Abstract

RODGERS, DOUGLAS PATRICK. Environmental Equity in North Carolina: An Empirical Study. (Under the direction of Dr. Andrew Taylor)

The purpose of this research is to examine the demographic composition of areas surrounding commercial hazardous transport, storage and disposal facilities (TSDFs) in North Carolina and determine if minorities and low income persons were disproportionately represented at the time of siting. The methodological approaches in environmental equity studies to date vary considerably. The research conducted in this study utilized two methodologies with independent variables to determine if there were environmental equity concerns at the time each of the facilities were sited. The research revealed that utilizing two different methodologies in the same study area produced substantially different results.

The census tract method consists of examining census data such as race and income of the commercial TSDF's host census tract. I then compared the data with the host county's census data. The data indicated that facilities were sited in tracts with a large percentage of low income households. Furthermore, census tract data indicated that facilities were sited in tracts with an overwhelmingly high percentage of white households. The concentric circle method consists of using specialized software to draw a one mile concentric circle around the facility and examining the demographic data inside the circle. Similar to the census tract method, results from the concentric circle method suggested that low income households were disproportionately represented around the facilities. However, an examination of race presented drastically different

results. The concentric circle method indicated that facilities were sited in tracts with an overwhelmingly large percentage of African Americans.

ENVIRONMENTAL EQUITY IN NORTH CAROLINA:
AN EMPIRICAL STUDY

By
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Biography

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Environmental Equity in North Carolina: An Empirical Study

1. Overview

"Environmental Justice is 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 a racial, ethnic, or a socioeconomic group, 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 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."[1]

"Environmental justice is the goal to be achieved for all communities and persons across this Nation. Environmental justice is achieved when everyone, regardless of race, culture, or income, enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work."[2]

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[1] http://www.epa.gov/compliance/environmentaljustice/index.html

There is very little argument that an environmental injustice can be broadly defined as a deliberate action that disproportionately harms the environment of either a low income or minority group in comparison to other groups that realize little or no effects. The debate has been whether the decisions to site Local Undesirable Land Use (LULU's) facilities are based on sociopolitical or economic reasons. If siting decisions are made based solely on economic reasons such as low land costs or transportation and infrastructure needs, one may conclude that there is less of a concern of environmental justice. If however, the facility is sited deliberately in low income and minority areas, environmental justice becomes a very real issue.

Previous studies, while well intentioned, have held that a pattern of discrimination exists if the area surrounding the hazardous waste facility was of low income and minority persons. Studies have failed to look at historical data in determining the demographics at time of siting. Furthermore, previous studies have failed to look at other sociopolitical characteristics other than race and income and have failed to view an alternative theory that the siting of these hazardous sites are merely a result of rational economic decision making.

Susan Cutter makes a critical distinction with regards to environmental equity studies. Cutter contends that there are two types of equity, process and outcome[3]. Process equity examines the causal mechanisms for inequities, while outcome equity measures the distribution of hazards compared to the distribution of marginalized populations.[4] While such a distinction is necessary to understand the concept of equity,

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[2]http://www.epa.gov/compliance/environmentaljustice/index.html
[3] Cutter, S. 1995. "Race, Class and Environmental Justice". *Progress in Human Geography*. 19:1. 111-122.
[4] http://www.geo.wvu.edu/i19/papers/scott.html

studies must look at both process and outcome equity measures to determine the level of injustice that may or may not be present. Process equity is by the far the most difficult to study. In studying process equity, the researcher must examine all of the factors that may or may not have contributed to the siting of a facility and the subsequent disproportionate exposure to the hazard. Determining the cause of an environmental inequity requires that the researcher have demographic data available at the time siting and be able to prove that siting decisions were made based solely on that data. Often however firms make siting decisions for other external reasons such as low property costs, proximity to transportation hubs or simply because the firm had owned the land for decades prior to siting. Outcome equity is much simpler and by far more widely studied. Outcome equity studies merely require that the researcher be able to formulate some type of pattern from the location of the hazardous sites and the minority or low income population that inhabits the area surrounding the site. Many studies to date have been outcome in nature. This is not to say that the outcome studies do not have value. Outcome studies can be useful in determining whether certain areas with certain demographic characteristics have a disproportionate share of hazardous facilities at any given point in time. It is not enough however; in any credible or comprehensive environmental justice survey to merely examine income demographics and race in and around the waste site and determine that this population is being adversely exposed to a hazard.

The limitations of previous studies suggest that a broader examination is essential to determine if environmental equity exists. Those who have studied the issue to date have used multiple methodologies to determine the presence of environmental injustice. Few

studies however, have examined multiple demographic and economic characteristics of areas that contain commercial transportation, storage and disposal facilities (TSDFs).

