

Contaminated Groundwater and Community Drinking Water Justice
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UNEQUAL WATER JUSTICE?
**Environmental Justice and Well Contamination: A
Preliminary Study of Diverse Communities
Impacted By Groundwater Contamination**

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*~~~This report is dedicated to the life and wonderful work of Nan Freeland (1950-2004),
Environmental Justice Leader in North Carolina for decades~~~*

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“Unequal Water Justice”

EXECUTIVE SUMMARY

In an effort to strengthen environmental justice regarding North Carolina’s drinking water, this study aims to compare the experiences of communities of varied socioeconomic and ethnic backgrounds when faced with groundwater contamination incidents. Because private wells are excluded from statewide drinking water protections, and, except for a few local ordinances, have no regulatory standards for testing, most well owners and consumers of untreated groundwater are at an increased risk in comparison to public water supply users. Therefore, this study will provide information about the experiences of communities impacted by groundwater contamination and how they believe that their rights to safe drinking water can be better protected. We are particularly interested in the extent and timing of resident notification of contamination, assistance by agencies with testing of wells, and success in obtaining replacement water supplies where necessary.

Four study communities were selected which have each experienced a groundwater pollution incident, and each was characterized for diversity factors related to environmental justice issues. More specifically, the communities can be compared based on income, race, and educational characteristics that may shape their experiences in the wake of groundwater contamination. In-person and telephone surveys were collected from residents in each community within 1500 feet of a pollution incident.

Ultimately, this study preliminarily concludes that various environmental injustices have been experienced by low income and minority communities in comparison to white and middle-to-upper income communities. The degree to which low income and minority residents are negatively impacted, combined with the lack of notification, and inferior efforts for the provision of a clean water supply, represent significant environmental justice concerns. Clean Water for North Carolina recommends that mechanisms for full notification and participation of communities be implemented by government agencies following any known contamination incident, as well as the prompt provision of safe alternative water supply to residents with contaminated wells. We also recommend that all Environmental Justice principles be implemented by local state and federal agencies in their work with communities.

RECOMMENDATIONS

This study has found apparent discrepancies in the extent of notification of residents depending on community characteristics such as income and community affluence, educational level of residents, and even race and ethnicity. In one case, notification was given door-to-door by a private seller of filtration systems, rather than a public agency, providing a means by which Greenview Bluff residents were relatively well informed. Agency officials also selectively sampled drinking water wells for possible contaminants around a pollution incident depending on community characteristics, whereby some communities underwent mass samplings and residents of other communities were only sampled if they complained. Based on the experiences of these communities, we recommend that:

- state groundwater officials fully notify private well owners and users within a 1,500 feet radius of any contamination in violation of NC groundwater standards
- water supply wells within 1000 feet of a known site of groundwater contamination be tested at the expense of the responsible party, if known, or the state.
- A state Emergency Drinking Water Fund be created to provide immediate funding for public water supply hook-ups or other safe and adequate household water to all users of contaminated wells.

Additional recommendations include:

- A requirement for testing of wells before any real estate transfers
- A requirement for full cleanups of groundwater incidents to protect groundwater standards, even after alternative water supply is provided
- A requirement for double walled tanks, or additional secondary protection to prevent leakage from underground storage tanks
- The strengthening of inspections and pollution prevention programs to reduce groundwater contamination incidents, and full accountability for responsible parties.

Ultimately, we recommend that NCDENR implement all environmental justice principles into all of their policies and procedures with communities. The principles of environmental justice were formally adopted in 1991 by the First National People of Color Environmental Leadership Summit. Principle Two and Principle Seven most pertinently reflect CWFNC requests of NCDENR. Principle Two states “environmental justice demands that public policy be based on mutual respect and justice for all people, free from any form of discrimination or bias” (First, 1991). Principle Seven states “environmental justice demands the right to participate as equal partners at every level of decision-making, including needs assessment, planning, implementation, enforcement, and evaluation” (First, 1991). These principles are most relevant as agency officials extend information and opportunities for mutual interaction (community meetings, door-to-door contact, etc.) in support of residents to some communities while failing to provide this support to others.

HISTORICAL REVIEW

North Carolina Origins of the Environmental Justice Movement

The African American community in Warren County, North Carolina gained national attention in 1982 by protesting the proposed construction of a toxic waste disposal site. They were the pioneers for African Americans thrust into the environmental justice arena by the growing recognition that environmental hazards were as pertinent to the health and empowerment of African American communities as the Civil Rights Movement’s fight for equal education, housing, and employment.

Starting in 1978, 32,000 cubic yards of soil contaminated with highly toxic PCB’s (polychlorinated biphenyls) had been dumped along ditches throughout 14 North Carolina counties (Bullard, 1990). As the largest PCB spill in U.S. history, “more than 30,000 gallons of PCB-laced oil was left on 210 miles of roadway in the state for four years before the federal EPA and the state of North Carolina began clean-up activities” (Bullard, 1990).

The PCBs originated from the Raleigh-based Ward Transfer Company. A Jamestown, New York, trucking operation owned by Robert J. Burns obtained the

PCB-laced oil from the Ward Transfer Company for resale. Faced with economic loss as a result of the Environmental Protection Agency (EPA) ban on resale of the toxic oil in 1979, the waste haulers chose the cheap way out by illegally dumping it along North Carolina's roadways. Burns and Ward were subsequently sent to jail for the criminal dumping of the tainted oil. (Bullard, 1990)

In 1982, Governor James B. Hunt designated the 84% African American community of Afton, North Carolina as the dumping site. Afton is located in Warren County, which was reported as having the highest percentage of African Americans in the state and ranking 92nd out of 100 counties in median family income in 1980 (Bullard, 1990). "Per capita income for residents was \$6,984 in 1982 compared with \$9,283 for the state," and the county unemployment rate was 13.3 percent in 1982 and 1983" (Bullard, 1990). However, over three-fourths of Warren County residents owned their homes, with 64% of African Americans owning their homes (Bullard, 1990). This is significant in that it renders a larger proportion of residents vulnerable to being impacted by well contamination. Ken Geiser and Gerry Waneck in *Science for the People* describe the decision:

The site at Afton was not even scientifically the most suitable. The water table of Afton, North Carolina, (site of the landfill) is only 5-10 feet below the surface, and the residents of the community derive all of their drinking water from local wells. Only the most optimistic could believe that the Afton landfill will not eventually leach into the groundwater. Unless a more permanent solution is found, it will only be a matter of time before the PCBs end up in these people's wells. (Bullard, 1990)

Local citizens organized to found the Warren County Citizens Concerned About PCB's, and became supported and endorsed by local grassroots groups, national civil rights leaders, black elected officials, environmental activists and labor leaders including Reverend Leon White of the United Church of Christ's Commission for Racial Justice, Reverends Joseph Lowery and Ben Chavis and Fred Taylor of the Southern Christian Leadership Conference, and District of Columbia Delegate Walter Fauntroy of the Congressional Black Caucus (Bullard, 1990).

