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Toxic Landscapes, Environmental Justice, and the Community: An Assessment of Citizen Participation in Superfund Site Remediation across Vulnerable Populations

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TOXIC LANDSCAPES, ENVIRONMENTAL JUSTICE, AND THE COMMUNITY: AN ASSESSMENT OF CITIZEN PARTICIPATION IN SUPERFUND SITE REMEDIATATION ACROSS VULNERABLE POPULATIONS

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ABSTRACT

The environmental justice movement has made progress toward unveiling environmental inequalities and addressing these inequalities through the empowerment of low-income and minority communities. Federal agencies like the EPA have incorporated environmental justice principles into their operating frameworks, with the goals of ensuring every community is treated similarly when it comes to the implementation of environmental statutes, and ensuring community members are active participants in environmental activities that affect community well-being. Community involvement at federal Superfund sites is rarely conceptualized as an event related to environmental justice despite the role it has in shaping decisions at hazardous waste sites. This study assesses community involvement across 32 Superfund sites in the EPA's 6^{th} region, in light of these environmental justice commitments. Multinomial logistic regression and case studies addressed the following questions: are minority and low income communities less likely to be involved with Superfund site remediation and what other factors explain variation in community involvement? Two case studies addressed outcomes associated with high community involvement and specific site dynamics that emerged in order to gauge how meaningful involvement was at these sites. The results showed no clear evidence of disparities in involvement among minority and low income communities, although urban areas were found to be significantly associated with higher levels of community involvement. The case studies demonstrated that while involvement in superfund remediation is solicited by EPA officials, communication issues and lack of representation of all community interests lend themselves to controversial cleanups and dissatisfied sectors of the community.

CHAPTER 1: INTRODUCTION

1.1 Problem Statement and Research Objectives

Perhaps to the surprise or dismay of some, it was not that long ago when industries disposed of toxic waste by simply burying it in the ground or discharging it directly into adjacent water bodies. Certainly it is not surprising that these practices (which were eventually made illegal) resulted in the creation of numerous relic toxic waste sites across the country. The virtually invisible landscape of toxic pollution from relic sites and present facilities is a troubling scene, and what is equally disconcerting is the fact that the communities most likely to be affected by this pollution are precisely the communities that are the least well equipped to deal with said pollution (Bullard, 1994). This scene is not entirely new, the consequences of resource extraction, chemical production, and industrial operations have been rationalized by economists and policy makers as externalities of industrial activity; in turn, economists and policy makers say these industrial activities generate net gains for society (Shrader-Frechette, 2002). However, some scholars argue that environmental inequalities, like uneven exposure to toxic materials across socio-economic classes, are products of an unequal society- a society in which not all members benefit from the economic gains of these operations (Bullard, 1994; Downey, 2005).

There have been institutionalized efforts to address aspects of the unequal toxic landscape. Legislative reforms eventually provided legal channels for the remediation of toxic waste sites, and subsequently identifying health disparities became a guiding principle for federal agencies. After empirical work revealed the linkages between race, income, and proximity to hazardous wastes, the Clinton administration took heed of the scholarship and findings of environmental justice researchers, like Dr. Robert Bullard, and in 1995 President Clinton signed Executive Order 12898 (Cole & Foster, 2001; O'Neil, 2007).

The Environmental Protection Agency (EPA) has crafted extensive policies and guidelines in order to stress its commitment to these environmental disparities. The EPA's definition of Environmental Justice is as follows:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal environmental programs and policies. Meaningful involvement means that: (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision makers seek out and facilitate the involvement of those potentially affected (EPA, 2004, p.9).

Despite these positive steps, some scholars maintain that regulatory agencies could do more to protect communities against pollution, hold responsible parties accountable for harmful practices, and seek better means for rectifying environmental harms (Brulle & Pellow, 2006; O'Neil, 2007). The forces that create and maintain an uneven toxic landscape, coupled with weak mechanisms for redress, have thus created a situation that deserves increased attention from researchers and agency officials alike.

This research deals with community involvement in the federal program tasked with remediating hazardous waste sites, i.e. Superfund sites. A Superfund site is the colloquial term for a site contaminated with toxic wastes that the federal government has authority over. This authority was established in 1980 when Congress passed the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA). Community involvement became a legally binding requirement in the cleanup decisions upon enactment of a round of amendments in 1986, known as the Superfund Amendments and Reauthorization Act (Ferrey, 2004).

Community involvement is particularly salient when addressing Superfund sites because it captures the extent to which agencies incorporate the will of the community into remediation plans that directly affect the livelihood and well-being of community members. Community involvement in the Superfund program signals the strength of mechanisms intended to rectify the harms of past environmental actions, and disparities in this program would represent potential for inequality formation- inequalities that may later resurface as assailants to human health and quality of life.

According to the EPA, (EPA, 2014) community involvement is considered a fundamental part of building the capacity of vulnerable communities to deal with environmental threats. Because the EPA has focused attention on identifying possible environmental justice indicators, such as percent minority population and percent of the population in poverty, this research will focus on low income and minority communities in addition to other demographic attributes of communities and site specific factors.

The objective of this study is to assess community involvement at Superfund sites spanning five different states in light of the EPA's Environmental Justice commitments. These commitments include the fair treatment of all types of communities and the meaningful involvement of these communities in site proceedings. These commitments are also related to how environmental justice scholars conceptualize justice. The focus on community involvement thus provides an important framework for realizing the EPA's environmental justice goals and fits within the theoretical framework articulated by environmental justice scholars. This study utilizes a two-pronged approach to assess community involvement in light of the EPA's definition of environmental justice. This is done by ranking and modeling community involvement, then by assessing community involvement more specifically through the

examination of site documents. The first part addresses the following questions: Are minority and low income communities equally as likely to participate in the superfund clean-up process? What socio-economic or site specific factors are associated with high community involvement?

In order to answer these questions, the influence of demographic and site specific characteristics, such as toxicity and complexity of a site, will be assessed in a regression model that utilizes level of community involvement as the dependent variable. The second part of the analysis addresses the question: What does community involvement look like, and how meaningful is involvement across communities?

Information on what community involvement looked like in practice will be taken from site documents of two Superfund sites; particular attention will placed on the form of community involvement that emerged at these sites, the concerns of the community, and how these concerns were addressed. These two sites were chosen because they exhibited a high degree of community involvement and displayed a contrasting demographic attributes.

This study fills a void in the literature by assessing participation in minority and low income communities since the enactment of environmental justice mandates, in order to reveal potential disparities and subsequent opportunities for agencies to strengthen commitments to environmental justice at Superfund sites. There is little research on community involvement and who participates or is likely to take advantage of this critical capacity building pathway.

The subsequent sections of this chapter more thoroughly describe the Superfund program and its antecedents, as well as the EPA's environmental justice policies. Chapter 2 presents literature on community involvement in environmental issues, as well as participation and cleanup at Superfund sites. Chapter 3 describes the methods and data used for this study, and chapter 4 presents the results of the analysis. Chapter 5 discusses several reoccurring themes of

community involvement using examples from two Superfund communities. Finally, chapter 6 includes a discussion of the findings and reflects on the direction for further research.

1.2 The Historical and Legal Background of CERCLA

One of the infamous triggering events that precipitated a heightened sense of environmental concern among policy makers and subsequently led to the formation of CERCLA was the incident at Love Canal. This incident refers to a series of events that occurred after a community discovered that their homes were located atop drums of toxic waste buried by Hooker Chemical Co. years before their neighborhood was established (Laws, 2000). When local departments offered no aid in addressing the problem, concerned citizens mobilized efforts to clean up the site and petition for compensation; eventually, the state's health commissioner declared the site an emergency and President Jimmy Carter approved disaster aid for its inhabitants (Cable, 2012). In a 1979 issue of the EPA journal, an official expressed fear that the country was full of these types of contaminated sites- a fear that turned out to be completely warranted (Beck, 1979).

As a response to situations such as this, Congress passed CERCLA, and over the years hundreds of sites like Canal were discovered, in fact today, according to the EPA's website, there are over 2000 Superfund sites that have not been completely addressed (http://www.epa.gov/superfund/sites/npl/). The CERCLA legislation established a system for identifying, prioritizing, seeking responsible parties, and remediating hazardous waste sites. The law is unique in its retrospective outlook that exerts authority over past environmental releases, and allows the government to seek reparations from numerous responsible parties (Ferrey, 2004; Wernstedt & Hersh, 1998). At its inception, the fund that the government tapped to clean sites was paid for by a tax on chemical companies; this however is no longer the case, as the program

lost this source of revenue and was subsequently funded by settlement payouts and general congressional appropriations- a fact that some believe greatly reduce the strength of the program (O'Niel, 2007; Virjee, 2010) In 2009, CERCLA funding was given a boost by the American Recovery Act, the positive results from this boost in funding has spurred some policy makers to call for the reinstatement of the chemical tax (Virjee, 2010). As with many environmental statues, the key regulatory authority charged with administering CERCLA is the EPA (Vig & Kraft, 2013). Sites that are suspected to be contaminated with toxic or hazardous materials can be reported to the EPA by citizens, businesses, or other parties. Sites then go through a series of assessments in order to warrant a listing on the National Priorities List. These assessments include measures of toxicity and potential exposures to populations around the site, an initial score known as the Hazard Ranking Score incorporates these conditions (EPA, 1991). Once a site is listed, there are further investigations and studies in order to determine the risks of the site and ultimately select and implement a remediation strategy. Determination of the cleanup strategy is driven in part by a public health risk assessment that consists of 4 inputs, hazard identification, exposure assessments, toxicity assessments, and risk characterization and uncertainty analysis (EPA, 1991).

The remedial action is also mandated to be protective to human health and the environment, comply with all statutory requirements, and be cost effective (EPA, 1988). The language of CERCLA states that preferred remediation strategies completely remove or treat hazardous wastes (Wernstedt & Hersh, 1998). The EPA administers the program, but sites are managed by a specific officer who retains a large amount of discretion as far as the treatment process is concerned, this decentralization is premised on the notion that each site is unique in its biophysical, legal, and social circumstances (Daley & Layton, 2004).

1.3 Superfund Site Remediation and Health Risks

Superfund sites represent complex environmental problems as these sites may have several forms of media contaminated by toxic substances. Some policy experts and scientists believe that the treatment of hazardous waste represents an environmental problem that the US government has not made sufficient progress toward solving (Kraft & Vig, 2013). Although CERCLA has undergone important statutory reform that has sped up the remediation process to some degree, agency officials believe that technical demands are still very high relative to other constraints (such as funding) on the program (Daley & Layton, 2004).

Johnson and DesRosa (1997) note that there is evidence to support the claim that hazardous waste from Superfund sites are a major public health concern, as many sites have complete exposure routes for toxic substances. According to researchers, (Dearwent, Mumtaz, Godfrey & Falk, 2006; Johnson & DesRosa, 1997) substances found at many of the sites include trichloroethylene, lead, tetrachloroethylene, arsenic, benzene, cadmium, chromium, 1,1,1-trichloroethane, PCBs, 1,1-dichloroethene, chloroform, vinyl chloride, zinc, mercury, among others. Many of these substances are known carcinogens and are linked to negative health outcomes. Health implications include increased risk for neurological, developmental, and immune suppression problems, and increased risk of cancer from air pollutants, pollutants in drinking water, and pollutants making their way through the food chain (Johnson & DesRosa, 1997; Williamson et al., 2006; Vyas, Goachfeld, Georgopolous, Lioy & Sussman, 2006).