2. History of Environmental Justice

The present day environmental justice movement can be traced back to a small community in Warren County, North Carolina. In the early 1980's, the State of North Carolina decided to site and build a toxic waste landfill in a low income and high minority area of Warren County. Local church members contacted the media and national environmental groups. Before long, people came from all over to protest the siting of this facility. Hundreds of protesters were arrested. One of the protesters, Ben Chavis, Executive Director of the United Church of Christ Commission for Racial Justice (UCCCRJ), was on hand to protest the action of the state and was subsequently arrested.

The effects of the protests were felt throughout the nation. The siting of unwanted land uses in minority and low income areas was becoming a subject of much debate. National attention on this issue from both the media and certain members of Congress prompted the GAO to conduct a study. The study examined the racial and economic profiles of communities that live in proximity to hazardous waste landfills.[5] The study's conclusion was that a predominate number of landfills in the Environmental Protection Agency's Region IV, which includes eight southeast states, were located in minority neighborhoods.

In 1987, the UCCCRJ examined zip codes of communities that hosted hazardous waste facilities. This landmark study brought the local somewhat obscure Warren County issue to the forefront of a national stage.[6] The study found that patterns could be identified that showed race was the predominate predictor of the location of a hazardous

[5] US GAO, *Siting of Hazardous Waste Landfills and Their Correlation With Racial and Economic Status of Surrounding Communities*, GAO/RCED, 83-163, (June 1, 1983)

waste facility. While the study was criticized for using the ambiguous and inexact zip code method, it nonetheless offered substantial evidence that there was a correlation between the location of hazardous waste sites and minority zip codes.

Following the CRJ report, the National Law Journal in 1992 conducted a study and found that the "EPA took 20% longer to place abandoned sites in minority communities on the national priority action list and that polluters of those neighborhoods paid fines 54% lower than polluters of white communities."[7] This report put tremendous pressure on the EPA to address its policy on environmental justice.

On February 11, 1994, President Clinton signed Executive Order 12898. EO12898 directs 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."[8] This EO put the EPA on notice that issues surrounding the siting of hazardous waste facilities are of great importance to the administration and the country. Following EO12898, scholars have written extensively on all different aspects of environmental justice and equity.

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[6] United Church of Christ. 1987. *Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics with Hazardous Waste Sites*. New York: UCC, Commission for Racial Justice

[7] The National Law Journal, Special Issue: *Unequal Protection: The Racial Divide in the Environmental Law*, Sept. 21, 1992

[8] Executive Order 12898, 1994 Federal Actions to Address Environmental Justice, Federal Register 59, Number 32

3. Literature and Methodology of Environmental Justice

There is no clear and defined way to conduct an EJ analysis. The methodology quite clearly can dictate the results. The less aggressive approach of merely looking at the current demographic composition of the neighborhood around a site can be illustrated in any number or studies. The strategy in conducting this study will be based on a comprehensive examination of several characteristics, the commercial TSDFs and the host community.

One of the most troublesome areas is the selection of the sites to be studied. Yandle and Burton chose to examine all Hazardous Waste Landfill in Metropolitan Texas. The purpose of their study was to "examine the claims that poor and nonwhite communities host a disproportionately large number of waste disposal facilities."[9] However, problems arose during the study that led some to question the credibility and accuracy of the conclusions. The authors found that ten facilities in the metro Houston area were sited well before 1970 and therefore were included in census tracts that were very large. The authors determined that because the census tract would be too large to determine who was affected by the hazardous site, they must be left out. In a rebuttal to the article in *Social Science Quarterly*, Robert Bullard rightly asserts that "Yandle and Burton's exclusion of older sites (pre-1944) may have omitted an important slice of Texas waste facility siting history."[10] The argument that Bullard makes is a good one. According to Bullard's findings the sites that were excluded were based primarily in African American

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[9] Tracy Yandle and Dudly Burton, "Reexamining Environmental Justice: A Statistical Analysis of Historical Hazardous Waste Landfill Siting Patterns in Metropolitan Texas", *Social Science Quarterly*, Volume 77, Number 3, September 1996, pg. 2

[10] Robert D. Bullard, "Environmental Justice: It's More Than Waste Facility Siting", *Social Science Quarterly*, Volume 77, Number 3, September 1996, pg. 494

or Latino neighborhoods.[11] This evidence suggests to me that the conclusions in general as well as those relating to areas around Houston are not credible. Furthermore, the fact that this study failed to include sites outside of metro areas seems odd. While it is not overtly suggested, one could surmise that the author's conclusions were driven by the data they chose. By excluding hazardous landfills in areas(substantially black) that may border a metro area primarily because they are not categorized as metro, one has to question whether this study can be called complete.