Warren County Concerned Citizens About PCBs' official position was that the hazardous waste be shipped to Emelle, Alabama, the chemical waste landfill site approved by the U.S. Environmental Protection Agency (EPA). "While this option would cost considerably more money, how could the state put a price tag on the value of lives in Warren County" (McGurty, 2000)?

Upon gathering national attention, Dr. Charles E. Cobb, director of the United Church of Christ's Commission for Racial Justice affirmed to African Americans in 1982 that "We must move in a swift and determined manner to stop yet another breach of civil rights. We cannot allow this national trend to continue. If it means that every jail in this country must be filled, then I say let it be. The depositing of toxic wastes within the black community is no less than attempted genocide" (Bullard, 1990).

Nevertheless, "the state began hauling more than 6,000 truckloads of the PCB-contaminated soil to the landfills in mid-September of 1982. Just two weeks later, more than 414 protesters had been arrested" (Bullard, 1990). "This marked the first time Americans had been jailed protesting the siting of a waste facility" (Bullard, 2004). Robert Bullard, a leading African American social environmentalist, in his 1990 *Dumping in Dixie: Race, Class and*

Environmental Quality, credits Warren County African Americans with bringing national attention to siting inequities and galvanizing African American church leaders, civil rights organizers, and grassroots activists around environmental justice issues (Bullard, 1990). Bullard concludes “the question is not *if* the facility will leak but *when* the facility will leak PCBs into the environment” (Bullard, 1990). It would be more than twenty years before the remediation of the contaminated soils was completed and the landfill closed.

National Attention: The Emerging Awareness of Environmental Racism

Based on the militancy and organization of Warren County’s African American community, the District of Columbia’s congressional delegate Walter Fauntroy ordered the U.S. General Accounting Office’s 1983 investigation, “*Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities*” (Brueggermann, 1993). This study concluded that three out of the four commercial hazardous waste landfills located in Region IV of the Environmental Protection Agency (including Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) were located in predominately African American communities (Bullard, 2004). “All of the three black communities were disproportionately poor, with 26 percent to 42 percent of the populations living below the poverty level” (Brueggermann, 1993). Specifically, the hazardous waste landfill sites were Chemical Waste Management in Sumter County, Alabama, SCA Services in Sumter County, South Carolina, Industrial Chemical Company in Chester County, South Carolina, and Warren County PCB landfill in Warren County, North Carolina (Bullard, 1990).

In 1987, the United Church of Christ’s Commission for Racial Justice published *Toxic Wastes and Race in the United States: A National Report on the Racial and Socioeconomic Characteristics of Communities with Hazardous Waste Sites*. This study concluded that race is the most significant factor in determining where waste facilities are located (Interim, 1999). The study further confirmed “that 3 out of 5 African Americans and Hispanic Americans live in communities with uncontrolled toxic waste sites and that 15 million African Americans lived in communities with at least one site” (Interim, 1999). It identified four major “underlying factors related to race” that contribute to this phenomenon:

1. Availability of cheap land
2. Lack of opposition to the siting of the facility due to lack of political resources and clout
3. Inability to "walk with their feet" or lack of mobility resulting from poverty and housing discrimination
4. Poverty. The characteristics contribute to communities' vulnerability to unfair sitings of waste and polluting industries and, thus, their disproportionate exposure to environmental risk.

The long awaited 1990 analysis *Dumping in Dixie: Race, Class and Environmental Quality* served as a pioneering foundation for the progressing environmental justice movement. It correlated transportation, housing, urban development, Southern economic prosperity, waste facility siting, and other extraneous factors contributing to pollution with the disproportionate exposure to African Americans. Bullard therefore serves as a significant source of information

conveyed in many environmental justice literature reviews. In *Dumping in Dixie*, Bullard contends that:

Polluting industries were brought into poor communities with little input from local community leaders. When questions were raised by concerned citizens, the argument of jobs for local residents was used to quell dissent. Environmental risks were offered as unavoidable trade-offs for jobs and a broadened tax base in economically depressed communities. Jobs were real; environmental risks were unknown. This scenario proved to be the de facto industrial policy in "poverty pockets" and job-hungry communities around the world.

For example, in the 1970s four of the five states that led the nation in attracting polluting industries such as paper, chemical and waste disposal firms were located in the South. These four states, Texas, South Carolina, North Carolina, and Florida, are not known for having strong environmental programs. (Bullard, 1990)

In 1992, The National Law Journal's Special Issue *Unequal Protection: The Racial Divide in Environmental Law*, "concluded that the Environmental Protection Agency (EPA) took 20% longer to identify Superfund sites in minority communities and that polluters of those neighborhoods paid fines 50% as large as polluters of white communities" (Shrader-Frechette, 2004). Concluding that "there is a racial divide in the way the U.S. government cleans up toxic waste sites and punishes polluters," it specifies that "white communities see faster action, better results and stiffer penalties than communities where blacks, Hispanics and other minorities live. This unequal protection occurs whether the community is wealthy or poor" (Texas, 2004). Ultimately, *the Journal* reveals discrepancies existing in the enforcement of environmental laws, including penalties imposed, and in the pace of cleanup (Texas, 2004).

In 1994, African American communities in Mebane, North Carolina organized to form the Westend Revitalization Association in response to increased racial discrimination in protecting their environment and historic properties from a highly destructive highway bypass, and municipal unwillingness to provide basic amenities including sewer, water, voting rights and decent housing. After years of battling with local officials over contamination issues in their wells, the EPA collaborated with WRA and University of Chapel Hill researchers to produce the EPA Environmental Justice Study, *Failing Septic Systems and Contaminated Well Waters: African-American Communities in Mebane, North Carolina (2002)*. It specified that over 500 homes, churches, and a Masonic Temple were being threatened by failing septic systems and contaminated well water and surface water, along with water and sewer lines that do not meet minimum code standards in the City of Mebane (EPA, 2002). It also cited a toxic spill of petroleum fuels, land-use and facility plans that exclude minority communities, current and future city growth plans that redline and reduce the voting strength of minorities, and "Mebane's long-history of refusing to apply for state/federal grants to address affordable housing and lack of basic amenities in the face of public health risks, HUD investigations, and directives by the U.S. Department of Justice" (EPA, 2002).

Federal Environmental Justice Initiatives

As it has served substantially for many struggles of equality faced by minorities, the Civil Rights Act of 1964 also provides protections from environmental threats that

communities have fought against. Title VI's "no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance" has increasingly been applied to decisions on projects that receive federal funds (Interim, 1999). However, "the EPA's guidelines released in late June stipulate that 'both the demographic disparity and the disparity in rates of impact (must be) at least a factor of two times higher in the affected population' for the EPA's Office of Civil Rights to pursue civil-rights cases against companies" (Lantigua, 2000). Ultimately, President Clinton, upon agitation by the United Church of Christ's Commission for Racial Justice and others, issued the 1994 *Executive Order 12898 "Federal Action To Address Environmental Justice in Minority Populations and Low-Income Populations,"* which intended "to ensure that such populations are not subjected to a disproportionately high level of environmental risk" (Office, 2004). It directed each federal agency to develop an environmental justice strategy for "identifying and addressing . . . disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Office, 2004).