Although a recent study concluded that a small percentage of sites pose immediate health threats from particular pollutants, researchers believe that the long term latency effects of many contaminants coupled with emerging contaminants of concern produce a troubling public health situation (Dearwent et al., 2006; Wendell et al., 2011). Inadequate national funding and

reluctance to focus on environmental exposures to chemicals underscores the challenges of this situation (McCormick, 2009).

Cleanup options for sites vary depending on the type of media contaminated and other constraints. For example, cleanup may involve removing contaminated soil from an area, or capping contaminated soil with some sort of cover. Treatment also includes incineration at high and low temperatures, thermal treatment, and the use of biological agents that degrade substances into innocuous constituents. There are different remediation techniques and some techniques present their own unique exposure risks, for example, on site thermal incineration can be associated with the release of harmful by-products to the air (Cruz et al., 2012; Vyas et al., 2006). Incomplete byproducts of incineration as well as ultrafine particles have been linked to respiratory and cardiovascular dysfunction (Cormier, Lownicki, Wayne & Dellinger, 2006). The plan selected for cleaning up toxic wastes in a community can also affect how people use their own land and the general direction of redevelopment in these areas as well (Wernstedt & Hersh, 1998; Vyas et al., 2006).

While the health and ecological risks posed to communities by uncontrolled hazardous waste are concerning in and of themselves, economic factors also pose problems for residents. The calculations made during sites studies relate to the potential future uses of the site and different cleanup standards are set accordingly. Different standards exist for industrial, commercial, recreational, or residential future uses. As part of the cleanup process sites often have institutional controls (ICs) placed on them such as deed restrictions or property easements in order to further reduce the likely that people will come into contact with any toxic substances left un-remediated. These controls ensure that potential purchasers of the property are aware of any hazards associated with the land, such as contaminated groundwater, and subsequently

comply with any restrictions on the use of that land. Research has shown that housing values have deprecated after areas have been listed as Superfund sites, although this depreciation may not be permanent, and may be the result of other market factors and the location of sites, i.e. in rural vs urban areas (Greenburg & Hughes, 1992; Kohlhase, 1991). Impact on housing values may also be more pronounced in minority neighborhoods (Michaels & Smith, 1990). For these reasons, the remediation process should be seen as very important event that has the potential to affect a community.

1.4 Environmental Justice and Policy

The environmental justice perspective is premised on the recognition of environmental inequality, or the recognition that the natural environment can be understood as a medium of social stratification (Freudenburg & Wilkinson, 2008). In this vein, the inequality space includes environmental dimensions such as the location of toxic waste, physical exposure and risk, and other general environmental dis-amenities that can be unevenly divided among society. Scholars site the functioning of the market economy, neoliberal policy reforms, institutionalized discrimination in housing markets, and an inability to mobilize resources as components that contribute to the creation of environmental inequalities (Brulle & Pellow, 2006; Mascarenhas, 2009). Pellow (2000) describes environmental inequality as a broad concept that focuses on relations of resources and power within differing political and historical contexts; the term environmental justice, utilizes notions of justice and fairness in order to address inequalities and combat manifestations of environmental inequalities, such as deleterious health effects. These notions of justice in relation to environmental inequalities emerged out of a collection of grassroots campaigns that have been deemed the environmental justice movement (Bullard, 1994; Macarenhas, 2009). The movement was seen by some researchers (Schweitzer &

Stephenson, 2007) as a response to the mainstream environmental movement of the 1970s by which proponents of environmental justice sought to bring to light that minority and low income communities are the bearers of the brunt of environmental harms (Brulle & Pellow, 2006). Scholars note that the mainstream environmental movement deterred listing decisions by polluters in white suburban neighborhoods, but did little to focus attention to marginalized neighborhoods in highly segregated areas, where people have little political capital and are not included in decision making processes (Schweitzer & Stephenson, 2007; Mascarenhas, 2009).

Cole and Foster (2001) describe the Civil Rights movement as a major contributor to the environmental justice movement; they note that the Civil Rights movement helped to focus attention to the structural nature of inequalities, which environmental justice scholars use to understand the distribution of environmental harms. The Civil Rights movement also stressed direct action as a means to empower people and communities, a notion that is essential to the environmental justice movement. Cole and Foster also expand on how the environmental justice movement sought to break the "cycle of quiescence" (p.156) that perpetuates environmental harms; the cycle refers to the positive feedback system wherein injustices lend themselves to perceptions of powerlessness among community members, and these feelings disincentive action to address possible future injustices. This cycle creates communities that are easily side-stepped by entities that seek to minimize efforts and cost when making decisions, which follows a standard economic model of rational decision making. The environmental justice movement sought to disrupt these events by encouraging community action and empowerment to fight industry sightings and fight for compensation for adverse impacts. Environmental justice scholars also stress the decision making ability of communities as an essential right (Faber & McCarthy, 2003; Harrison, 2014); Shrader-Frechette (2002) defines this type of justice as

participative justice, or the right of residents to “self-determination in societal decision-making” (p.24) which encompasses notions of parity in political and democratic processes.

The notion of environmental justice became codified in the regulatory framework of all federal agencies when President Clinton issued Executive Order 12898. This order mandated the incorporation of environmental justice issues into the proceedings of all federal agencies, with the objective of focusing federal attention on disparate health impacts in low income and minority populations (O’Neil, 2007). At its inception, this event was credited as having a deeply transformative role in the proceedings of many federal agencies; however, past actors within the EPA have been criticized for a reluctant acceptance of this mandate (Cole & Foster, 2001). The EPA established the Office of Environmental Justice and an advisory council in order to better incorporate concerns for injustices within the separate EPA offices, an action sited as having varying degrees of success (O’Neil, 2007).

There are differential understandings among agency sectors of what constitutes an environmental injustice and types of environmental injustice are also addressed by scholars (Downey, 2005). The EPA’s 2004, *Toolkit for Assessing Potential Allegations of Environmental Injustices*, details how environmental injustice assessments must review evidence of disproportionally high deleterious health effects in potential cases (2004). In 2012, the EPA released a screening tool to aid in the identification of potential environmental injustices (EPA, 2012) that utilizes environmental and socioeconomic data. In this sense, environmental injustice is implicitly defined as a health or environmental outcome. Gathering corroborative evidence that indicates disparate health effects in populations exposed to toxins is a trouble laden practice; confounding factors in public health research, lack of coordination between environmental inequality and public health research, long latency period of toxicants, and insufficient data all

work to yield much uncertainty on the issue of health disparities (Brulle & Pellow, 2006; Johnson & DesRosa, 2007).

The Office of Solid Waste and Emergency Response, which houses the Superfund program, now utilizes the definition of environmental justice stated previously, that places emphasis on the fair treatment and meaningful involvement of all communities. Fair treatment is characterized by the notion that no groups of people should bear a disproportional amount of environmental harm, while meaningful involvement includes the requirements that agencies foster involvement of community members, and include them in the decision making process by letting them influence regulatory decisions.

The intent for community involvement to be a component weaved into every step of environmental programs is related to the idea of environmental justice. It captures the extent to which residents are considered equal partners in the decision making process. This meaning of justice in environmental programs has not been adequately addressed, both in the sense of how well it is incorporated in these programs and if it is then implemented fairy across all communities. Increased focus on this concept is a means for agencies to more fully incorporate environmental justice principles into their operations and more effectively work toward those principles. This study addresses this concept by evaluating variation in community involvement across Superfund communities in five states, under the assumption that community involvement is a way to incorporate the community as stakeholders and not passive bodies in the program.

CHAPTER 2: LITERATURE REVIEW

2.1 Low Income and Minority Communities

Community involvement is considered by some to be a function of interest or concern for environmental matters. This understanding of community involvement postulates that low income and minority populations are less concerned or interested in environmental issues as shown by the low numbers of these groups in certain types of environmental organizations (Taylor, 1989). This perspective, however, does not account for the fact that minorities and low-income communities have different environmental burdens, so participation in organizations that deal with preservation will likely not elicit a strong response by these groups (Mohai & Bryant, 2001). In fact, there is ample evidence to contend that the relationship between vulnerable populations and the environment is complex and arises out of the confluence of historical, social, and economic forces. The remainder of this section summarizes literature on environmental perceptions and action in order to gauge some expected relationships between community involvement and low income and minority groups.

Environmental awareness and perceptions of risk among different socioeconomic groups are important considerations when evaluating involvement and concern for environmental problems among these groups. Research on immigrant farm workers exposed to pesticides has shown that these groups are not homogenous in the way they perceive risk and the utility of addressing risk by taking any preventive measures (Austin et al., 2001; Elmore & Arcury, 2001; Vaughn, 1995). Lower socioeconomic class may not necessarily confer a lowered environmental hazard awareness and action, for example, in a 2013 study of residents in East Baton Rouge Parish, home to the world's second largest oil refinery and hazardous waste sites, there was found to be no association between income and adaption of environmental risk

reducing behaviors (Reams, Lam, Cale & Hinton, 2013). There is evidence to support the notion that minority communities tend to be very concerned about the health effects of environmental pollution (Mix & Shriver, 2007; Mohai & Bryant, 2001), for example, in a case study of the Oak Ridge Reservation Superfund site, it was noted that African Americans were much more likely to express concerns over environmental pollution and damaging health consequences (Mix & Shriver, 2007). Native American communities also exhibit a unique sense of environmental awareness as these communities may equate threats to their environment as threats to their community, way of life, and spiritual beliefs (Arquette et al., 2002; Shriver & Webb, 2009).

Residents living near Superfund sites may feel heightened senses of environmental concern, given that research suggests experience, proximity to waste sites, past health problems, and general dissatisfaction with an individual's built environment influence perceptions of risk (Bickerstaff & Walker, 2001; Wakefield et al., 2001). Some studies emphasize the power of effective risk communication, suggesting that it has the potential to positively affect vulnerable populations by increasing the confidence of group members to engage in risk reducing behavior (Reams et al., 2013; Flocks et al., 2007). While this particular sentiment is encouraging, engagement from agency members at Superfund sites should go beyond raising awareness to engaging with members about the direction of cleanup at the site, thus involving the need for collective action. Furthermore, engagement is not always a priority of agency officials, in fact officials may even work to suppress environmental concern, as will be discussed in subsequent sections of this chapter.

Although perceptions of risk may vary greatly depending on a number of socioeconomic, personal, and contextual factors, perception does not always translate into action or mobilization of groups. Disbelief in the efficacy of action along with other restraints may deter participation in

certain activities (Clarke & Agyeman, 2011; Ohmer, 2010). These barriers to participation include officials withholding or muddling information, as well as shaming concerned citizens (Harrison, 2014; Shriver, Adams & Messer, 2014; Mascarenhas, 2009; Downey & Strife, 2010). Shriver et al., note, that the use of overly technical language and jargon coupled with the resident's dependency on experts may help to shield these officials from public opposition. These researchers explored the suppression of environmental concern in Blackwell, OK, home to a zinc smelting plant that warranted listing as a Superfund site. The site was turned over by the EPA to the Oklahoma Department of Environmental Quality for full cleanup responsibility. A transnational corporation overtook ownership of the site in later years when environmental contamination was still problematic; researchers noted the corporation's use of marketing techniques to promote their image as a "good neighbor"(p.282) although at the same time the business, in conjugation with the state's department of environmental quality, openly vilified a coalition of concerned citizens.