Some studies have heeded the criticism of Yandle and Burton's site limiting methodology and examined a much larger and complete area. In a study by Vicki Been, Been examined the relationship between income and race and the location of all Commercial TSDFs in the United States. [12] The study consisted of examining the census tracts of host facilities and non host facilities. Been chose to examine the demographics of the communities prior to the tract becoming a host and then every ten years following. What she found is that there was "no substantial evidence that the facilities that begun operating between 1970 and 1990 were sited in areas that were disproportionately African American." Been also found that there was no substantial evidence that siting was targeted at poor communities. Been chose to exclusively use census tracts to evaluate the demographics instead of a concentric circle method. The concentric circle method requires the researcher to map the hazardous site as latitude and longitude point. Once the point is mapped, a private software program is used to draw a concentric circle around the site. Data that are contained within the circle is used for the study area. Been

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[11] Robert D. Bullard, "Environmental Justice: It's More Than Waste Facility Siting", *Social Science Quarterly*, Volume 77, Number 3, September 1996, pg. 494

acknowledged that concentric circles offered the greatest consistency over time, but the expense of applying Geographic Information System (GIS) technology was prohibitive. Been determined that for the purposes of her study, census tract data would be ample.

Been's study took into account many of the data inconsistencies of prior research. Been included all 608 then operating TSDFs in the US. She chose to look only at census tracts as a source of data as opposed to examining concentric circles with GIS software. In her defense, at the time of the study the software available was certainly much more cumbersome to use than that which is available today. Been also chose to look only at the host tract and not examine the adjacent tracts. She reasoned that facilities are often located on the edges of tracts because tracts tend to be bordered by roadways or railways. Therefore, if a facility was sited on the edge of the tract, the siting was more likely to be based on infrastructure needs. She did acknowledge that, "Data and time constraints precluded us from analyzing the demographics of areas adjacent to the host tracts, but other researchers may wish to pursue that inquiry."[13] Been's findings were that African Americans and low income or poor neighborhoods are not a predictor or whether the facility would be sited. However, she did find that a slightly larger percentage of Hispanics were more likely to have a facility sited in their communities. One has to question, however, what the results would have been if she had used adjacent tracts or concentric circles to compare data. Would her conclusions have been different?

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[12] Vicki Been, "Coming to the Nuisance or Going to the Barrios? A Longitudinal Analysis of Environmental Justice Claims", *Ecology Law Quarterly* 24: 1-56

[13] Vicki Been, "Coming to the Nuisance or Going to the Barrios? A Longitudinal Analysis of Environmental Justice Claims." *Ecology Law Quarterly* 24: 1-56

The results of a study conducted by Paul Mohai and Bunyan Bryant entitled, Environmental Racism: Reviewing the Evidence, suggest that the concentric circle method may provide different conclusions. [14]

Mohai and Bryant conducted an analysis of the communities surrounding hazardous waste facilities in the Detroit metro area. The objective of the study was to determine the strength of the relationship between race and income to the distribution of waste facilities. Mohai's team conducted face to face interviews with residents living within a one mile radius of the hazardous waste site, a one and a half mile radius and those outside of one and a half radius but still within the three surrounding counties of Detroit. Mohai and Bryant found that those living closer to the site were substantially more likely to be minority and living below the poverty line. For instance, of the respondents within 1 mile of the facility, 48% were minorities and 29% lived below the poverty line. Of those living 1-1.5 miles from the facility, the number of minorities and those below the poverty line drops to 39% and 18% respectively. Finally, those living more than 1.5 miles away only 18% were minorities and a mere 10% lived below the poverty level. One can only speculate whether the results of Been's study would have differed if she were to have taken a broader look using a concentric circle method as did Mohai. Mohai's study demonstrated that there is a direct correlation between the proximity to a hazardous waste site and income and race.

Many studies such as Been's and Mohai's and Bryant's have shown that there is a relation to the location of hazardous wastes sites and low income and minority communities. What is difficult to determine however is why a firm would choose to site

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[14] Bunyan Bryant and Paul Mohai, "Environmental Racism: Reviewing the Evidence." *Race and the Incidence of Environmental Hazards*, Chapter 13, 1992

in low income or minority neighborhoods. Hamilton's research went a step further and examined the reasons why a firm may choose to site its facility in a low income or minority area.