In conclusion, the above-mentioned studies and proclamations of environmental justice document the imminent need for accountability and progress in improving the health risks of minority populations. Many of the statistically supported studies citing environmental racism have focused on landfills and other hazardous waste facilities because these are most apt to be public record, included in federal and state databases, and can be more directly traced in terms of public notification, location determination and outcomes. However, this study is unique in that it intends to investigate the experiences of communities with varying demographics in the wake of groundwater contamination of private wells.

INTRODUCTION

Methodology

Sources Used & Compared: 1. NCDENR Files for each groundwater contamination incident
2. Resident Survey Results

Information regarding the investigations of contamination incidents was acquired from the North Carolina Department of Environment and Natural Resources (NCDENR) regional Divisions of Water Quality and Waste Management sections. The public has access to complete file contents for each incident. When an investigation has obtained substantial information on a particular incident, the Groundwater Section investigator will compile a "Report of Investigation," summarizing the purpose and scope of investigation, background information surrounding the incident and community impacted, site investigation results, costs, and future plans. In some cases, the owner or operator found responsible for a contamination incident is required to hire a consultant that also produces a formal investigation report or Corrective Action Plan (CAP). These files (NCDENR Regional Office Files) were used as the primary source of information concluding the scientific results and implications of the contamination from NCDENR's perspective.

These DENR files were directly compared to resident sentiments to determine the extent of notification of residents facing contamination and the efficiency of remediation procedures on residents' behalf. These Reports of Investigation, citing groundwater contamination, were also compared to the level of notification of surrounding residents with wells in respect to the findings. Resident sentiments were obtained through in-person and phone interviews of property owners adjacent and within a 1500 feet radius of each respective contamination incident.

Background

The U.S. Environmental Protection Agency defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (U.S. EPA, 2004). The environmental justice movement has emerged from the recognition that people of color, people with low incomes, and those with the least access to health care, financial security, or political power are more often exposed to life-threatening environmental risks where they live and work (Commission, 1987).

This study selected a diverse sample of North Carolina communities to investigate the relationships between income, race and education of communities impacted by groundwater contamination, and how these factors may influence notification of well users around a contaminated site, the extent of site cleanup and the provision of a safe community drinking water supply. Because private well users have no legal protections against groundwater contamination and no water testing standards, and because groundwater contamination can be extremely difficult to trace, it is hypothesized that minority and low income communities impacted by groundwater contamination experience disproportionately higher social, political, and health risks than white communities of higher income. More specifically, this study will compare and analyze

- 1) The extent of notification of neighbors with wells susceptible to a contamination incident
- 2) The provision of a safe water supply
- 3) Quality, maintenance and efficiency of remediation of groundwater
- 4) Environmental justice implications

It should be emphasized that years may elapse between the time that a contaminant enters the environment and when it shows up in the groundwater. Just as likely, years of remediation are required to clean up groundwater contamination with often very expensive methods (Danielson, 1996). “Contaminants dissolved in groundwater do not degrade rapidly, since there is little potential for their breakdown from the action of air and light” (Danielson, 1996). The North Carolina Cooperative Extension Service reports that “underground storage tanks are responsible for 67 percent of the contamination incidents reported, and spills are responsible for 12 percent of the incidents reported” (Danielson, 1996). Of the four communities surveyed, confirmed contamination sources include Underground Storage Tanks (UST's) and associated petroleum products, while three communities' contamination sources are not fully defined, but are likely due to dairy farming and other agricultural by-products, an auto body shop and other businesses.

A DIVERSE SAMPLE OF COMMUNITIES

Two communities surveyed reflect a predominantly minority or low-income population and the other two reflect predominately white middle to upper income populations. The residents closest to the Bennett & Bailey site, located southwest of Winston- Salem, NC, are a trailer park community comprised of six low-income families, five white and one Hispanic. The education level of this community averages high school graduation. All six families share one drinking water well. The Poole and Barwell Roads site, where residents have used private individual wells, is a historically African American community of mixed incomes located in southeast Raleigh. Resident education levels vary from terminal degrees, and several Master's degrees, to below high school education. Ironically, a North Carolina legislator is a resident of this community. The Jimmy's Quickie Mart site is located in Providence, a small township near Yanceyville, in Caswell County. The Jimmy's Quickie Mart community is predominantly white, closely knit, rural, and of low to working class incomes. With many retirees, educational levels are low but the rural dynamics allow long-term home ownership. Residents used private wells before widespread contamination was found.

Finally, Greenview Bluffs is a rural housing development outside Raleigh city limits composed of about 30 homes. Census Bureau demographics reveal that the area is composed of zero to ten percent minority presence. The community is highly affluent, composed of large and stately residences with elaborate landscaping. Education levels average some college to post-graduate.

Each Community's Struggle

Bennett & Bailey

Groundwater Contamination Background

A small trailer park community and adjacent residences in the southwest corner of Forsyth County along U.S. 158 and the old Stratford Road have been struggling to get adequate notification of residents and reliable remediation of a groundwater contamination incident originating from the Underground Storage Tanks of an old neighborhood gas and convenience store. "Bennett & Bailey" was the gas station and convenience store originally built in 1933. In 1993, the Bennett & Bailey store was condemned and torn down due to widening US 158 (Stratford Road). Five underground storage tanks containing gasoline, diesel and kerosene were removed in December 1993, and have been blamed for petroleum releases. In addition, the Department of Transportation removed at least one UST, product pipe and approximately 2,100 tons of contaminated soil. Soil and groundwater samples revealed high concentrations of MTBE, benzene, toluene, ethylbenzene, and zylenes. Currently, the site is considered a "High- Risk" priority because no water supply lines extend to the area.

NCDENR requires that when groundwater contamination is found in private wells, the cleanup process be sponsored by the responsible party. The responsible party sited in this incidence hired a consultant firm to analyze the toxic contents of the area and implement treatment processes to cleanup the pollution. The 1997 Corrective Action Plan outlined by the consultant identified a total of 34 potable wells within 1,500 feet of the site. However, few of them have been sampled. It took environmental consultants and NCENR from January of 1997 to December of 1999 to approve and implement a remediation system at the site. Since, the

remediation system has been cited on numerous occasions by residents and DENR officials for a functional failures, and a new consultant was hired in 2003.

Although DENR maintains that the contaminated plume has not reached the drinking water well yet, they have concluded that the 1999 Corrective Action Plan has failed to control the contamination plume. All parties recommend that the trailer park residents, whose water supply well is highly in danger, be connected to city water lines that are only 300 feet away.

Residents' Sentiments

The immediate trailer park includes six trailers/families. Across a small stream from the trailer park is the childhood residence of Harold Stanley, whose family he believes to have been impaired by the long-growing pollution and who has stepped up as a community advocate, fighting continually for justice in notification of residents and for safe drinking water.