In some instances, what might be thought of a barrier to involvement, like mistrust in agency officials, may actually mobilize community members, not surpass them (Capek, 1993; Checker, 2005), this is considered more thoroughly in the following section that deals with concerted action, involvement, and equity at Superfund sites.

2.2 Involvement and Equity in the Superfund Program

According to the EPA, "the mission of the Superfund Community Involvement Program is to advocate and strengthen early and meaningful community participation during Superfund cleanups" and it is founded upon the belief that community members have the right to be a part of decision making processes that affect their community (EPA, 2005, p.1). Community involvement comes in the form of public meetings, hearings, technical assistance, community

factsheets, information sharing, community advisory groups (CAGs), and other activities such community interviews (EPA, 2005). Community involvement can take place at any stage of the cleanup process, but it is recommended to begin as early as possible (EPA, 2005). Figure 1 shows the major steps involved in the cleanup process, and the EPA encourages community members to be active during all stages, for example, during the remedial investigation and feasibility study (RI/FS) the community should decide if it will apply for a technical assistance grant (TAG).

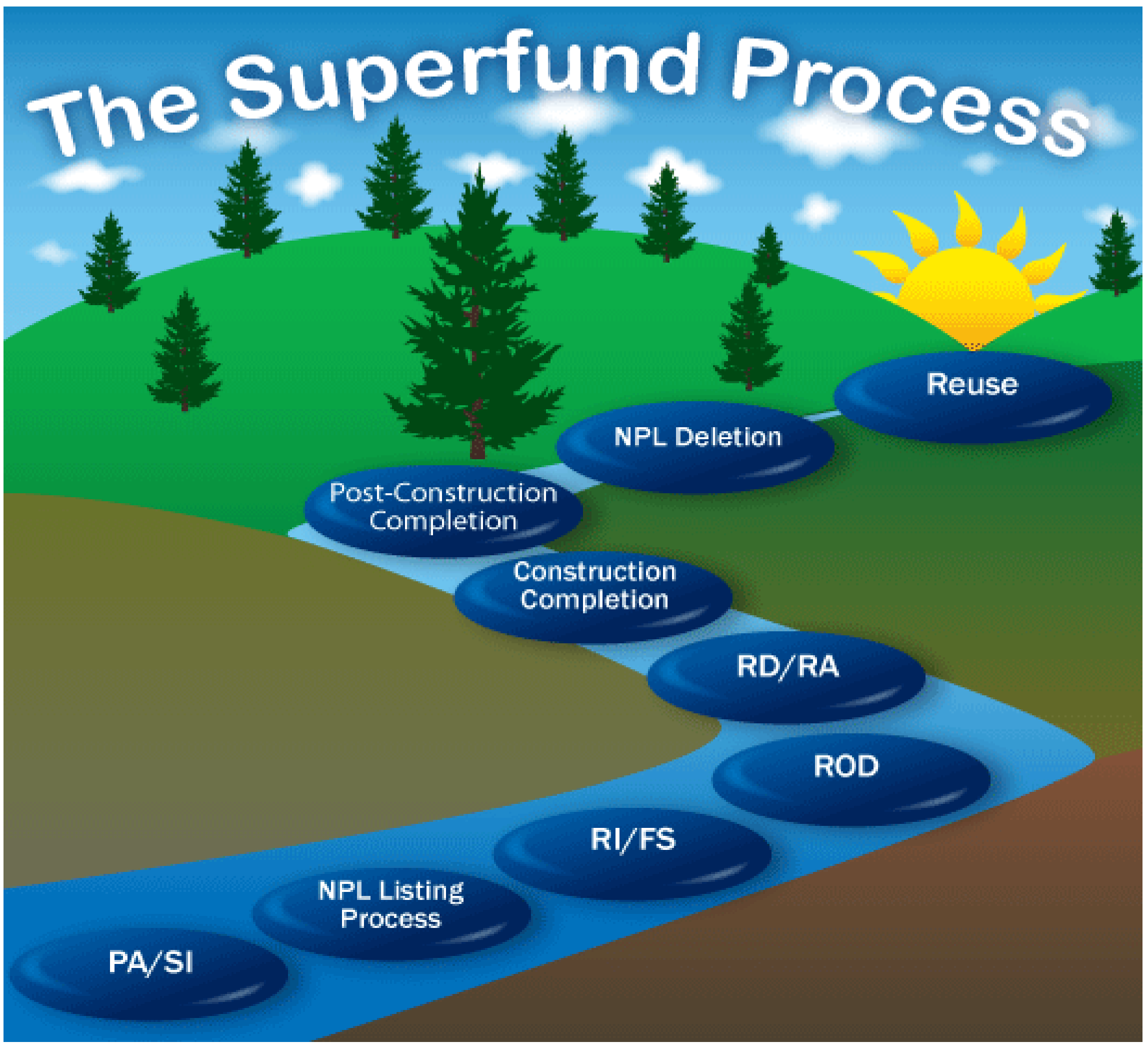

Figure 1: The Superfund cleanup process
Source: http://www.epa.gov/superfund/community/process.htm#reuse

It is the specific duty of enlisted officials to engage with the community at large and develop a plan for how information is spread to the community. A site depository is usually established and in some cases a mailing list is developed in order to mail interested citizens updates and notices of public meetings. Notices about public meetings must be made known to the public, usually through a newspaper advertisement, and the public must be allowed a 30 day comment period in order to review and comment upon site decisions. Community involvement is a means for the community to be involved in the cleanup process by commenting on remediation options and expressing concerns to the EPA. The only time it is acceptable to forgo these types of activities are when removal activities are time-critical (EPA, 2005).

Community Advisory Groups (CAGs) are a particularly useful tool for community involvement as they purposefully connect community representatives with agency officials. According to the EPA, these groups enhance public participation by creating a forum for the exchange of concerns and ideas between community representatives and Superfund site officials (EPA, 2002). According to the EPA, CAGs are encouraged in minority and low income communities (EPA, 2002). Despite this recommendation, there remains little evidence to identify the types of communities in which CAGs are established. Technical assistance grants are also valuable tools for communities wishing to be involved in the cleanup process. These grants provide money for established groups to hire an independent consultant about the site activities. EPA handbooks and material generally encourage TAGs and CAGs, however, there are stipulations on the types of groups that can apply for TAGs and CAGs and there are upfront costs involved in the application process (EPA, 2005).

Involvement in the Superfund process can be wrought with conflict and disagreement among community members, making cohesive community action problematic (Campbell, 2003).

Conflict regarding decision making is influenced by an individual's personal frame of reference for understanding environmental issues, for example, employment in certain industries may quell suspicions of environmental pollution among those members of a community (Capek, 1993; Mix & Shriver, 2007). Although disagreement among members of a community may be a fairly common component of environmental and natural resource problems generally, these dynamics may actually be unifying in certain environmental justice cases. For example, in Capek's study (1993) of an African American Superfund community in Texarkana, the use of the environmental justice frame was a unifying concept for a community that showed un-relinquishing effort to petition the EPA for buyouts. In the book, *Polluted Promises: Environmental Racism and the Search for Justice in a Southern Town* (Checker, 2005), details the relations a Superfund community in Augusta, Georgia had with the EPA. Initially it was noted that the community was optimistic about the EPA coming in to do scientific testing in the area where a wood preserving plant was located. However, when the EPA concluded that the elevated levels of contaminants in the area did not constitute an urgent problem, the community was understandably confused. Community members were further angered when they learned that the scientific testing was contracted out to an entity holding a strong business relationship with the wood preserving plant. After this incident, residents of the community lost trust in the EPA and suspected a component of racial discrimination was at play.

While qualitative research has grappled with community involvement, there is little quantitative data present on indicators and effects of community involvement at Superfund sites. Empirical studies that have considered community involvement do so in order to gauge its effect on cleanup time, and the results appear with varying conclusions (Burda & Harding, 2013; Daley & Layton, 2004; Petrie, 2006). In a 2004 study Daley and Layton tested different hypotheses

about the factors that influence EPA decisions to initiate cleanup at Superfund sites on the National Priorities List. They found sites with lower HRS and lower costs were more likely to be remediated, suggesting that the EPA seeks to tackle sites that are less complex and have lower administrative costs. Although sites perceived as more toxic and dangerous might spur activity by community members, HRS was shown to be negatively associated with cleanup time, a conclusion that might raise some concern given the HRS is a measurement of a site's potential threat to human health (Daley & Layton, 2004). Petrie (2006) considered the relationship between minority participation in superfund cleanups in the EPA's fifth region. She rated community involvement on a scale of low to high by the presence of a CAG or TAG and the number of public comments. She found that minorities were less likely to participate in remediation, while higher poverty rates were associated with higher community involvement. Petrie (2006) also found community involvement to be associated with longer cleanup times, an occurrence that may be the result of more lengthy deliberations and more public meetings. This finding may be an important consideration to consider, as community involvement may embody a trade-off between involvement and actual time to completion. Low income and minority communities already face many threats to quality of life that result in health inequalities, so prompt cleanup of contaminated areas is an understandable concern (Bernard, 2007; Cohen et al., 2003; Ohmer, 2010).

Burda and Harding analyzed cleanup time at Superfund in two time periods, one time period prior to the enactment of Executive Order 128989 and the second time period after its enactment. The researchers found prior to Executive Order 129898 appreciable bias against minority communities existed, however there was no appreciable bias in the second time period and community involvement was listed as a possible factor in explaining variation in cleanup

time (2013). Capabilities of vulnerable communities also pose questions for researchers, as mobilizing community members to respond to environmental problems may vary with resources of the community at hand, leaving low income and minority communities with a diminished capacity for action (Kaufman, 1995; Cutter, Boruff & Shirley, 2003). There have been few studies that focus attention on differences in community involvement or clean up duration and quality between rural and urban sites. Rural communities may also face unique vulnerabilities such as lacking expanded social networks that serve as conduits for information and resources (Ellis, 2000; Nelson et al., 2009).

To conclude, the exclusion of minorities and low income groups from decision making processes is a contributor to the perpetuation of environmental injustices, and scholars have noted that increasing participatory parity is essential for redress (Faber & McCarthy, 2003; Mascarenhas, 2009; Shrader-Frechette, 2002), and this sentiment is echoed in the EPA's definitions of environmental justice and meaningful involvement. Community involvement at Superfund sites can thus be seen as one input that could factor into the disruption of environmental inequality formation by realigning people with their rights for self-determination, empowering individuals to be positively impact their community, and preventing future health inequalities. In case studies of Superfund sites, both suppression and mobilization of environmental action occurred in different types of communities. Empirical research has shown that the potential hazard of site may also be related to community involvement. In order to add to these findings, this study will utilize demographic characteristics, like percent minority population and rural population, along with indicators of site complexity and hazard to measure differences in community involvement in the post Executive Order 12898 time period.