Hamilton's first explanation for a firm's siting is pure discrimination. In this model, the firm will site based on the likelihood that the decision makers in the siting process, often politicians, are less likely to be worried about re-election if they site in low income/minority than if they site in a politically active affluent white area. In Hamilton's second model, Coarse Theorem, the firm chooses to locate in a low income/minority areas based on the purely economic reasons. The firm reasons that people in areas that have low income/minority and possibly low education levels place a low value on the environment and thus are less likely to care if a hazardous waste site is located in the area. By the firm locating in areas that traditionally placed a low value on the environment, the firm ensures that should the environment be harmed their liability for damages would be low. Finally, Hamilton's third model implies that firms will locate in communities where the cost of opposition is least. The collective action model implies that compensation for siting from communities depends on two factors: "the value placed on environmental amenities by those threatened by the firm's location, and the ability of this group to voice those demands through the political process."[15] If low income and minority communities are less likely to collectively voice their opposition, a firm would view this site as favorable for a facility. Under the collective action model, firms internalize the expense of opposition to the siting and factor that into the decision to site.

[15] James T. Hamilton, *Testing for Environmental Racism,* Journal of Policy Analysis and Management, Vol. 14, No. 1, 107-132 (1995)

4. Competing Methodologies

Determining the appropriate methodology to utilize in a study is critical step in any environmental justice research. The research that I conducted was based on holes that existed in previous studies as well as suggestions in previous research on how future studies may be improved. My research focused on Commercial TSDFs located in the state of North Carolina. There are currently 10 such sites in the state. I chose to base my research on these ten sites for several reasons. First and foremost, Commercial TSDFs pose an inherently grave danger to surrounding inhabitants in relation to non commercial sites. What distinguishes commercial and non commercial sites is the former's ability to treat, store and dispose of outside waste from other firms. While both emit hazardous by products, only commercial TSDF s accept and process hazardous wastes from outside firms. The transport and storage of hazardous waste whose origins were outside the host community suggest that the host community firm is willing to expose its community to others hazardous waste. In short, these commercial facilities are willing to mortgage the host community's future for short term financial gain. Secondly, to conduct an accurate EJ study, data must be readily available and accurate. Commercial TSDF's have relatively good measurable data available. Data that are not available by normal channels can be gained by site visits throughout the state. Limiting my study to 10 sites across the state ensures that resources do not have to be stretched to get ample data. Finally, many studies to date have failed to examine demographics at the time of siting as well as ignoring the impact that alternate methodologies can have on the conclusions.

The methodology in determining which area to study also needs to address exactly who specifically is the victim of unequal environmental risk. We know for a fact that no one would readily welcome a hazardous waste TSDF into their community nor would they readily accept dangerous levels of toxins into their air, land or water. This study will determine which demographic characteristic are most common when siting a TSDF. Additionally, we will examine two separate methodologies for the same dataset to determine whether methodologies will affect the outcome of an environmental equity study.

There is ongoing controversy surrounding the exact method to use in measuring and analyzing areas affected. The ongoing question is whether census tracts, zip codes, concentric circles or county boundaries are the preferred method.

County boundaries simply do not give the researcher a precise study area surrounding a TSDF. The greatest problem surrounding the use of counties is that the county is so diverse and so large. One could not make a good case that a person living in the county miles from the hazard is at the same risk level as someone who lives within a block of the hazard. For instance, in the case of one TSDF site in Wake County, NC, the site itself is roughly 20 miles from 2 of its borders. Merely studying the county data set in relation to the TSDF in this case would offer little in the way of substantive proof of injustice. Where counties become significant and useful is in relation to a data set such as a census block. For instance, if the average African American population of at the time of siting for the county was 30% and the host census tract was 80% African American, one could argue that in relation to the county, the host tract may have been targeted for a hazardous waste facility due to the high concentration of minorities.

Zip codes offer very little value as a tool for evaluation as well. Zip codes change frequently and boundaries have more to do with ease and efficiency of mail delivery than they do in representing the identity of one community in relation to others.

The last two methods, concentric circles and census tracts are the preferred method of analytical measurement. Many studies have used census tracts in examining demographics in relation to environmental hazards. Census tract data are in fact readily available and for the most part at no cost to the researcher. Several web sites, both commercial and governmental, offer the researcher an enormous amount of data from which to choose. The problem and at the same time the value of census tract data is that the tracts reflect the needs of collecting data in an efficient way, initially using walking routes for census takers. The value in using census tracts is that the tract is somewhat reflective of a community or a neighborhood. In evaluating the demographics for an environmental equity study, the best study area will be a neighborhood of like individuals with respect to income and race. This optimal study area may be found within the confines of a census tract. The tract offers a view of a "walkable" contiguous neighborhood that often has a like minded objective in keeping the integrity of the community intact. This fact as well as the availability of easily accessible data makes census tracts a viable option for a study. There are however some problems with using census tracts. In examining the harmful effects of a hazardous site in relation to the demographics surrounding the site, there is a distinct correlation in the population's distance from the site and the level of harm that one actualizes. For instance, if an individual lives 5 miles from a hazardous site versus an individual that lives 1 mile from that same site, one could surmise that the level of potential harm is far greater for the