As a result of responses from the resident surveys distributed to local residents within 1,500 feet of each contamination incident, information was obtained that greatly exceeded that related to the extent of notifications found by reviewing the investigation from the NCDENR files and officials. The first recollections of any knowledge of the contamination by residents occurred when contractors hired by the responsible party actually began removing the contaminated soil, witnessed by trailer park residents. Stanley, along with the trailer park's resident co-owner, say that the construction crew stopped them from smoking because the petroleum vapors absorbed in the soil and as free product around the UST were so strong that cigarette butts could start a blaze. They witnessed the huge hole where the underground storage tank was removed and even remember the Department of Transportation Superintendent concluding that they had removed *most* of the contaminated soil but that the new Stratford Road construction would cover some and the rest would be left. The co-owner claims that he was not even notified by NCDENR by the time the remediation system was up and running. He says that he was informed by an investigative reporter from the Winston- Salem Journal who had come on site to complete his story, *A Soiled Past: Old Store's Leaky Fuel Tanks Leave A Complex, Unwanted Legacy* in July of 2001. Other residents surveyed within 1,500 feet range in notification, from the removal being their first knowledge, to hearing it on television, or "word-of-mouth."

NCDENR files indicate that notifications of well sample results and health risk evaluation reports were conveyed to the trailer park owners throughout the investigation. Although both owners of the trailer park were not available for interview, the one surveyed said that some materials may have been sent to his co-owner but he obtained testing results and investigation information by going to the Winston- Salem office himself. He also requested information from the environmental consultants as their staff were on site.

Certainly, since not even the adjacent property owner was notified, as NCDENR officials unofficially claim to be their procedure, the actual residents living in the trailers had no idea that groundwater contamination was so closely threatening their well.

Residents seem to doubt the results of sampling around the site because the tests and reports are carried out by consultants hired by the responsible party, therefore leaving suspicion of biased reporting of test Confirmed contamination sources results.

Poole & Barwell Road Wells

Groundwater Contamination Background

Residents residing in the Beechwood community near the intersection of Poole and Barwell Roads in Southwest Raleigh have been plagued by the existence of well contamination

for which NCDENR officials have failed to conclude any direct source or responsible party, therefore, stunting clean up efforts and posing grave financial responsibilities for residents. In response to complaints from a community leader throughout April and May of 2003, Wake County Environmental Services officials sampled wells along the intersection of Poole and Barwell Roads, concluding that “samples revealed low levels of contaminants in 18 residential water supply wells” (North, 2004). The compounds detected in these samples included 1,2 dichloropropane, methyl tertiary-butyl ether, tetrachloroethylene, trichloroethylene, chloroform, and naphthalene (North, 2004). The existence of an abandoned Underground Storage Tank pit from Carolina Auto Body Repair & Open Air Market and from a former Self-Serv gas station, along with the petroleum products found in the surrounding wells initially suggested a specific source. However, further investigation failed to specify any UST’s with leakage. Consequently, on July 1, 2003, the UST section transferred the files to the Groundwater section (North, 2004). This meant that bottled water could no longer be supplied to the residents because it was being provided under the UST Trust Fund.

Contamination first emerged in the area as far back as March of 1986, when two residences across Poole Road were found to have hazardous levels of benzene and 1,2 DCP in their wells and began receiving bottled water in the 1990’s. However, it was not until July 21, 2003, that the NC Division of Water Quality Groundwater Section’s Field Investigation Group compiled results on the extent of contamination from the drinking water wells of residents, 11 monitoring wells and soil samples surrounding the old UST pits.

The most widespread contaminant found surrounding these wells was 1,2-dichloropropane (1,2-DCP), commonly used as a crop fumigant, degreasing solvent or gasoline additive. Because 1,2-DCP was “widely distributed in the deep aquifer,” but not detected in shallow aquifers or soil samples taken near the UST area, NCDENR officials concluded that the source came from its use as a crop fumigant (North, 2004). Tetrachloroethylene (PCE) and Trichloroethylene (TCE) were also found in the drinking water wells pulling from deep aquifers, but not in soil samples below the former UST systems, leading the Division to conclude contamination from household use. Local leaders and advocates for the community objected to this conclusion as tending to absolve the most likely local sources of responsibility and need for further investigation.

On June 19, 2003, the most adamant community leader held a meeting at his church intended to enable residents to raise their concerns and questions with NCDENR Groundwater Section representatives. City of Raleigh officials and NCDENR officials advised that city water hookup costs may be able to be financed with the city on a 5 year, 8% interest schedule, or that owners may also hire their own utility contractor. Residents actually considered collectively hiring a utility contractor for the connections, although they will still face city fees ranging from approximately \$500 to \$3,000 (City). Nevertheless, *connection* to the city water mains is the financial responsibility of the residents, with those residences not already within extension lines paying an additional \$2,500 per household, in addition to a connection fee.

Resident Sentiments

Community leaders on this site united residents, collected investigation information and corresponded with the media and advocacy groups to gather support for the provision of a clean water supply. The most persistent leader and local pastor lives adjacent to the Carolina Auto Body and Open Air Market. In response to statements in a summary report that suggest the residents were responsible for contamination of their own wells, leaders maintain that their wells

have always had a sealed casing, have never been opened, and recall all residents being outraged at the idea, exclaiming “we love our well water, why would we contaminate our own water.” However, they first learned of the community’s contamination through activism in the siting process of rezoning the surrounding land in the immediate neighborhood. Citizens mentioned that fuel tanks were still in the ground. They then called NCDENR and officials confirmed that there were UST’s in the ground and that there had been a 1996 spill at the Carolina Auto Body Shop. Three inquiring neighbors contacted the health department to test their wells, at a cost of \$100 per well. They then were alarmed to get answering machine messages warning them to not drink their water. They did receive a Health Risk evaluation from DENR’s toxicologist and began receiving bottled water provided by DENR’s UST section. Elderly residents recalled that the current Carolina Auto Body used to be a juke joint and then a service station with buried tanks.

In addition, there was another service station about a mile and a half away that had a recent spill in which a gas pump was running all night long, with gasoline flowing along ditches and down streets, and which the responsible party was allowed to ‘clean up’ themselves with sand. It was disheartening to the “Beechwood” community to realize that contamination had been evident and bottled water had been provided to two residences across the street since 1996 without notifying even their immediate neighbors or sampling other wells. They were astounded at the apathy of DENR officials in their lack of notification to residents and the extent to which they leave polluters to police themselves. Residents know that the Auto Body Shop has a history of disposing of chemicals in an obscure manner. Because several residents had newly built wells, they were disturbed to see that no notification was given upon issuing a well permit, but proudly confirm that as a result of their community’s agitation, all new wells are required to be tested at digging by Wake County. Ultimately, Poole and Barwell Road residents credit Wake County as being one of the most supportive levels of government, refunding the monies paid for initial well testing, and enforcing notifications for new wells. The Raleigh City council also heard their calls for support, proceeding with initiatives to get city water lines installed and assisting with grant applications to help with hookups.