CHAPTER 3: MATERIALS AND METHODS

3.1 Study Area and Data

The study area is comprised of Superfund sites in region 6, including the states of Louisiana, Texas, New Mexico, Arkansas, and Oklahoma. The study area will include Superfund sites in region 6 with Record of Decisions signed after 1995, (n=32). This is to ensure the study does not over represent bias for the years before environmental justice principles were implemented through the Executive Order and focus on recent EPA activities. Federal Superfund sites were excluded, these are sites in which the federal government is the responsible party and the US Army Corps of Engineers are responsible for cleanup activities. The dynamics of these sites are thought to be fundamentally different and thus unsuitable for comparison with other superfund sites (Daley & Layton, 2004).

Each Superfund site and the demographics of the community surrounding the site will represent a case. Site documents along with data from the National Priorities List Database (http://dx.doi.org/10.7927/H44X55RB) contain coordinates that are translated into points on a US Census Tigerfile, which can be downloaded through the US Census's webpage (https://www.census.gov/geo/maps-data/data/tiger-line.html). For sites that have already been deleted and are thus not listed in the database, the x and y coordinates in minutes and seconds from site documents were converted to decimal degrees using an online point translator (http://www.fcc.gov/encyclopedia/degrees-minutes-seconds-tofrom-decimal-degrees). The study maintains a focus on a region in the South and Southwest; these states have relatively large pollution burdens from lax regulations and have also been identified as having a legacy of environmental justice problems (Bullard 1994; Daley & Layton, 2004). This region has not been represented before in this type of analysis and is depicted in Figure 2.

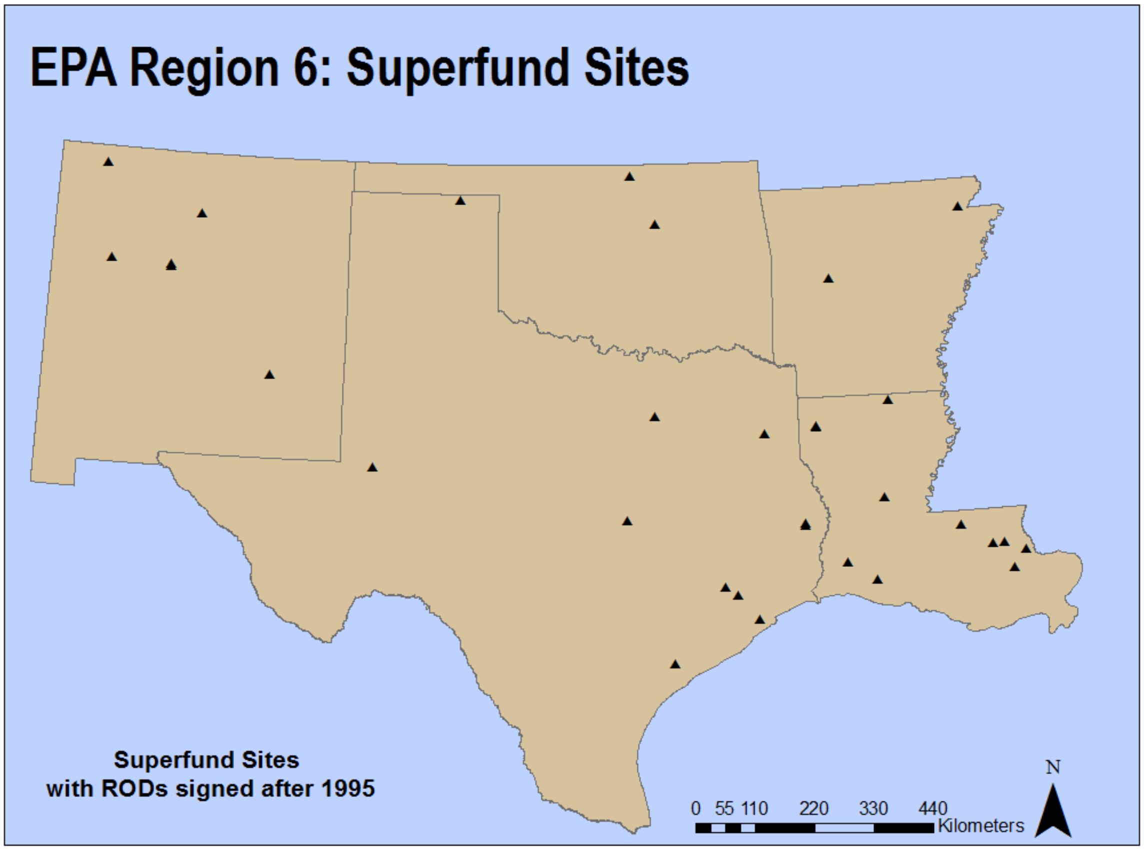

Figure 2: Study area

3.2 Variables

The EPA's online databases were used to retrieve documents about the Superfund sites. These documents include Record of Decisions (RODs), using the Record of Decision System (http://www.epa.gov/superfund/sites/rods/), and other site documents using the National Priorities List system (http://www.epa.gov/superfund/sites/npl/). RODs are legal documents that describe the site, site investigations, human health risk assessments, alternative remedies, the selected remedy, and community participation. One ROD is prepared for every operating unit that comprises a whole site. Each ROD contains a section named "Highlights of Community Participation", this section includes information on public meetings held and other community

engagement activities that may have occurred at a Superfund site. There is also a "Responsiveness Summary" in every ROD, this section includes public comments and responses, and in some cases short summaries of the overall receptiveness to the final remediation plan.

The dependent variable is community involvement, which was coded as 1, 2, or 3 depending on the following information from RODs and other documents: the presence of a Community Advisory Group (GACs) or Technical Assistant Grants (TAGs), the numbers of public comments, and the number of public meetings held. The first category corresponds to low community engagement as indicated by only 1 public meeting and few public comments, 2 will indicate medium community involvement shown by multiple public comments and more than 1 public meeting per operating unit, 3 indicates high community involvement as indicated by more than 1 public meeting per operating unit and the presence of CAG, TAG, or other comparable community group. This coding method is similar to that of Petrie in her 2006 study of community involvement in Superfund communities in the South region.

The predictor variables for the site were comprised of two site specific characteristics and socio-economic and demographic data for the surrounding community. Superfund site listing profiles, and site progress reports were utilized to obtain the HRS of each site as the number of operating units at the site which served as proxy variables for site hazardousness and complexity. In order to retrieve community demographics for every Superfund site, the US Census and American Community Survey data at the block group level was compiled and aggregated into a case. A standard Geographic Information System (GIS) procedure was used, where block groups within a 1 mile radius of a Superfund site were selected, and the demographic information from these block groups will be combined to make demographic variables for each Superfund

community. It is important to retrieve demographic information at a fine spatial scale to ensure that the data obtained is a true representation of the community that directly surrounds a Superfund site (Lam, 2011).

Demographic data from the 2000 and 2010 Census, along with the American Community Survey was utilized for each case, depending on when the ROD was signed. Demographic information closest to the time of the ROD was obtained in order to ensure that the community demographics accurately represent the community at the time when decisions were being made and to rule out misrepresenting the community based on changes that could occur after listing (O'Neil, 2007; Burda & Harding, 2013).

Table 1 summarizes the variables in the analysis. US Census data can be accessed through the American Factfinder (http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml) and American Community Survey data can be accessed using the Summary File Retrieval Tool (http://www.census.gov/acs/www/data_documentation/summary_file/).

Table 1: Variables used in the multinomial logistic regression

Independent Variables	Dependent Variables
Percent living in poverty Per capita income Percent minority population Percent of the population that is White Percent urban population Percent rural population Hazard ranking score Number of operating units	Community Involvement (1, 2, or 3).

The predictor variables selected in this manner consisted of percent of the population living below the poverty line, percent rural and urban populations, percent minority population, and percent white population. Percent minority population is composed of the following racial

categories in the US Census, African American, American Indian, Native Alaskan, Asian, Native Hawaiian, Pacific Islander, and other.

3.3 Regression Analysis

All statistical analysis was done using IBM Statistical Package for Social Sciences Version 21. First, group averages were taken and a correlation table was constructed in order to assess trends in the data. These trends helped to establish whether an ordinal logistic regression or a multinomial logistic regression is more appropriate for the data; these methods are extensions of the binary logistic regression model. Logistic regression relates the predictor variables to the probability of an event rather than the value of a dependent variable as in a linear regression, thus allowing the dependent variable to be categorical in nature. Logistic regression equations are expressed in logistic terms, or in terms of a logit. For example, when there are three groups two equations are generated that estimate the log odds of being in one group relative to a reference category as shown in Figure 3.

$$\text{logit}(y=1) = \log\left(\frac{p(y=1)}{1-(p=1)}\right) = \beta_0 + \beta_1 \cdot x_{i2} + \beta_2 \cdot x_{i2} + \ldots + \beta_p \cdot x_{in} \textit{ for } i = 1 \ldots n\,.$$

$$\text{logit}(y=2) = \log\left(\frac{p(y=2)}{1-(p=2)}\right) = \beta_0 + \beta_1 \cdot x_{i2} + \beta_2 \cdot x_{i2} + \ldots + \beta_p \cdot x_{in} \textit{ for } i = 1 \ldots n\,.$$

Figure 3: The logistic regression equations
Source: http://www.statisticssolutions.com/mlr/

The assumptions of logistic regression are more lax than that of other methods such as discriminate analysis. For instance, logistic regression makes no assumptions about the distributions of the predictor variables or the variances of the groups (Tabachnick & Fidell, 2004). Ordinal log regression allows for the dependent variable to be ordered rather than dichotomous or nominal. Ordinal logistic regression assumes that each predictor variables has the same effect on every outcome level, whereas multinomial logistic regression makes no

assumptions about the relationship of the predictor variable across the outcomes (Brant, 1990). Correlation analysis aided in the identification of variables that need to be removed in order to ward off problems of multicollinearity. Multicollinearity can also be assessed by running the model as a linear model and producing collinearity diagnostics such as the VIF or by utilizing a step-wise method (Field, 2009).

From this point in the analysis, the multinomial logistic regression model was used to test for significant relationships between the predictor variables and the different categories of community involvement. This model allows for the quantification of the effect of a predictor variable on the odds of a case being in the different categories of community involvement.

The first research objective is to look for evidence of disparities in community involvement in communities. First, the independent variable, percent minority population and percent poverty were put into the model separately to test for its association with the categories of community involvement. Then, the all of the predictor variables were put into a multinomial logistic regression model using a forward stepwise method for the predictor variables. This method adds predictors to the model one at time until the point where all of the remaining terms do not have a significant contribution to the model. This allows for a number of the predictor variables to be reduced to the a few variables that make the strongest contributions to the model. The Wald statistic is one measure of significance that can be used to test the contribution of predictors; it is the value of the regression coefficient divided by its standard error (Field, 2009). They type I error rate for the study was 0.05, and for the model produced by the forward step-wise method 95% confidence intervals were included. The Wald statistic consisted of the entry statistic, and the entry probability was set to 0.2; the statistic was set slightly higher than the default setting in order to ensure that no potentially important terms were left out (Hosmer & Lemeshow, 1989).

An analog to the ratio of explained to unexplained variance in linear regression, or R^2 is provided by Cox and Snell's R^2 (Tabachnick & Fidell, 2004).