person that lives closer. Furthermore, because census tracts are not exact squares, but polygons, the distance from one end the tract to a hazardous waste facility could be substantial. With census tracts, spatial integrity certainly becomes an issue. Since hazardous sites lie within the census tract, it can never be assumed that the site being studied is exactly in the middle of the demographic being studied. In addition to spatial issues, the census tracts can change. For instance in 2000 data, the hazardous waste site may be located in the middle of tract "x". However, when initially sited and built in 1979 that same cite may have been part of a larger tract that was subsequently split in the 1990s because of population growth. Additional problems exist in the frequency of the data. The census is conducted every ten years. While this is not a major issue and should not affect the overall study, I will address this issue.

The concentric circle method requires that the latitude and longitude of the site be determined first. Once the location is pinpointed, a concentric circle is drawn around the site at a given distance. The Atlas study used a 2 mile radius.[16] While there is no set standard for what is an acceptable radius, there are some generally accepted principles. The size of the circle should be large enough to capture the hazard effects of a site. The size of the circle should also take into account the type of hazard that is being measured. For instance, the "ring of hazard" of a nuclear underground storage tank would certainly be larger than that of a small municipal wastewater treatment plant. Additionally the size of the concentric circle must take into account whether it is measuring for demographic trends in siting of a neighborhood or potential health hazards of that same neighborhood. The general rule will be that the larger the concentric circle the more diffuse and inexact

[16] Atlas, Mark, *Testing for Environmental Racism Again*, Prepared for delivery at 2001 Annual Meeting of American Political Science Association, August 30, 2001.

your results will be. While using a circle of 2 miles will capture an enormous amount of data, to capture an exact snapshot a much smaller circle should be used. There can be no doubt that those within a one mile radius of a hazardous site will be much more affected or at the very least much more aware of the potential hazards of the facility to be studied.

I contend that using both census data and using concentric circles is the optimal method in capturing a true sense of the make-up of a neighborhood. The methodology of using a concentric circle around a hazardous waste site is not a simple process. Commercially available ARC View software, enables data from many forms to be attached to GIS based maps. Among many other things, the software allows the user to create a study area that contains not only points on the map but also data. The process of creating an ArcView project starts with the extraction of data. The data are then transferred into ArcView using a series of ArcView specific procedures. The data would be attached to the source which in this case would be a map. Once the data are completely merged or joined, then the user would simple identify the exact point shape of the facility, find its center and draw a concentric circle to as many miles out as needed. Once this is completed the data contained inside the circle is then reported on a spreadsheet. The inherent problem in using concentric circles is that if the facility was cited prior to 1980, there are limited electronic files containing census data. With limited data, converting the data from paper to electronic files is extremely labor and time intensive. Additionally, there is a question as to whether concentric circles clearly capture the community. It can be argued that a circle around the facility does not coincide with a neighborhood or any type of political unit and therefore is not an optimal study area. Short of actually conducting a door to door census in the neighborhood

surrounding a facility, the concentric circle method affords the researcher the best opportunity to study a neighborhood surrounding a site. Finally, the major stumbling block for many researchers using concentric circles is the time and labor intensive nature of collecting, verifying and merging data from census sources to Arc View software.

5. Independent Variables and Data

The North Carolina Department of Hazard Waste Management has over 100 facilities that transport, store or dispose of hazardous waste. All facilities are either categorized as large or small generator facilities. Sites are further categorized as to the extent in which they receive outside hazardous waste that is not produced on site. These sites are labeled and tracked as commercial sites. There are ten such sites in North Carolina. These sites are located in roughly in six of the one hundred counties that comprise North Carolina. The ten facilities that will be part of this study are Commercial Hazardous Waste TSD Facilities.

The research that I conducted was based on holes that existed in previous studies as well as suggestions in previous research on how future studies may be improved. In examining the data from the commercial TSDF's, I chose to focus on the two different methodologies using the same independent variables. The independent variables I have chosen to examine are as follows:

Race: Most studies to date have looked at the relation of race to areas where there is an environmental hazard. I will mirror previous studies and look at this same important variable. It is widely believed that the locations of hazardous waste sites are in direct relation to the density of African Americans. More and more however, looking beyond African American versus Caucasian tends to be the norm. With the growing Hispanic population in the United States, many of the contemporary studies have included Hispanics in their study areas.

Education: It is essential that educational demographic data is used in this study. Those that have little more than a high school degree are at a serious disadvantage in understanding the risks associated with hazardous waste.