Jimmy’s Quickie Mart

Groundwater Contamination Background

By May of 2001, eighty-nine wells within a 1500 foot radius of Jimmy’s Quickie Mart were sampled by Caswell County Environmental Health Department and the Winston- Salem Regional DENR office. Forty-three wells contained chlorinated solvents and petroleum hydrocarbons or both, with twenty-three being above standards. The chlorinated solvents included tetrachloroethylene (PCE), trichloroethylene (TCE) and carbon tetrachloride (CT). The petroleum hydrocarbon compounds included benzene, methyl tert-butyl ether and isopropyl ether.

The Town of Yanceyville was very responsive to the welfare of residents whose wells were impacted, waiving all tap and connection fees to hookup to city water within 11 months.

Resident Sentiments

Residents of this community were all but thrilled with their experiences with state groundwater officials. They said that they were supplied with bottled water, kept very informed, and connected to public water within a reasonable time span. Residents report that several community meetings were held over the course of a year keeping them updated. They first

learned of contamination in their neighborhood when Jimmy's Quickie Mart was sampled because it was opening a new grill and would be considered a community drinking supply. After finding contamination in the well, residents report that DENR sampled all wells within a radius of Jimmy's, which is a very commendable strategy that other communities were not afforded. Although community samplings revealed a complex mixture of contaminants and source directions, like that of Poole and Barwell Road wells, all residents with any contaminated wells were given free public water hookups. In interviewing residents, we found that Jimmy, the owner of the Quickie Mart, was very politically involved and participated on a number of county boards and governmental agencies. This significantly explained the responsiveness of the town of Yanceyville to connect residents for free. Residents also reported that the town of Yanceyville did indeed profit from this initiative, as many residents whose wells were not contaminated related to this incident paid for hookups to the public water system.

Greenview Bluffs

Groundwater Contamination Background

This site is a rural housing development of about 30 homes, with half of resident wells impacted by nitrates. Wake County Environmental Services Department first sampled wells in August and November of 2003. NCDENR officials report that possible sources include the previous dairy farm's waste lagoon on which the site was built, septic tanks and lawn chemicals. DENR officials believe that an additional supply well in the vicinity will only draw the plume closer to residents. The area where the development is located has specific zoning that prevents public water lines coming out from a municipality, in order to prevent sprawl. All parties consulted agreed that residents purchase personal filtration systems.

Resident Sentiments

Greenview Bluffs residents, upon contact, had very optimistic, non-specific, and satisfactory attitudes about their experiences with agencies investigating contamination. Most learned of the contamination from community meetings held with DENR in November of 2003, February and March of 2004, and from health risk evaluations. However, one resident insightfully informed us that she first learned of the contamination from a well filtration system business who was employed to install a personal system on the household and that the company consequently informed other residents for sales purposes. We also concluded that at least part of the reasoning for the sufficient notification received as compared to the other communities was because the private filtration business that had discovered contamination in one home initially, then went door-to-door, notifying residents for sales purposes. Upon gaining information and investigation progress at the community meetings, residents actively responded by email to DENR, expressing concerns and recommendations. One resident concluded that priority be placed on clean-up efforts rather than finding a responsible party, that a swifter timeframe for testing monitoring wells be implemented, and that well testing should focus more around the highest contaminant readings rather than geological formations. Residents were also concerned about the value of their properties decreasing, as they describe their community as one where "there is literally nothing ever for sale." For alternative sources of water, one resident already had a Reverse Osmosis filter, which is very expensive to maintain, and others purchased personal filters on their wells. Overall, residents said that agency officials were very helpful, tested their wells adequately, and even went door-to-door discussing information.

The Extent of Notification Received by Residents Susceptible to Contamination: Resident Experiences with NCDENR

In contacts with NCDENR, officials very cautiously contended that the demographics of the communities impacted were in no way made a part of their investigations and that they could not distinguish communities on any such basis. However, the resident survey results revealed slightly different results. Coincidentally, both Greenview Bluffs and Jimmy's Quickie Mart communities, white, rural and middle to upper income communities reported excellent interactions, notifications, feedback and updates from DENR officials. Both communities included many residents who could afford to connect personal filter systems to their wells, either before or upon notification of contamination. Residents reported door-to-door visits from DENR officials, regular updates, several informative community meetings, and excellent experiences overall from DENR.

These survey results compare to Poole and Barwell Road and Bennett & Bailey residents, who collectively expressed significantly contrasting experiences with DENR officials. When asked "What recommendations would you make to DENR officials as to how they could better serve you" as well as "What specific concerns or dissatisfactions can you recall in your experience with agency officials," Poole & Barwell Road and Bennett & Bailey residents all resoundingly responded initially with "we would be here all day" or "where do I start?" Poole and Barwell leaders said that they received official notification of the local contamination only after contacting DENR themselves to verify the rumors. Their wells were tested by Wake County Environmental Services, who they regarded as helpful and more consumer friendly. They continue to contend that obtaining information from DENR has been a struggle, as officials have tried to hide findings, have not done more than the initial samplings, and have threatened their bottled water supplies. Bennett & Bailey residents contend that agency officials have strategically disserved and undervalued the experiences and risks of the trailer park families because of stereotypical, economical, and education implications. NCDENR officials held community meetings at all three other sites except for the trailer park residents. NCDENR officials did not walk through the community and discuss information with Poole & Barwell or Bennett & Bailey residents, as they did in Greenview Bluffs and Jimmy's Quickie Mart cases. Poole and Barwell Road residents had to call their own community meeting, inviting DENR officials, and Bennett & Bailey residents have had no such community meeting with state officials, whereas DENR officials initiated and satisfactorily conducted informational meetings with Greenview Bluffs (at least twice) and Jimmy's Quickie Mart residents.

The Provision of a Safe Water Supply

In both the Poole & Barwell Road and Bennett & Bailey's incidents, the provision of a clean water supply has been largely left to the communities. Bottled water was being provided to a *few* insistent residents in the Poole & Barwell Road incidents, although they do not officially qualify for the water services any more because their case has been transferred out of the sponsoring department. Bennett & Bailey residents are constantly disturbed by a loud pump-and-treat remediation system that has proven to be unstable in proper functioning or preventing the plume from spreading. The community impacted by Jimmy's Quickie Mart was supported by the town of Yanceyville, who extended water mains and provided hook ups to city water at virtually no cost. Ironically, in a letter to Yanceyville's Town manager regarding remediation options, a

NCDENR supervisor expresses that the use of pump-and-treat- systems “are of limited benefit.” This is the same treatment chosen to remediate Bennett & Bailey’s groundwater. Some Poole & Barwell Road residents are financially able to hook up to city water while others are not. Trailer home residents would gladly hook up to city water in the face of a plume so close to their water supply well but fear costs. In all cases, DENR has maintained the installation and sampling of monitoring wells in each site as their focus, as opposed to focusing on acquiring an alternative water supply for residents, or keeping residents informed of updates and sample results. Greenview Bluff residents are either connected to a community well which has not been impacted or have been maintaining filtration systems on their individual wells.