3.4 Case studies

Two sites were chosen to investigate how involvement was solicited by officials and to evaluate how community concerns were received and addressed in two different types of communities surrounding the Superfund sites. The Alcoa site is made up of a predominately white community with a Vietnamese minority population and the RSR site comprises a largely African American population. The Alcoa site had the lowest amount of its surrounding population living in poverty, while RSR had the highest percent of its surrounding population living in poverty. First, short descriptions of the two sites are presented followed by a discussion of site dynamics that led to the emergence of controversy and tension between community members and agency officials. Information for the sites was taken from the Record of Decisions (RODs) of the sites (EPA, 2002; EPA, 1995), other site documents, and local newspaper articles.

CHAPTER 4: RESULTS

4.1 Descriptive Statistics and Correlations

This study analyzed Superfund sites in the EPA's 6th region that had Record of Decisions (RODs) signed after 1995 (n=32). Socio-economic and site characteristics were compiled and used as predictor variables in a multinomial logistic regression. The following are descriptive statistics of the independent variables used in the analysis. The minimum values, maximum values, mean, and standard deviation are listed in Table 2 as well as their abbreviations.

Table 2: Descriptive statistics of independent variables

Variable	Abbreviation	Min	Max	Mean	Stand. Dev.
Per capita income in dollars	prcinc	7873.8	33,309.7	15467.3	4396.2
Percent urban population	pcturban	.00	.99	.6925	.36039
Percent rural population	pctrural	.00	.99	.2971	.35711
Percent of population below poverty line	pctpov	.05	.44	.2178	.09577
Percent white population	pctwhite	.05	.97	.6359	.24107
Percent minority population	pctmin	.01	.95	.3478	.24955
Hazard ranking score	hrs	29.34	70.71	47.0994	7.15946
Operating units	ou	1.00	6.00	1.4375	1.21649

Averages of the socio-economic data from all sites were combined and compared to regional and national averages in order to show how the make-up of all the sites differ from the make-up of the region and country as a whole. As Table 3 shows, the demographic

characteristics of Superfund sites in the 6th region are different than the demographic characteristics of the general population of the states they reside in and that of the nation. Superfund sites in the 6th region are typically located in areas that are less affluent, with more people living in poverty, have greater minority populations, and a slightly larger rural population.

Table 3: Demographics of Superfund sites compared to the general population

	prcinc	pctpov	pcturban	pctrural	pctmin	pctwhite
All sites	15467	22%	69%	30%	35%	64%
Region 6	17,668	16%	75%	25%	26%	72%
Nation	21,587	12%	77%	28%	22%	75%

Bivariate correlations were computed using the Pearson's correlation coefficient and a full correlation table can be found in Appendix B; correlations over the 0.5 level are noted in Table 4. As the table shows, percent urban population and percent rural population, as well as percent minority population and percent white population are almost identically negatively related; for this reason, only percent urban population and percent minority population were placed in the model.

Table 4: Table of high correlations significant at the .01 level

Variable	Highly correlated variable(s)	Pearson correlation coefficient
Per capita income in dollars	pctpov	-.742
Percent urban population	pctrural	-.997
Percent white population	pctmin	-.990
	pctpov	-.798
Percent minority population	pctpov	-.786

In order to ensure that correlation between these variable does not represent a major concern, the variables were put in a linear regression model in order to obtain collinearity diagnostics. The variance inflation factor measures relationships among predictor variables, and generally a VIF value over 10 or a tolerance level below 0.2 would flag a problem of collinearity (Field, 2009).

As Table 5 shows, no variables had VIFs over 10, but percent minority population had a tolerance level under 0.2. For this reason, a step-wise procedure was used for the last model to control for multicollinearity.

Table 5: Variance inflations factors and tolerances of independent variables

Variable	Tolerance (1/VIF)	VIF
Per capita income	.369	2.717
Percent urban population	.734	1.362
Percent minority population	.184	5.438
Percent of the population living in poverty	.319	3.1362
Hazard ranking score	.884	1.132
Operating Units	.748	1.336

4.2 Low Community Involvement Sites

There were 32 sites in the analysis, out of those 32, 13 sites fell into the “low community involvement” category. These sites had no extra meetings held, had no technical assistance grant (TAG) or community advisory group (CAG), and had less than 10 written or oral comments. The sites are listed in Table 6, along with a brief description of the site and the remediation option chosen by the party responsible for cleanup. Other events related to the site are also listed, such as if the site had an amendment or was removed from the NPL.

Almost all of these sites involved contamination of different media, i.e., soil, sediment, surface, and groundwater. Three of these sites were removed from the National Priorities List, two of which were deemed to need no further cleanup actions.

Table 6: Low community involvement site descriptions

	Description	Contaminants	Major Actions	AMD/ESP/ other
Mountain Pine Pressure Treating, AR	abandoned wood treatment facility	PCPs, arsenic	excavation and treatment of soil to be returned, capping, ground water monitoring	No
Central Wood Preserving Co., LA	abandoned wood treatment facility	arsenic, heavy metals, PAHs	on-site thermal treatment	No
Delatte Metals, LA	abandoned battery recycling and smelter	lead	immobilization of waste in soil, off-site transport, monitoring	No
Lincoln Cresote, LA	abandoned wood treatment facility	PCPs, PAHs, CCAs, dioxins	no further action (soil excavated before listing)	removed from NPL
Mallard Bay Landing Bulk Plant, LA	inactive crude oil refining and bulk storage facility	PAHs	solidification/ stabilization and offsite disposal of waste, monitoring,	AMD new treatment to meet waste disposal requirement
Marion Pressure Treating, LA	abandoned wood treatment facility	PAHs	on-site thermal treatment, DNAPL recovery	No
Lee Acres Landfill, NM	site of solid waste and liquid waste, contamination from adjacent refinery	metals, VOCs	capping of soil	No
Rinchem Co., NM	electronics and industrial facility	VOCs	no treatment	removed from NPL

(Table 6 continued)

	Description	Contaminants	Major actions	AMD/ESP/other
City of Perryton Well No 2, TX	former municipal water supply, contaminated with carbon tetra-chloride	carbon tetra-chloride	extraction and treatment of water	No
Garland Creosoting, TX	abandoned wood treating facility	PAHs	excavation and onsite containment, DNAPL removal	No
Hart Creosoting, TX	abandoned wood treatment facility	VOCs	excavation and onsite containment, pump and treat	No
Jasper Creosoting, TX	abandoned wood treatment facility	PAHs	excavation and onsite containment, NAPL recovery system	No
Rockwool Industries, TX	former insulation manufacturing facility	heavy metals	excavation and onsite containment	No

Source: Compiled by Author

One site had a Record of Decision Amendment, these documents note significant changes to the selected remedy. The selected remedy for the Mallard Bay Landing Plant changed slightly to meet the standards for the disposal of treated waste from the site (EPA, 2003). Most of the remedies selected for these sites involved excavating contaminated soils and treatment of these soils on site or offsite disposal. Thermal treatment onsite occurred at two of the sites.

4.3 Medium Community Involvement Sites

There are 11 sites that fell into the second category of community involvement. These sites had numerous public comments and public meetings and thus, these sites are considered sites of high concern. However, there were no TAGs or CAGs present, so citizen input may have

been limited due to the absence of this mechanism for exchange. Multiple meetings may also be the result of the higher concern from local municipalities over the direction of site cleanup or re-development. Four of these sites involved groundwater contamination that had the potential to impact citizens around the sites. The sites and a brief description are listed below in Table 7.

Table 7: Medium community involvement site descriptions

	Description	Contaminants	Major action	AMD/ESP/other
Monroe Auto Equipment Co., AR	Industrial landfill	VOCs	removal and off-site disposal of waste, ground water monitoring	AMD (strong support in favor of removal and offsite disposal)
Highway 71/72 Refinery, LA	former oil refinery	benzene, PAHs, lead	NAPL recovery, sampling for lead in soil, benzene in air	
Madisonville Creosote Works, LA	abandoned wood treatment facility	PAHs	thermal treatment, DNAPL recovery	
Ruston Foundry, LA	abandoned metal foundry	heavy metals, PAHs, PCBs	stabilization, excavation and offsite disposal of soil	ESP, site reuse changed from recreational to industrial
Fruit Avenue Plume, NM	groundwater contamination from dry cleaning facility and other commercial operations	chlorinated solvents	soil vapor extraction, pump and treat, bioremediation	
Grants Chlorinated Solvents, NM	groundwater contamination from dry cleaning facility and other commercial operations	chlorinated solvents	thermal treatment, in-situ oxidation, bio-barriers	

(Table 7 continued)

	Description	Contaminants	Major action	AMD/ESP/other
McGaffey and Main Groundwater Plume , NM	groundwater contamination from dry cleaning facility, private wells for drinking and irrigation		vapor control systems, excavation and offsite disposal, oxidation, pump and treat, hydraulic containment system	
RSR Corp., TX	former lead smelter	heavy metals	capping, excavation and offsite disposal. No action some OUs	
Sprague Road groundwater plume, TX	ground water contaminated from former industrial operations, drinking water	chromium	pump and treat	
Tex-tin Corp., TX	former tin smelting operation	heavy metals	stabilization, offsite and onsite disposal, capping	AMD, further studies show contamination in ground water because of piercing of waste pits, not migration, background levels already exceed MCLs
Blackwell Zinc, OK	former zinc smelting facility	heavy metals	removal and onsite disposal of waste, capping	state led cleanup, removed from NPL

Source: Compiled by author

There were three sites with special additions or amendments to the RODs. The Monroe Auto site changed the selected remedy to offsite disposal of wastes. The basis for the change was listed as strong community opinion in favor of offsite disposal (EPA, 2000). The Ruston Foundry site's future use changed from recreational to industrial and this changed the values used in the

risk assessment and subsequently the clean-up standards. This virtually had the effect of reducing the amount of soil excavated and the cost of cleanup. According to the Explanation of Significant Differences (ESD) these changes resulted from new information from “the city, community, and the responsible party” (EPA, 2004, p.7).

There was also an AMD to the Tex-tin site in Texas, the amended remedy utilized onsite containment of contaminated soils, not off-site disposal. One site utilized thermal treatment of solid wastes, while the majority of the other sites had wastes excavated and disposed of off-site.

4.4 High Community Involvement Sites

There were eight sites, listed in Table 8, that were categorized as having high community involvement and participation in the clean-up process. These sites had environmental groups awarded TAGs, or had community groups such as CAGs that served to keep the community apprised of site activities. The cleanup action proposed at the Southern Shipbuilding site in LA included the incineration of hazardous wastes from the site. A local environmental group opposed this technique, but the city council and a large part of the public favored incineration (EPA, 1995). In an effort to inform the general public about the decision, there were meetings held in order to explain the thermal incineration and other alternative techniques.