Income: In addition to race, income is the most widely examined demographic in environmental equity studies. However, most studies categorize the individual as "above or below" the poverty level. This method offers little in the way of substantive evidence. Even those above the poverty level still are disadvantage and in many cases indigent or poor. In looking at the data, I will look first at the median household income of the county in which the community is located. Then I will examine the median household income data for the census tracts.

6. Methodology

For reasons already given, I will utilize the concentric circle method and the census tract method. Utilizing the concentric circle method, I will examine communities within a 1 mile concentric circle. The one mile radius that I will be using will be ample. Several studies have chosen to use much larger circles to study demographic data. I contend that a one mile concentric circle captures the view of the neighborhood that we are trying to represent. In looking at the census tract size in North Carolina, tracts tend to be no larger than 1-1.5 miles wide. Therefore, the size of the average tract is comparable to the 1 mile concentric circle.

In his study, Atlas used a two mile circle to examine data.[17] Unfortunately, a two mile circle is too large for the purpose of this study. In studying the communities in which these facilities are located, most sites are in populated areas that within themselves are communities. Should these sites have been located in rural areas, then in fact one could contend that a two mile circle is needed. This is clearly not the case with these facilities. A one mile circle will be sufficient for data gathering. A smaller concentric circle produces a much reflective view of the community for several reasons. Persons living in a one mile circle are more aware of the presence of a facility than those that may live for instance two miles away. One could make the case that the further removed someone is from the hazard area, the more apathetic they would be to the siting. Therefore, larger rings water down the truly affected populace. A study conducted on behalf of Waste Management Corporation by Anderton illustrates the "watered-down"

[17] Atlas, Mark, *Testing for Environmental Racism Again*, Prepared for delivery at 2001 Annual Meeting of APSA, August 30, 2001.

effect of using larger rings.[18] His study utilized a 2.5 mile ring as opposed to the widely used one to two mile model. There is clearly no wrong ring size, but one would surmise that the larger the study the more diffuse the data. The further away from a facility that one studies, the less people will be impacted by the hazard and thus the less significant the findings will be.

In using census tracts, I will examine the census tract in which the facility is sited. I will collect all the relevant data from the census sources from 1980, 1990 and 2000. Data will also be gathered for the counties that each commercial TSDF is located. The most commonly used commercial software for census data is Census CD from Geolytics. Geolytics collects census data from the U.S. Census Bureau and catalogs it on a series of compact disks. The data gathered from the CD can be formatted to be merged into Arcview. The versions of Geolytics that will be used will be 1980 Version 1.0, 1990 Version 3.0 and Year 2000. In addition to Geolytics, it will be necessary to extract data from various U.S. Census Bureau databases.

Once the data are extracted in .dbf format from the census tract info, we will merge the data into the GIS Software, ARCVIEW 3.3. Once joined into ARCVIEW, I will draw a one mile concentric circle or buffer around all facilities in Mecklenburg County. Each circle that is drawn will require that additional data be gathered from non-host census tracts. While the site may be located in one tract, the one mile circle drawn around the site will encroach into other census tracts. Illustrated in Appendix 1 and 2, in all four sites the composition of the circle that is drawn will consist of pieces of surrounding tracts. Results from each of the concentric circles will be analyzed and

[18] Douglas L. Anderton et all, "Hazardous Waste Facilities: Environmental Equity Issues in Metropolitan Areas", *Evaluation Review* (vol. 18, no. 2), pp. 123-140, 1994 Sage Publications.

compared to the results from the census tract data. I have chosen to only use the concentric circle method around the Mecklenburg County sites because of the enormous amount of data collection that would be needed if we were to use all 10 sites. The data produced from these four sites should give us a good picture of the different conclusions that can be reached using two different methodologies

7. Data Findings-Census Tract Method

Census Tract Analysis-Population and Race

Table 7.1 Race in Tracts

Race	*Mean Census Tract %*	*Mean Host County %*	*t-Test Scores-95% Confidence Level*
White	70.7	72.1	.31-No Difference
African American	27.1	22.3	1.28-No Difference
Hispanic	1.17	1.03	.463-No Difference

Race in Tracts: Of the ten facilities sited between 1980 and 2003, all but one is predominately white. The mean percentage of all whites in all tracts is 70.7%. The one tract that has a higher percentage of blacks to whites, M4-Mecklenburg, the percentage difference is roughly 11%. Four of the ten sites are more than 80% white. The percentage of Hispanics is relatively negligible in relation to white and black population. In fact, of the ten tracts, only one tract has more than 3 percent Hispanic and seven tracts have less than 1 percent. (Appendix 11.1)

Tracts in Relation to Counties: Six of the ten tracts had a higher percentage of whites than did their corresponding host counties. Nine of the ten counties were 70% white. (Appendix 11.1) The one county that was not predominately white was Robeson County which has an American Indian population that accounts for roughly one third of the population. Illustrated in Table 7.1., the difference of means between the tracts and the county appear to be insignificant.