Quality, Maintenance and Efficiency of Groundwater Remediation

The quality, maintenance and efficiency of a remediation system installed to pull a contaminated groundwater plume away from drinking wells is most pertinent in the case of Bennett & Bailey. This is the only remediation system out of the four communities studied that is already up and running, and is being trusted by DENR to keep the plume away from a water well still being used by six families. More specifically, the inefficiency of the remediation system, reported by both DENR officials upon site visits and residents presents a minimally functioning solution to a wide spread plume. Residents more candidly conclude that these inefficient clean up efforts only parallel the regard for lives demonstrated by NCDENR to residents.

In September of 1997, a combination of soil vapor extraction, air sparging, and groundwater pump-and-treat was approved as the official remediation method for this site. DENR’s Groundwater section admitted that “although this combination is not powerful enough to clean up the site in a short term, it is the best we have for this site.” Pump-and-treat is a mechanism that pumps contaminated groundwater from the center of the plume (to prevent further migration) and then passes it through a treatment filter before releasing it to a surface stream. Air sparging injects air into an aquifer to speed up the biodegradation process and soil vapor extraction extracts the vapor phase of petroleum hydrocarbons from soil and groundwater. In May of 1998, the responsible party was issued a Notice of Violation for failure to implement the remediation system in a timely manner. By February of 2000, the remediation system was supposed to be up and running continuously. On June 3rd, and from September 10th to 24th of 2003, NCDENR visits to the site showed that the remediation system was not running, indicating varied and insufficient functioning.

As of October 2002, the environmental consultants admitted that the Corrective Action Plan initially proposed in June of 1998 and including the remediation system has been failing. They recommended the installation of 3 additional recovery wells to “immediately protect the water supply well for the mobile home park and to capture the existing release plume.” They also recommended replacing the existing pumps in the pump-and-treat remediation system as well as connecting the mobile home park to the city of Winston-Salem water supply. A new consulting firm has since been hired, and newly assigned DENR staff are more closely monitoring the site.

In the Poole & Barwell Roads incident, many residents have long relied on their wells not only for drinking, cooking and bathing, but also for swimming pools, gardening, home improvements, and car washing. Most health risk evaluations in the area advise against drinking and cooking, but allow short showers, leading one resident to comment “If we are not supposed to drink the water, how can it be safe for us to let it saturate our skin?” Although some adamant

residents are still being supplied bottled water, many more are still left susceptible to the un-delineated plume of contamination.

Individual filtration systems can be a reliable form of protection for well users when kept continuously functioning and when filters are properly changed, as in the Greenview Bluffs case.

Environmental Justice Implications

As of the date of this publication, neither Bennett & Bailey residents, nor Poole & Barwell road residents have been connected to city water, though the latter community is having water lines installed. For the Poole & Barwell Roads and Greenview Bluffs sites, Wake County Environmental Services has led the way in acquiring initial samplings of wells upon complaints and then transferring results and the need for health risk evaluations to the NCDENR toxicologist. Wake County Environmental Services has also led the way in the establishment and enforcement of well regulations that protect new renters, leasers and homeowners from already contaminated wells, and require testing and tougher permit requirements for newly constructed wells. Yet, income differentiations and other various factors result in the white, upper income Greenview Bluffs community connected to city water or equipped with personal filtration systems since the August of 2003 contamination results, while Poole & Barwell residents have faced known contamination close to their wells since at least 1996.

Jimmy's Quickie Mart residents had the opportunity to connect to Yanceyville city water, essentially free of charge by December of 2001, within a year of the initial February samplings. However, Bennett & Bailey residents, the poorest population surveyed, have been fighting for unaffordable city water lines and hookups, and have instead been forced to use a drinking well close to the contaminated plume since 1993. Residents say that over the years, the city has connected water lines all around them, including the closest and most recent connection for a new subdivision down the street. The county has also annexed the developing township of Clemmons, down the street in the other direction, but has refused to extend Clemmons lines to the trailer park. To residents, this sums up to a blatant refusal by government officials to protect them, and a flagrant method of "running them out."

Jimmy's Quickie Mart residents were also included by DENR in a wide community sampling, where a 1,500 foot radius was drawn delineating the extent of possible contamination and all wells within that radius were tested. This technique exemplifies the proper way in which communities should be sampled, but was apparently only done in this case, out of the four. Poole & Barwell Road residents were only tested once as each household complained, leaving other less assertive residents living between and beside contaminated households untested.

The above literature review largely cites environmental injustices that clearly conclude disproportionate risks to African American citizens with inferences based on racism. However, investigation of the experiences of Bennett & Bailey residents strongly compares with the predominately minority Poole & Barwell Roads community. The significant similarities in the experiences of minority and low-income communities include the objectionable agency summations of risks, the length of time in which residents have been at-risk to contaminated water without an adequate alternative source, and the negative receptions of residents as to their experiences with DENR and notification. For Bennett & Bailey residents, environmental injustice has prevailed more because of income, class, lack of education and lack of political power. These factors have caused residents to feel distanced from their right to information, a factor increased by NCDENR's minimal efforts at conveying information to these residents. It

should be highly noted that Poole & Barwell Road residents were very politically involved, a factor external to race, income and education, and therefore this greatly enhanced their success in obtaining an alternative, clean water supply.

CONCLUSION

The EPA factors environmental justice assessments by four indicators: environmental, health, social and economic. “The conditions these indicators seek to illuminate include, but are not limited to: adverse health or environmental impacts, aggregate or cumulative impacts, unique exposure pathways, vulnerable or susceptible populations, or lack of capacity to participate in decision-making process” (Environmental, 2004).

Environmental Risks

Due to reduced resources and funding in DENR agencies, when communities are hooked to city water supplies, the cleanup priority levels of contaminated sites are lowered to produce minimal further investigation and in many cases, no impetus for clean up, especially when a responsible party is not found. For example, the UST Trust Fund is now some 30 million dollars in debt, allowing remediation funding of only the highest risk sites. Therefore there are long term environmental risks to groundwater safety when communities are hooked up to city water supplies, while leaving the contaminated groundwater unremediated.

The Interim National Black Environmental and Economic Justice Coordinating Committee recommends that environmental justice in such cases include government and industry policies aimed at reducing and preventing pollution and all forms of environmental degradation, such as sustainable economic practices, involving the use of clean technology applications and materials uses, safe recycling and reuse of materials, advanced procedures to safely eliminate or substantially reduce existing environmental toxins, and use of alternative energy resources (Interim,1999). Support for enforcement, pollution prevention and toxics reduction has actually decreased in recent years on both federal and state levels, leaving communities and their environments more vulnerable.

Health Risks

With multiple contaminants identified and residents exposed to the contaminated groundwater being notified via “Health Risk Evaluations,” the health risks of each contaminant to residents is highly pertinent, with possible synergistic effects. Bennett & Bailey residents report suspected impact to the extent that numerous cancer deaths have occurred within the surrounding area. Poole & Barwell Road residents report having been drinking water from wells in closer proximity to the polluting sites than a few residences across the street which had been supplied bottled water since 1996. Therefore, the specific health implications of the major pollutants impacting these communities are discussed below.