Table 8: High community involvement site descriptions

	description	contamination	major actions
Agriculture Street Landfill, LA	municipal landfill	metals, PAHs	excavation of contaminated soil, capping
Gulf State Utilities, LA	groundwater contamination from manufactured gas plant and landfill	VOCs, PAHs	monitored natural attenuation, sampling and monitoring of surface and groundwater

(Table 8 continued)

	description	contamination	major actions
Southern Shipbuilding, LA	marine service station, site features pits used for marine vessel wastes	PAHs	capping, consolidation, excavation and thermal treatment of wastes
North Railroad Ave Plume, NM	drinking water aquifer contaminated by dry cleaning facility	chlorinated solvents	DNAPL removal, bio-remediation
Alcoa, TX	aluminum smelter and chlor-akali plant	mercury, PAHs	DNAPL collection, extraction wells, dredging of contaminated sediments, controls on fishing
Jones Road Groundwater Plume, TX	drinking water contaminated from dry cleaning facility and other commercial operations	VOCs	in-situ enhancements to pump and treat
Many Diversified Interests Inc. TX	metal casting foundry and recycling plant	heavy metals	excavation and offsite disposal, monitored natural attenuation
Hudson Refinery, OK	former oil refinery	PAHs, metals	excavation and offsite disposal of soil, stabilization and offsite disposal of sediment, LNAPL recovery, ground water monitoring

Source: Compiled by Author

4.5 Multinomial Logistic Regression Assumptions

The mean of independent variables are listed across the three different community involvement categories in the Table 9. The data shows that high community involvement sites have higher average per capita incomes and hazardous ranking scores, while the middle community involvement sites have the lowest averages for those two measures. The medium community involvement group has the highest percentage of poverty and percentage of urban population. The lowest community involvement group has the lowest average for percent urban population and number of operating units. The percent of minority population increased over all three community involvement groups, although the increase from the low to medium groups was much larger than that from medium to high.

Table 9: Variable averages across the three levels of community involvement

	Low Community Involvement	Medium Community Involvement	High Community Involvement
Per Capita Income in dollars	15,107	14,255	17,720
Percent of Population below poverty line	20.60%	23.30%	18.00%
Percent Urban Population	48.90%	83.50%	82.60%
Percent Rural Population	49.40%	15.50%	17.10%
Percent Minority Population	29.80%	32.50%	42%
Percent White Population	68.60%	63.00%	55.80%
Hazard ranking score	46.00	44.80	50.10
Operating units	1.10	1.60	1.75

A multinomial logistic regression was utilized because this model does not make the assumption of proportional odds. This assumption specifies that the coefficients that describe the relationship between the first level of community involvement and the next two categories is the same as the coefficient that describes the relationship between the second and third community involvement groups (Tabachnick & Fidell, 2004). A multinomial model allows for the production of coefficients for every pair of outcome levels. A multinomial logistic regression also assumes that the response categories are independent of each other, and multicollinearity is not present. The categories of community involvement are still denoted as low, medium, and high for convenience. Small sample size may present particular problems with this model, and it is generally believed that a ratio of at least one predictor variables to 10 cases should be used (Hosmer & Lemehow, 1989). For these reasons, first a model with only one predictor was run, and then a forward stepwise method was used to identify any other variables that have significant effects on the odds of being in a certain category of community involvement.

4.6 Model Summary

The table of means shows that minority population increased over the categories of community involvement, suggesting that minority populations may be more involved with Superfund cleanup. Percent of the population in poverty was highest in the medium community involvement group and lowest in the high community involvement group. In order to test the strength of the association between percent minority population and percent poverty and the different categories of community involvement, two multinomial regressions were run with percent minority population and percent poverty as the independent variables. Coefficients denote how an increase in the predictor variables decreases or increases the odds ratio of being in a certain category of community involvement. The results of the analysis are depicted in a table that shows the coefficient β, and its exponentiated form, Exp (β). The Wald statistic and the 95% confidence intervals are also shown. The negative coefficient (β) indicates that as percent minority population increases the odds of being in the low or medium category relative to the high categories decreases. The Wald statistic indicates that percent minority population does not have a significant association with the different categories of community involvement. Table 10 shows these values and is depicted below.

Table 10: Relationship of minority population with low and medium community involvement groups compared to the high group

Community Involvement	Variable	β	Exp (β)	Wald	Sig
Low	pctmin	-2.477	.084	1.659	.198
medium	pctmin	-.469	.626	.064	.800

Minority population does not have a significant relation to the odds of being in different levels of community involvement, although it does show some directionality. The odds of being in the low involvement group decreases as the percent minority population increases indicated by the negative B coefficient, although this is not a significant association (p=.198). Going from the

medium involvement group to the high group, the direction is similar but the p-value is very large, suggesting there is little effect of minority population going from medium to high involvement. Minority population was associated with medium and high involvement groups compared to low involvement groups but was not statistically significant, shown in Table 11.

Table 11. Relationship of minority population with medium and high community involvement groups compared to the low group

Community involvement	Variable	β	Ex(β)	Wald	Sig.
Medium	pctmin	2.008	7.450	1.212	.271
High	pctmin	2.477	11.9	1.659	.198

Percent of the population living in poverty was also not significantly associated with any increase or decrease in the odds of being in a certain level of community involvement, as can be seen in Tables 12 and 13.

Table 12: Relationship of percent poverty with low and medium community involvement groups compared to the high group

Community involvement	Variable	β	Exp(β)	Wald	Sig.
Low	pctpov	-2.739	.065	.295	.587
Medium	pctpov	3.832	24.161	.563	.453

Table 13: Relationship of percent poverty with medium and high community involvement groups compared to the low group

Community involvement	Variable	β	Exp(β)	Wald	Sig.
Medium	pctpov	6.571	714.171	1.914	.167
High	pctpov	2.739	15.478	.295	.587

There are a number of other variables that may have stronger and more reliable relationships with the outcome categories. In order to identify variables that may make a significant contribution to a model of community involvement, a stepwise method of multinomial logistic regression was conducted. The step-wise entry method produced a model

that contained only one predictor variable, percent urban population, which by itself had a Cox and Snell R^2 value of 0.40. Tables 14 and 15 depict the coefficients for percent urban population.

Table 14. Relationship of percent urban population with medium and high community involvement groups compared to the low group

Community involvement	Variable	β	Exp(β)	Wald	Sig.	Lower Bound	Upper Bound
Medium	pcturban	6.604	737.771	5.075	.024	2.359	230745.8
high	pcturban	3.583	35.995	3.861	.049	1.009	1284.174

Table 15. Relationship of percent urban population with low and high community involvement groups compared to the high group

Community Involvement	Variable	β	Exp(β)	Wald	Sig.	Lower Bound	Upper Bound
low	pcturban	-3.583	.028	3.861	.049	.001	.991
medium	pcturban	3.020	20.496	1.004	.316	.056	7547.089

Percent urban population was significantly associated with being in the medium and high groups of community involvement relative to the low group, with p-values of .024 and .049 respectively. So, an increase in percent urban population is associated with significant increases in the odds of being in medium and high groups of community involvement. More specifically, a one unit increase in the percent of urban population at a Superfund site reduces the odds of being in a low community involvement group by a factor of 36 relative to a high community involvement group. The confidence intervals do not cross 0 and show that the coefficient has a 95% chance of being between the lower and upper boundaries shown in Table 12. The predictor lost its significance when the medium group was compared to the high group, which is in agreement with Table that depicted the averages for the three levels of community involvement. Percent urban population had the highest average in the medium group, suggesting that there is not much effect of urban population going from medium to high groups. These results indicate that Superfund sites located in urban areas were significantly more likely to garner community

involvement and participation, although its effect at the highest level of community involvement is somewhat unclear. Similarly, percent minority population trended toward an association with medium and high levels of community involvement, but the evidence presented here is not enough to discern a major difference of community involvement between sites based solely on minority populations. Percent urban population or its opposite equivalent, percent rural population was the only demographic variable that showed reliable association with the different levels of community involvement. The medium and high levels of community involvement were more similar in regards to urban population and minority populations, this suggests that the differences between these two groups may lie in other site conditions. Indeed, the high involvement group did have a higher average per capita income and HRS.

CHAPTER 5: CASE STUDIES

5.1 Case Study of Alcoa Superfund Site

The Alcoa Superfund site, located in Calhoun, Texas, consists of the expansive 3,500 acre Alcoa Point Comfort Operations Plant, used for a variety of industrial activities such as aluminum smelting and bauxite refining. In addition to these activities, a cryolite plant, a chlor-alkali plant, and coal tar processing plant were also located in the vicinity of the Alcoa plant. The Superfund site also consists of a dredge island that stored wastes from these operations. The transported wastes escaped to several surrounding bay areas which were home to both recreational and commercial fishing activities.

As early as the 1970s, information from the Texas Department of Health and the federal Food and Drug Administration indicated that mercury levels in marine fauna were a health concern spurring site investigations and a mandate that the Alcoa Plant reduce the amount of mercury in discharged wastewater. In 1988 the Texas Department of Health ordered part of the bay to be closed to fishing because of mercury levels in fish, shellfish, and oysters. The site was finally listed to the NPL in 1994, as the soil and sediment remained contaminated with mercury and poly-cyclic aromatic hydrocarbons (PAHs).

A citizen's advisory panel was established early on in the Superfund process. According to the ROD, the panel enlisted the help of an independent facilitator and expanded membership to create a more "diverse" panel (EPA 2002, p.9). The group met every month and the EPA, Alcoa, and the Texas Natural Resources Conservation Commission served as liaisons to the group. According to the ROD, most public comments supported the proposed plan of action, although a closer examination of the comments revealed potential concerns, and most comments were submitted by Alco. Figure 4 shows a map of the Superfund site.

Figure 4: Map of Alcoa Superfund site
Source: http://www.epa.gov/region6/6sf/pdffiles/alcoa-lavacabay-tx.pdf

The remedial actions for the site described in the ROD included measures to address sediments in Lavaca Bay that were contaminated with mercury and PAHs, as well as soils contaminated from the chlor-alkali and coal tar plants. Remedial actions for the Bay system included measures to extract and treat groundwater using aeration and carbon adsorption to eliminate mercury, and a containment system to intercept dense non-aqueous phase liquids (DNAPL). A major component of the remedial action consisted of dredging the Bay, which aimed to remove 200,000 cubic yards of sediment and dispose of this untreated sediment onsite. Institutional controls were placed on fish and shellfish in order to continue the restricted consumption of these items, and periodic monitoring would evaluate the effectiveness of the previous strategies. The selected remedy for the PAH contamination consisted of laying a cap over contaminated soils.

Although site investigations revealed that mercury concentrations in all areas of the bay posed a health risk, the site activities only concentrated on remedial activities in the closed areas of the bay. The rationale for this being that risks to fishermen in the Lavaca Bay system were not much greater than risks to fishermen in all bay systems in the state. The risk assessment studies were conducted using the estimation that fishers consume one fish meal every 10 days.

The Responsiveness Summary from the ROD yields more insights into what some concerns around the site were from Alcoa, the Calhoun County Navigation Districts, and the public. For instance, Alcoa submitted comments alleging that the EPA was overstating risks posed at the site, particularly health risks from the consumption of fish and shellfish from the site. Alcoa did not concur with what they considered overly conservative consumption estimations and reference doses used by the EPA, which were based off of study in the Faroe Islands. Alcoa even commissioned its own consumption study and petitioned for this study to guide the risk assessment. The general public expressed concern that monitoring of the groundwater and soils needed to be more frequent. Environmental groups expressed concern over the plan to leave dredged soils contaminated with mercury on site given the chances of severe weather and hurricanes hitting the site (Gold, 2005). Eventually, a settlement was reached between Alcoa, the EPA, the Texas Department of Health and several other agencies. The settlement included a plan to compensate for damages incurred by recreational fishers and ecological damages from the contamination. This plan, designated a restoration plan, included funds for the building of piers and boat ramps, Alcoa also designated over 700 acres of the land to be part of a wildlife refuge (DOJ, 2004).