Census Tract Analysis-Education

Table 7.2 Education in Tracts

Education	*Mean Census Tract %*	*Mean Host County %*	*t-Test Scores-95% Confidence Level*
HS or GED, population over 25 years old	50.1	55.8	1.29-No Difference

In six of the ten tracts, there are a lower percentage of high school graduates than in their respective counties. In three of the counties, the percentage of high school graduates is significantly higher-more than 10%. In the four tracts that had higher rates for high school graduate attainment than their host county, the difference was insignificant-between 1 and 7%. (Appendix 11.1) According to Table 7.2, the mean percentage of high school graduates or GED equivalent of persons over 25 was roughly 50% for tracts compared to a little over 55% for the host county. There appears to be little difference between the mean percentages of tract graduates versus county graduates.

Census Tract Analysis-Income

Table 7.3 Income in Tracts

Household Income	Mean Tract HH Income	Mean Host County HH Income	*t-Test Scores-95% Confidence Level*
Mean HH Income in dollars	24290	27150	1.31 No Difference

Tracts in Relation to Counties, Income: Seven of the ten tracts had a lower median household income than their host county. (Appendix 11.1) However, using a difference of mean test, there appears to be no difference.

8. Data Findings-Concentric Circle Method

A one mile concentric circle was drawn around the four sites in Mecklenburg County. Two facilities were sited from 1980-1989 and two facilities were sited from 1990-1999. Aggregate data were included from the host tract as well as neighboring tracts that were encompassed in the circle. Each concentric circle could contain between 5 and 8 parts of neighboring tracts. The analysis consists of an examination of the circle followed by a comparison of the circle to the host tract. I chose to compare the tract to the circle to test the two methodological approaches.

Concentric Circle Analysis-Population and Race

Table 8.1 Race In Circle

Race	Mean Census Tract %	Mean Circle %	*t-Test Scores-95% Confidence Level*
White	56.3	33.0	4.76 Highly Significantly Different
African American	42.9	65.9	4.47 Highly Significantly Different
Hispanic	1.29	.83	1.25 No Difference

Race in Circle: Of the four concentric circles analyzed, all but one is predominately black or African American. The average percentage of African Americans in the circles is 65.9%. The one circle that has a higher percentage of whites to African Americans, M5-Mecklenburg, the percentage difference is insignificant-less than two percent. For Hispanics, the circle percentage is relatively negligible in relation to the white and African Americans. (Appendix 11.2)

Circles in Relation to Tracts: There is a clear statistical difference between the census tract and the concentric circle. For each of the concentric circles, the percentage of African Americans residing inside the circle area is significantly higher than that for whites. The data show that the difference ranges from 12%(M5) to 35%(M9). For instance, in site M2 the census tract data reveals that there are 40.11% African Americans in the tract. However, the concentric circle around the same site reveals that the population surrounding the site is 75.9% African American. (Appendix 11.2) In Table 8.1., the difference in means between circle and tracts in relation to both white and African Americans are highly significantly different.

Concentric Circle Analysis-Education

Table 8.2 Education in Circle

Education	Mean Tract %	Mean Circle %	*t-Test Scores-95% Confidence Level*
HS or GED, population over 25 years old	42.6	39.1	2.93 Significantly Different

Circles in Relation to Tracts: The circles surrounding the sites, appear to have a very small percentage less high school graduates than to the tracts in all four areas. (Appendix 11.2) All four circle areas have a smaller percentage of high school graduates than do the tracts. According to the difference of means test performed, the difference is significantly different.

Concentric Circle Analysis-Income

Table 8.3 Income in Circle

Household Income	Mean Tract HH Income	Mean Circle HH Income	*t-Test Scores-95% Confidence Level*
Mean HH Income in dollars	16800	12330	2.77 Highly Significantly Different

Circles in Relation to Tracts: In all circles, the median household income is lower than the host tract. The difference in all tracts is highly significantly different as illustrated in Table 8.3.

9. Conclusion

In looking solely at the analysis with the census tracts in comparison to their host counties, we can conclude that those tracts that hosted commercial TSDFs tended to be predominately white. The tracts racial composition reflected that of the host county. The difference in means test revealed that there was little or no difference. With respect to education with census tracts and counties, the data revealed that there was no difference between the percentage of high school graduates between the tract and the host county. While low high school graduation rates are the norm in each of the census tracts in relation to the counties, the difference was only significant in three of the ten tracts. It does not appear that low high school graduation rate is a predictor of the siting of a commercial TSDF. While African Americans and poorly educated persons do not appear to be disproportionately represented in host tracts or counties, low income households appear to be over represented. In eight of the ten tracts, the percentage of households making less than $25,000 is greater than the average county household in which it is sited. Using a difference of means test, there is a significantly higher number of households earning under $15K and $25K in the study tracts than there are in their host counties. This does suggest that using only the census tract method, low income households are at greatest risk to have a commercial TSDF sited in their neighborhood.