Benzene is a clear, colorless, and highly flammable liquid used to make plastics, rubber, resins and synthetic fabrics, or as a solvent in printing, paints, and dry cleaning (U.S. Environmental, 2004). Short-term exposure to benzene can yield temporary nervous system disorders, immune system depression, and anemia (U.S. Environmental, 2004). Long-term exposure can result in chromosome aberrations and cancer (U.S. Environmental, 2004). The EPA

recommends that benzene be removed through a treatment process called Granular activated charcoal in combination with Packed Tower Aeration (U.S. Environmental, 2004).

1,2 dichloropropane (1,2- DCP) is reported by DENR to be used as a crop fumigant, a degreasing solvent or a gasoline additive (North, 2004). It is a carcinogen, particularly to the liver, but also may damage the kidneys and nervous system (New, 2002). The North Carolina state groundwater standard for 1,2 Dichloropropane is 0.56 micrograms per liter or parts per billion. The EPA recommends that 1,2- DCP be removed through a treatment process called Granular activated charcoal in combination with Packed Tower Aeration (U.S. Environmental, 2004).

Methyl tertiary-butyl ether (MTBE) is a gasoline additive used to reduce carbon monoxide air emissions and commonly stored in underground storage tanks. The EPA states that “there is little likelihood that MTBE concentrations between 20 and 40 ppb in drinking water would cause negative health effects” (EPA, 2004). The City of Santa Monica shut down the majority of the City’s drinking water wells due to MTBE contamination in 1996 (Amini, 1997). At the California State Action Level of 35 µg/l, the preliminary potency estimates lead to calculation of lifetime incremental cancer risks for 30 years of continuous exposure of less than 2 per million for MTBE ingestion exposures and less than 5 per million for inhalation exposures related to indoor air pollution from tap water use (Amini, 1997). The EPA recommends that MTBE be removed through air stripping, granular activated carbon (GAC), advanced oxidation, and through the use of some home treatment units (U.S. Environmental, 2004).

Tetrachloroethylene, also referred to as perchloroethylene (PCE) is used as a general industrial and degreasing solvent found in products sold to clean small engines, automobile motors and brakes, and to clean grease clogs out of drain pipes (North, 2004). PCE is a carcinogen that can have adverse biological impacts even when absorbed through the skin. It can damage the lungs, liver, kidneys, reproductive system, and nervous system, and can irritate breathing, skin, eyes, nose and throat upon exposure (New, 2004). Additionally, a study of women exposed to PCE, also used as a dry-cleaning chemical, researchers found that women over 35 years of age and those with several past miscarriages were at greater risk of having a small-for-gestational age infant when exposed to the chemical (Mulvihill, 2001).

Trichloroethylene (TCE) is used as a general industrial and degreasing solvent found in products sold to clean small engines, automobile motors and brakes, and to clean grease clogs out of drain pipes (North, 2004). It can also be a by-product of PCE degradation (North, 2004). In drinking water, most of TCE will be absorbed in the blood and then changed by the liver into other chemicals, the majority of which are expelled from the body within a day (Hasan, 2002). “But some of it can be stored in body fat for a brief period and may build up in the body if exposure continues” (Hasan, 2002). Research shows that prolonged exposure to TCE can affect the liver, kidneys, endocrine system and fetuses, and can also cause cancer (Hasan, 2002).

The physical and chemical properties of the chlorinated hydrocarbons trichloroethylene (TCE) and perchloroethylene (PCE) “permit small amounts of these solvents to contaminate a large volume of groundwater while simultaneously creating technical problems in the application of conventional groundwater treatment technologies” (Cheremisinoff, 2004). Because the very dense poisons TCE and PCE percolate very quickly through the unsaturated zone and then below the groundwater, sometimes hundreds of feet, the volume of contaminated water can be much greater (Cheremisinoff, 2004). “As an example, about 15 gallons of TCE can impact an area 1,000 meters in length, 100 meters in width, and 20 meters in depth with an average concentration of 100 ppb, or roughly 528 million gallons of contaminated groundwater”

(Cheremisinoff, 2004). Regarding the strangely difficult tracing of the contaminants in the Poole & Barwell Road wells, the existence of TCE and PCE contaminants themselves pose remediation issues.

First, because of daughter compounds or by-products of environmental transformations, the identification of the source of contamination becomes much more difficult. As a result, the abatement of the source of discharge takes more time, during which additional contaminants may be introduced into the environment. Second, treatment methods developed to remove one compound may prove ineffective in removing the breakdown compounds. Third, the chlorinated hydrocarbons may be transformed into contaminants that have lower MCLs or higher MCLs, making remedial activities much more difficult to accomplish. (Cheremisinoff, 2004)

Researchers warn that drinking water contaminated with PCE is not solved by drinking bottled water because "inhaling PCE is so much more (of an) efficient way to get into the body, that showering with contaminated water contributes as much to exposure as ingesting it" (Mulvihill, 2001). The EPA recommends that PCE and TCE be removed through a treatment process called granular activated carbon in combination with Packed Tower Aeration (U.S. Environmental, 2004).

Chloroform is used as a solvent and in production of other chemicals (North, 2004). It can be a by-product of disinfectants used in wells and drinking water systems (North, 2004). However, it is carcinogenic, can damage developing fetuses, cause the heart to beat irregularly or stop, and can cause long-term damage to the liver, kidneys and nervous system (New, 2002).

Nitrates, the primary contaminant in the Greenview Bluffs community, are historically used in crop treatments to prevent nitrogen depletion from soil. The EPA's maximum contaminant level is 10 mg/L. Once consumed, nitrates are converted to nitrites in the body. The EPA warns that high levels of nitrate in drinking water have caused serious illness and sometimes death. It can also cause life-threatening illness in infants because the conversion of nitrate to nitrite by the body can interfere with the oxygen-carrying capacity of a child's blood (U.S. Environmental, 2004). "This can be an acute condition in which health deteriorates rapidly over a period of days. Symptoms include shortness of breath and blueness of the skin" (U.S. Environmental, 2004). On a long-term basis, nitrates and nitrites are contributed to diuresis-increased starchy deposits and hemorrhaging of the spleen (U.S. Environmental, 2004). The EPA recommends that nitrates be removed through Ion exchange, Reverse Osmosis, and Electrodialysis (U.S. Environmental, 2004).

Lead, a contaminant also of issue in the Bennett & Bailey and Jimmy's Quickie Mart incidences, "remains the number one environmental health threat to American children" (Interim, 1999). Among the 1.7 million children who are lead poisoned, Black children are contaminated at twice the rate of white children at every income level (Interim, 1999). Short term effects include interference with red blood cell chemistry, delays in normal physical and mental development in babies and young children, slight deficits in the attention span, hearing, and learning abilities of children, and slight increases in the blood pressure of some adults (U.S. Environmental, 2004). Long term effects include strokes, kidney disease, and cancer (U.S. Environmental, 2004).