Although the restoration and cleanup did constitute an example of positive collaboration from state, federal, and private entities to improve the environmental conditions of a vital

ecosystem- this is not how some community members recount the episode. In fact, the affair was much more volatile. In particular, local area fishermen not only felt that their vantage point was absent from the EPA's decision making, they felt that Alcoa had devastated the bay, a seminal part of their existence (Claitor, 2005). As fishers feared for economic losses, public health officials spoke out about health risks, declaring the site an urgent hazard and noting that fish consumption studies did not take into account the consumption patterns of subsistence fishermen, especially those in the Vietnamese community who often fished in the closed area and were reluctant to admit this to officials (ATDSR; Claitor, 2005). Although the fishing community consisting of different racial minorities became more unified by the perceived threats to the longevity of their way of life, this community may have been overshadowed by the rest of the surrounding area who are largely employed by Alcoa (Gold, 2005). This situation is not unique in the study of natural resource and environmental conflicts, whereupon a community is often divided along a line of loyalties to their industry. The events at this site also provided much fodder for local environmental activists, environmental action groups, and environmental lawyers. They have gone as far as accusing the Texas agencies and Alcoa with collusion and purposeful deception as they charge that the amounts of mercury discharged into the bay were altered, and claiming that the cleanup process was co-opted by industry (Gold, 2005).

5.2 Case Study of RSR Superfund Site

The RSR Corporation in West Dallas conducted secondary lead smelting operations, such as the recycling of lead batteries, which resulted in contamination of surrounding neighborhoods from the fallout of airborne pollutants. Contamination also occurred due to the use of slag material and battery casings as fill material for yards and driveways and the disposal of smelter wastes into a local municipal landfill. The site consisted of several operating units, two of which

consisted of public housing units, churches, parks, schools, and retail establishments. Two operating units consisted of the former smelting operations and the last operating unit contained the landfill where wastes were buried. The surrounding communities were largely African American with a large portion of the population living below the federal poverty line (43%).

In 1983 the state agency that regulates air quality, the Texas Air Control Board, filed suit against RSR forcing the cooperation to control emissions and fund the removal of soils where lead contamination exceeded 1,000 ppm. It should be noted, that at the time the Center for Disease Control (CDC) blood level of concern was 30 micrograms per deciliter. Lead is considered a dangerous environmental pollutant that is particularly damaging to the development of children. According to the CDC's website, the value for blood levels of concern is now 5 micrograms per deciliter (http://www.cdc.gov/nceh/lead/acclpp/blood_lead_levels.htm). Through the following years concern over lead and heavy metal contamination persisted, resulting in another soil removal action and the listing of the site as federal Superfund site.

The human health risk assessment that was conducted for the residential operating units evaluated the risk posed to residents by heavy metals in the soil. Residential homes in the first operating unit with soil lead levels over 500 ppm were addressed by having contaminated soils around the homes removed. The EPA then conducted further studies to determine if there were lingering health threats from lead contamination.

The blood lead levels of 63 children from the area were analyzed, and mean blood lead levels for children ranged from 4.5 to 5.7 µg/dL, indicating that 2 to 17% of the children have blood lead levels over 10 µg/dL. The highest blood level measured was 22 µg/dL. These measured blood levels were lower than what a site model predicted given the environmental and physical parameters of the site. Correlation analysis indicated that little correlation between soil

samples and blood lead levels, suggesting that lead had a ubiquitous presence in the area. Figure 5 shows a map of the site.

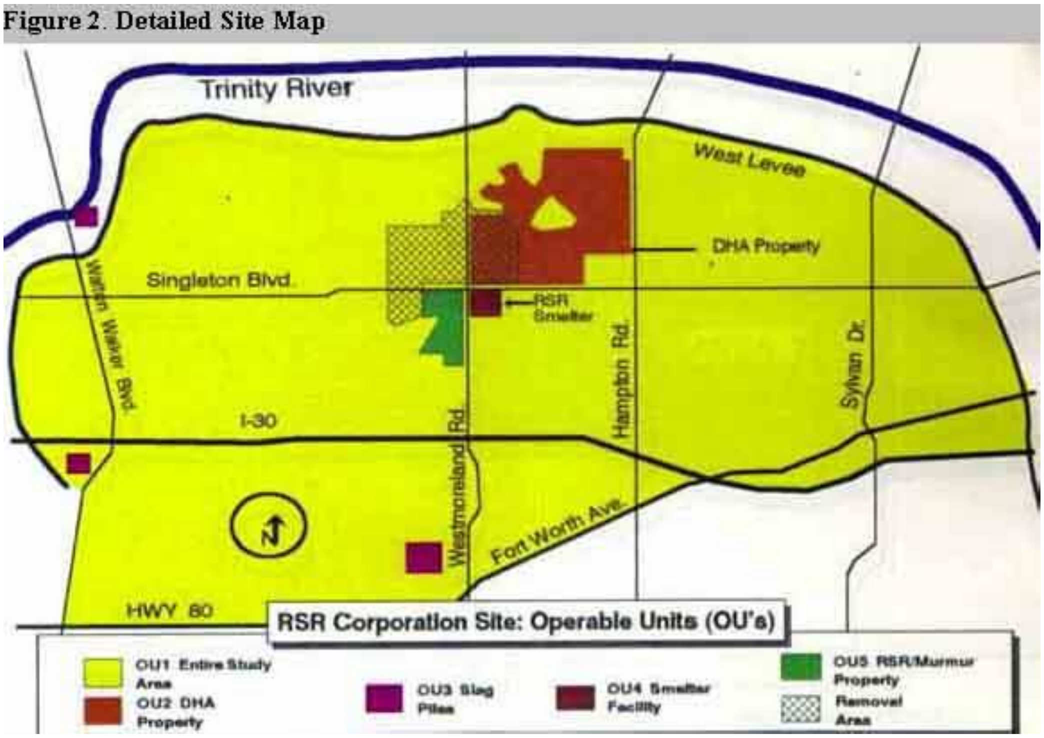

Figure 5: RSR Superfund site map
Source: http://www.atsdr.cdc.gov/HAC/PHA/reports/rsrcorp_08161995tx/images/rsr-f2.jpg

The Dallas Housing Authority, the agency that oversees public housing, conducted the site investigations and risk analysis in operating unit 2, under EPA supervision. The same cleanup level was applied, resulting in demolition of contaminated structures and the removal of contaminated soils. After this removal no further actions for residential areas were warranted by the EPA. Operating units 3, 4, and 5 were also investigated, these operating units contained structures that were demolished and soils with contaminant concentration exceeding the standards were excavated and disposed of offsite.

Comments from the public expressed great concern over the events that occurred throughout the cleanup process. Residents were generally skeptical about many aspects of the cleanup, including how sites were sampled, the levels used to decide what constituted a removal

action, the thoroughness of the soil removal, and the risk posed from demolition activities. Citizens also expressed confusion about how to get information about the site. Many residents were somewhat unclear on the authority and scope of the EPA and the Superfund program as compared to other programs, for instance some citizens wanted the EPA to provide compensation for health care expenses. One concerned citizen commented that his or her children were experiencing sudden blackouts, nose bleeds, trouble sleeping, and asked the EPA for medical advice. The EPA responded by providing the names of several health clinics and referring to a Citizen's Guide on lead prepared by the EPA in collaboration other agencies. The community also objected to the demolition of several structures such as the RSR smelter stack after previous demolition activities resulted in the large amounts of dust on the site. The community organized a petition, but the ROD stated that this petition was too late as the comment period for that decision had ended.

The site is still mired in controversy as follow up studies commissioned by different parties come up with different results (Wigglesworth, 2012). Samples of yards often come up positive for having more lead than the standards set, however, these studies generally cannot address the sources of the lead, leaving room to doubt that it can be directly tied to RSR and the Superfund cleanup.

5.3 Themes of Community Involvement

The first case highlights a theme that has been echoed in previous research on environmental conflicts at Superfund sites (Mix & Shriver, 2007). That is, communities are often not unified in their opinions on what courses of action are best for a site and for a community. This occurrence may be more prevalent when large amounts of the community continue to be employed by a responsible party, as is the case in the Alcoa site. This point reinforces the need

for citizen’s advisory panels to be representative not only of different community, interests and concerns, but also different members.

Residents around a Superfund site may also be confused by the technical language and what can appear to be contradictory findings or conclusions from multiple assessments with different parameters and objectives. They are often concerned by what they perceive as lack of coordination with other agencies that may be have more specific input into the actions they need to take to feel protected from environmental harms. For example, at the RSR site, the EPA expressed concern over lead levels in the area and tried to offer resources to residents that contained exposure reducing actions, and offered advice on seeking medical help for health problems related to lead. Residents desired buyouts for the community, but the EPA resisted, stating its mandate to only offer buyouts when successful cleanup is not possible by their standards. Admittedly, the area around RSR still posed health risks from lead, but residents were unable to obtain buyouts from a statute that only recognized one input of lead into the environment. Indignation is thus a commonplace emotion that pervaded the comments of concerned citizens who did not understand why the agency charged with cleaning up toxic waste and protecting human health cannot directly address all the hazardous waste in an area or the detrimental health effects that burden the community.

Confusion over the rational for certain cleanup strategies were common in the two cases, and the confusion can feed into citizen distrust in the process. For instance, at the RSR site citizens preferred that the lead smelter stack not be demolished over concerns about the dust and debris contaminating the grounds and causing health problems from the heavy metals in the stack. The EPA tried to reassure citizens that recontamination would not be a problem and tearing down the stack would not pose significant health risks. This statement was misinterpreted

by some residents who then thought the stack was not contaminated at all, and as consequence did not understand the rational for tearing the stack down in the first place. When citizens hear statements like this about the cleanup and health risks, they often conceive these statements as being contradictory. This worked to undermine the credibility of the officials and fueled notions that officials were being deceitful as several comments took a very accusatory tone.

Overall the activities at these two sites indicate that efforts to alert the public about the events at the site are earnest. However, it is also evident that opportunities for input do not necessarily dissolve all tensions at a site, especially tensions that arise when stakeholders feel significantly wronged and feel that they are not given all the tools they need to rectify these wrongs. Ways of alleviating these tensions may include enhancing opportunities for involvement by strategically targeting organizations that may be more able to disseminate relevant information about the site to their peers and other stakeholders, and equipping citizens with the necessary platform for disseminating this information.

CHAPTER 6: CONCLUSION AND DISCUSSION

6.1 Summary and Conclusion

Scholars of environmental inequality and environmental injustice stress the attenuated ability for collective action in certain communities as a feature that feeds into reinforcing cycles of inequality. Inequality manifests itself in a number of ways, one of which is disparate health impacts. Environmental agencies like the EPA have given credence to this notion and have sought to ensure that every community is treated equally and is protected from the threat of deleterious health effects from their environment. Given this backdrop, this study provided evidence that this parameter is changing- in other words, given an uneven toxic landscape shaped by societal, economic, and other forces, is there evidence that low income and minority communities are being drawn in as decision makers in the Superfund program as a means of preventing further inequalities? If low income and minority communities are not being engaged in the cleanup, then these communities are being separated from the decision making process- an action that reinforces the forces that lead to the continuation of environmental inequalities.

