yablokov, Alexey V., Vassily V. Nesterenko, Alexey V. Nesterenko. Chernobyl: Consequences of the Catastrophe for People and the Environment. New York: Annals of the New York Academy of Sciences. (2009).

Young, Iris Marion. "Five faces of oppression." *Geographic thought: A praxis perspective* (2009): 55-71.

Young, Iris Marion. *Justice and the Politics of Difference*. Princeton University Press, 1994.

Zerubavel, Eviatar. "Social mindscapes: An introduction to cognitive sociology." *Cambridge, MA.: Harvard University Press.* (1997).