Social Implications

One of the main social implications or risks exemplified in environmental injustices is the underestimation of risks to impacted communities. These underestimations involve health risks, financial obligations imposed on residents, already disproportionately low housing, food, education and employment resources, inadequate citizens rights given to non-owner residents, and institutional racism. Underestimating risks is embodied by using qualitative and opinionate assumptions. That is, basing conclusions on largely subjective judgments formulated in purely qualitative language (Shrader-Frechette, 2004).

Because moral and legal rights to equal protection are not contingent on socioeconomic status or power, those who employ flawed assessments (either knowingly or through culpable ignorance) are responsible for consequences of environmental injustice. They are accountable whenever their analyses help to sanction inequitable risk impositions on people who are less able than others to resist the imposition. And if they violate standards of procedural justice at the expense of minorities, then promoters appear to violate ethics in helping to create a situation of environmental racism. (Shrader- Frechette, 2004)

Daniel C. Wigley & Kristin S. Shrader-Frechette argue through their study *Environmental Racism and Biased Methods of Risk Assessment* that environmental injustice and racism occur also when risk assessors use biased scientific methods whose policy consequences de facto result in unjustified discrimination against people of color and socioeconomically disadvantaged groups” (Shrader-Frechette, 2004). For example, the minority residents of Poole and Barwell Roads understood and highlighted that health risk evaluations (which were the sole source of notification given by DENR) vaguely informed residents not to drink their well water, although short bathing was acceptable. Without specific sampling results or further notice, they concluded that their health risks were obviously being undervalued by agency officials, a phenomenon familiar to minority residents and also recognized by the poor community around the Bennett & Bailey site as well. Shrader-Frechette and Wigley conclude that “U.S. minorities disadvantaged in terms of education, income and occupation, bear a disproportionate environmental risk, and that socioeconomically deprived groups are more likely than affluent whites to live near polluting facilities, eat contaminated fish and be employed at risky occupations (Shrader-Frechette, 2004).

Economic Implications

One of this study’s most obvious conclusions is that income, or the extent to which residents are financially able to apply resources to remedy contamination, largely determines the length of time that residents are potentially exposed to polluted water, as well as determining the impact to lives. Impact, the degree to which the contamination negatively degrades one’s quality of life, for the poor and minority neighborhoods includes enduring the daily inconveniences of bottled water, the inability to receive due medical or legal services pertinent to the years of exposure to contaminated water, the increasing degree of mistrust and disservice produced through interactions with government entities, and the denial of a basic human right to tax-paying citizens: safe drinking water. Greenview Bluffs and Jimmy’s Quickie Mart residents reported no negative experiences with agency officials and little to no negative impact on their lives (after the initial scare) due to short-term bottled water supplies, quick public water

connections, and ultimately, the ability to purchase personal filtration systems. The financial ability to obtain these domestic filtration systems significantly distinguishes how income can afford these citizens virtually no impact from groundwater contamination. This study, therefore, reiterates the need for a statewide funding source to quickly assist distressed communities in acquiring safe, alternative water supplies.

Resident Empowerment

As a tool for residents and policy makers, may the environmental justice issues highlighted by this study serve as informative and enlightening in assessing the experiences of residents impacted by groundwater contamination. Although each community's story is different, resources including power, income, and education serve as monumental factors in the reduction of impact to residents. Fortunately, the education and power necessary to achieve justice can be acquired through community organization, increased political agitation, allies and advocacy groups.

The freedom of information is one of the most significant resources available to all citizens. Residents have the right to review all documentary materials made or kept by governmental agencies. Specifically, all pollution incident and groundwater contamination information can be obtained from NCDENR, in most cases by making an appointment to review specific files in Regional Offices and then by paying for copies.

Once empowered with vital facts, residents must then unite and mobilize as a group to specify goals, delegate the execution of initiatives, provide mutual support, develop leaders, get attention, and in many cases, consolidate funds for the provision of clean water.

Residents also have the right to public participation through public hearings and public meetings, which may require the pressuring and lobbying of government officials to call the hearing through a letter writing campaign or petition drive. Legal redresses can be effective in limited cases but the need to find attorney representation on a contingency basis leaves low-income residents vulnerable to misrepresentation and even malpractice. Community empowerment in pursuit of a common goal has proven the greatest achievement for residents. In each incident illustrated in this study, community involvement stimulated the process to a great degree. As a Poole & Barwell Road leader concludes, "DENR responded to us because of agitation and leadership. If we were not successful in community action and media attention, I'm sure progress would be worse."

Discussion of Recommendations

The major recommendations highlighted initially in this study are the results of outcomes and experiences of residents in acquiring safe, alternative water sources. As resident interviews of Poole and Barwell Roads and the Bennett & Bailey site revealed, many residents were minimally informed, not at all updated except by complaining, and in some cases were not notified by DENR at all but were informed by "word-of-mouth." **Therefore, we recommend that, on a standardized statewide level, state groundwater officials fully notify private well owners and users within a 1,500 foot radius of any contamination in violation of NC groundwater standards.**

In comparing the impact of contamination on Greenview Bluffs residents, to the impact of contamination on low-income communities like Bennett & Bailey, we found that financial resources greatly determine risks that residents face. For poor communities, contaminated water is a direct and unyielding threat because resources like private filtration systems and funding for

public water hookups are unavailable. **Therefore, we recommend that water supply wells within 1000 feet of a known site of groundwater contamination be tested at the state's (or responsible party's) expense and that a state Drinking Water Trust Fund be created to provide immediate funding for public water supply hook-ups or other safe and adequate household water in the wake of contamination.**

Surprisingly enough, many residents may drink their well water for years before they are aware of neighborhood contamination. Even more astounding is that one may purchase a home or take on ownership of a business with preexisting contamination. **The requirement for testing of wells before any real estate transaction occurs has already been progressively implemented by a Wake County ordinance. We recommend this requirement implemented statewide as a preventive and informative tool for assessing contaminated groundwater and for protecting well users.**

Environmental justice includes not only the protection of citizens but also the protection of environmental resources, with water being one of the most fundamental. We have found that the priority ratings of contaminated sites are widely reduced with the connection of residents to public water supplies. In response to this obvious failure to consider future water resources or groundwater environments, **we call for full cleanups of groundwater incidents to protect groundwater standards.**

All but one of the communities surveyed were contaminated with petroleum compounds from underground storage tanks. State groundwater officials and environmentalists agree that all underground storage tanks leak eventually. Therefore, with the extensive prevalence of UST's, used by gas stations, automobile businesses, and agricultural industries, controls on leakage must be strengthened. **We recommend a requirement for double walled tanks, or additional secondary protection to prevent leakage from underground storage tanks.**

Overall, CWFNC recommends the strengthening of inspections and pollution prevention programs statewide to reduce groundwater contamination. Unlike treated public water supplies, groundwater is a naturally occurring source that only cleans itself over decades if at all, and we cannot replace it.