The study provided reason to be optimistic as to how the EPA is working toward environmental justice goals. For instance, there are no clear disparities in how Superfund communities vary by way of community involvement. This study revealed that minority populations were not negatively associated with community involvement; in fact these populations trended to being more likely to be involved in high community involvement as present in the form of technical assistance grants (TAGs) or community advisory groups (CAGs). The multinomial logistic regression model did not identify percent poverty or per capita income as significantly related to any category of community involvement, although group means show that per capita income is highest in the third category of involvement and percent

poverty is also the lowest in this category. The per capita income and percent poverty of all the communities were different than both averages for the states in the region and for the nation as a whole, indicating that the communities around the sites are comprised of less affluent populations to begin with.

This study also sought to identify other factors that may be related to community involvement and may distinguish between different levels of community involvement. This analysis could aid researchers in determining what community characteristics lend themselves to increased public activity and concern in environmental activities. The results of this study indicate that urban areas were highly likely to be associated with higher community involvement. This means that the converse is also true, rural areas are less likely to be involved in the Superfund cleanup process. The reasons underlying this finding are not completely clear, for example, this could be a function of sheer numbers and interest as urban areas are more populated and are more likely to have active environmental groups. Residents of rural communities may be less connected and community members may not be as privy to information that is communicated throughout the area. There might be a spatial component as well, that is, the further away people are from directly viewing the events happening at a site the more ambivalent they may be about the process. Site conditions did not turn out to be significant indicators of involvement, but the use of the hazard ranking score (HRS) and the number of operating units as proxies (which is often used in policy studies), may not be an adequate measurement of site conditions.

Thus, the reasons for participation may be a complex mixture of the unique historical and contextual settings of a site coupled with the perceptions of the community residents and the work of agency officials. Although the sites may be rich in idiosyncrasies further investigations

that take into account more specific site information, presence of activists groups, and spatial measure of proximity to the site may reveal variables that are distinct predictors of community involvement. There may be specific factors that exert more influence from the medium to high categories of community involvement. For instance, site hazard and per capita income could possibly influence the presence of CAGs and TAGs as averages for these variables were greater in the high involvement group. Further analysis on larger sample sizes could help to uncover these distinguishing factors.

This research does present evidence that warrants more research on rural Superfund sites, as there is little research that examines the dynamics or consequences of low community involvement at rural sites. For example, a number of sites with low community involvement utilized treatment methods that may have warranted some risk communication, in the absence of community involvement it is uncertain as to how communities were informed of health risks. This finding may indicate the need for agencies to review existing procedures for disseminating information to rural communities as well as efforts to recruit community groups and community leaders to head CAGs and preform additional activities. Also, a continued focus on empirical research that evaluates the community involvement program based on these types of metrics could ensure that equity in this program is achieved.

The case studies provided some valuable insights into the dynamics of community involvement, and two themes emerged that might help to shape new policies for making the Superfund process more accessible to communities, and thus enhance the meaningful involvement of these communities in the process. These themes included the need for better communication and the need for community participation to be representative of all members of the community.

It should be noted that the way in which minority populations are represented in US Census data is somewhat limiting as it makes hard distinctions between “race” and “ethnicity”, the study utilized minority populations which does not include ethnic categories. This study also assumed that populations living around a one mile radius of the Superfund site are representative of the populations that actually participate in the decisions regarding cleanup. This assertion was discussed somewhat in the context of the case studies, where community groups may not have actually represented all of the stakeholders. Future research seeking to empirically determine who participates in cleanup discussions and determine if disparities are present would thus need to take into account the general population of an area, the resident’s living closet to the site, and the residents who directly participate.

This research study was also specific in its geographical focus, which presents a limitation as to how well these findings can be applied to other regions of the United States. Thus, an expansion of the study area could present a logical next step for this type of research. This expansion would allow for comparisons of different EPA regions. For example in Petrie’s 2006 study, the results were slightly different, specifically, minority populations were found to be less likely to participate in the cleanup process while percent poverty was associated with higher community involvement. The differences could be due to methodological differences such as unit of analysis used, but the differences could also signify spatial, administrative, or cultural differences in community involvement in a different portion of the United States.

Further research could also track the impact of community involvement as it relates to health outcomes, housing prices, and community perceptions of empowerment. Another variable that may potentially influence outcomes at a site is the presence of other agency and local governments in the remediation and redevelopment process. For example, at the RSR site, the

city of Dallas tended to have little involvement in the site, although the city may have had the power to influence some aspects of cleanup (such as the standard for removing soils contaminated with lead). The second category of community involvement featured sites where more public meetings were held and redevelopment may have been a driver of concern at the site. Further investigations could delve into the conditions that entice city and stakeholder involvement and also investigate whether this involvement is representative of citizen concerns.

6.2 Discussion

The process by which toxic wastes are handled under Comprehensive Environmental Response Compensation and Liabilities Act (CERCLA) is guided by a clear directive to protect human health. This directive, like other environmental statues, is to be carried out simultaneously along with many other directives and under the influence of many other constraints. While CERCLA operates under its own statutory framework and the cleanup process is beholden to this structure, individuals affected by toxic pollution may feel perplexed and angered by a process that cannot offer full corrections for the situation they find themselves in and the injustice they feel. In some cases, the result of these forces yields itself to divisive politics and disheartened community members. The EPA has recognized the need to address the unfair burden some communities face in regard to toxic pollution and the EPA has committed itself to upholding the value of letting communities be active participants in the programs it oversees. Despite the tensions that result when complex environmental issues run up against societal inequalities, many scholars retain an element of hope that these tensions can be eased with focused attention to the drivers of conflict.

Scholars have offered perspectives on how the intersection of communities, justice, and complex environmental problems produce an enduring societal issue. Experts in environmental

governance doubt that the institutional structure of environmental agencies like the EPA lends itself easily to questions of environmental inequalities which relate to inequality in society (Durant, Fiorino & O'Leary, 2004). The politics of environmental justice do not lend themselves to comfortable dialogue; that is, these dialogues raise questions on the equitability of many things, while in a political climate that is often reluctant to ask for stringent environmental protections and promote social justice (Ringquist, 2004). For example, while it may be politically infeasible for the EPA to have a policy where cleanup standards are held to a higher standard for traditionally marginalized groups, although this notion is actually gaining traction in the medical community as a way of addressing environmental injustices and health disparities. Researchers argue that exposure pathways in vulnerable populations are greater in number, and vulnerable populations are more likely to be made up of individuals who are more susceptible or sensitive to environmental stressors (Burger & Gochfeld, 2011). For these reasons Burger and Gochfeld argue that risk assessment baselines should be different for vulnerable populations, and this change to the risk assessment would necessitate stricter cleanup standards at hazardous waste sites. Holifield presented a case study of a Superfund site in Minnesota that was embroiled in the politics of risk assessment. The site was located on tribal lands where members of the Ojibwe tribe engaged in subsistence fishing and hunting and wanted the risk assessment to take this into consideration (Holifield, 2012). This is not wholly un-similar to the Alcoa site, where risk assessment did not take into account the fish eating patterns of the Vietnamese community.

It is the viewpoint of this thesis that the EPA should continue its commitment to a holistic idea of environmental justice that recognizes the unique challenges presented to certain sectors of the population and also recognizes that these populations should be included in the decision making process. Many of the materials presented in this study suggest that the EPA does value

community involvement in the superfund process and community acceptance of the remedies selected for controlling toxic waste. For example, at the Southern Shipbuilding site the EPA went as far as to host a public meeting with two independent experts giving presentations on the benefits and pitfalls of two different remediation techniques, so the public at large could decide on an option. However, there are limits as to how far the EPA can reach when it comes to satisfying community wishes and alleviating the stress imposed by toxic landscapes on communities. This is especially true in communities that face other structural inequalities and desire full recompense for injustices that fall beyond the statutory powers of CERCLA and the EPA. Thus, a thorough assessment is needed of how the EPA can strategically use its authority and influence to more readily tackle these barriers that forestall the elimination of disparities.

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APPENDIX A: SPSS STEP-WISE OUTPUT

Case Processing Summary

		N	Marginal Percentage
comm_inv	low	14	43.8%
	medium	10	31.3%
	high	8	25.0%
Valid		32	100.0%
Missing		0	
Total		32	
Subpopulation		32[a]	

a. The dependent variable has only one value observed in 32 (100.0%) subpopulations.

Step Summary

Model		Action	Effect(s)	Model Fitting Criteria	Effect Selection Tests		
				-2 Log Likelihood	Chi-Square[b,c]	df	Sig.
Step 0	0	Entered	Intercept	68.591	.		
Step 1	1	Entered	pcturban	54.586	14.005	2	.001
Step 2	2	Entered	ou	50.503	4.083	2	.130
	3	Removed	ou[a]	54.586	2.231	2	.328

Stepwise Method: Forward Stepwise

a. Stepwise procedure stopped because a previously fitted model is encountered.

b. The chi-square for entry is based on the likelihood ratio test.

c. The chi-square for removal is based on the Wald test.

Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	68.591			
Final	54.586	14.005	2	.001

Pseudo R-Square

Cox and Snell	.354
Nagelkerke	.402
McFadden	.204

Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	69.577	14.991	2	.001
pcturban	68.591	14.005	2	.001

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Parameter Estimates

comm_inv[a]	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Intercept	2.960	1.455	4.136	1	.042			
pcturban	-3.583	1.824	3.861	1	.049	.028	.001	.991
Intercept	-2.440	2.737	.795	1	.373			
pcturban	3.020	3.015	1.004	1	.316	20.496	.056	7547.089

a. The reference category is: high.

APPENDIX B: PEARSON CORRELATIONS

	prcinc	pcturban	pctrural	pctpov	pctwhite	pctmin	hrs	ou
prcinc	1	-0.04	0.4	-0.742	0.486	-0.484	0.06	-0.254
pcturban	-0.04	1	0.997	0.352	0.417	0.386	0.057	0.163
pctrural	0.04	0.997	1	-0.35	0.425	-0.394	-0.056	-0.161
pctpov	-0.742	0.352	-0.35	1	-0.798	0.786	-0.17	0.352
pctwhite	0.486	-0.417	0.425	-0.798	1	-0.99	0.121	-0.466
pctmin	-0.484	-0.386	0.394	0.786	-0.99	1	-0.102	0.458
hrs	0.06	0.057	-0.056	-0.17	0.121	-0.102	1	0.15
ou	-0.254	0.163	-0.161	0.352	-0.466	0.458	0.15	1

VITA

Always the inquisitive (and never so decisive) type, it took quite some time for Simone to decide what she wanted to be when she grew up. She left her hometown of Lafayette, Louisiana to attend Mississippi State University on a full athletic and academic scholarship. There she earned a Bachelor of Science in nutrition, health promotion, and food science while also studying environmental science. She then traveled back to Louisiana to obtain a Master of Science in environmental science from Louisiana State University. During her studies she took particular notice of the complexities of both environmental and social problems around the places that she lived, worked, and called home. Henceforth, she has decided to spend her career researching the intersection of society and the environment. She will go on to earn a Ph.D. in environmental sociology from the University of Colorado at Boulder. She sure will miss Cajun food, music, and the joie de vivre of Southern Louisiana.