The findings were significantly different when I used a different methodology with the same data. In looking solely at the analysis with the circle data, I concluded that persons living within 1 mile of the site were predominately black. Of the four concentric circles analyzed, all but one is predominately African American and the difference is significant. The one circle that had predominately white population, the difference was insignificant.

The difference however in comparison to the tracts was highly significantly different using a difference of means test. With regard to education, there are significantly more high school graduates in tracts than there are in the circle data. While the difference is significant, it is only slightly significant in relation to the tract data. Finally, income does appear to be significant factor. It does appear that the median household income in the circles are significantly lower than that of the corresponding tract. There are a disproportionately high number of low income households in circles in relation to both the host county and the tract. The difference based on a difference of means test was highly significantly different.

As Hamilton (1995) suggests and common sense tells us, there are too many factors to take into account when trying to come to a conclusion as to why a firm chose to site in one location versus another. Reasons could be purely economic land cost issues, low cost of labor, transportation and infrastructure concerns or less resistance from the population. The best that one can do is to determine what factors tend to be common amongst all facilities at time of siting and which method yields the most accurate representation of the community's demographic composition. This is essentially what I set out to do in this study.

I chose the compare the data in the concentric circle to the data in the host tract to test the results using two methodologies. The two methodologies used produced quite different results. While the concentric circle method requires much more technical expertise, the results are far more reliable and complete. Should one choose to look solely at the census tract data at the time of siting and draw conclusions from that data, the snapshot of the siting area looks remarkably different from one who uses a concentric

circle method. Yet few researchers tend to use this method when conducting an environmental equity study. It is in fact very time consuming and cumbersome. However, the findings from this study prove that the results from both studies are entirely different. How could the results have been so different? The difference between the location of the facility inside of the census tract and those who are actually affected is significant. The census tract method offers at best a glimpse of the general demographic characteristics of the area that is close to the site. The concentric circle method on the other hand offers a much clearer snapshot of the demographic makeup of the area. Look no further than the race data in the four Mecklenburg County sites. If you were to look at only the census data, you would conclude that there could be no suggestion of blacks being overly represented in areas with undesirable land uses. However, looking at the much more accurate concentric circle method, it is clear that blacks are overly represented and possibly a target of environmental racism. While the disparity exists with regards to race and the methodology, it does appear that with both methods, income is a factor as well.

From the study, I can only conclude that low income households are likely to have commercial TSDFs sited in their communities in the state of North Carolina. Does this necessarily mean that in the future mostly low income communities will be the recipients of undesirable land uses? No one can truly determine that. As of October 2003, North Carolina had no policy in place pertaining to environmental justice or equity. The only factors that are taken into account to the siting of TSDFs are technical in nature. Should they conduct studies to determine whether the siting of a hazardous waste facility in a given neighborhood violates the whole premise of environmental equity? The answer

clearly has to be a resounding yes. However, as this study illustrated the methodological approach to environmental equity must first be reexamined.

Future research needs to be conducted in many areas. For the purpose of this study, I chose to limit my research to census tracts and one mile concentric circles. While this appears to be a valid methodology, one could make the case that examining block groups as well as using multiple circles would enhance the validity of the study. Additional research should also focus on a firm's decision process in siting hazardous waste facilities. Finally, it is troublesome that the state of North Carolina has no written policy or siting procedure pertaining to environmental equity. It appears that they are examining the issue, but to date the siting manual for commercial hazardous waste facilities does not address these concerns. Future research is needed to determine the extent in which other states address environmental equity.

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11. Appendices

Appendix 11.1 Census Sited

		Tractpop	County	White	%	County	%	Black	%	County	%	Hisp	%	County	%
G1	116.02	3,064	314452	2626	85.70%	235259	74.82%	421	13.74%	79125	25.16%	17	0.55%	68	0.02%
M2	9	2119	511433	1246	58.80%	364651	71.30%	850	40.10%	134507	26.30%	54	2.50%	6137	1.20%
M3	42	3911	399387	2340	59.83%	291856	73.08%	1537	39.30%	107222	26.85%	34	0.87%	309	0.08%
M4	44	2155	511433	958	44.50%	364651	71.30%	1197	55.50%	134507	26.30%	17	0.80%	6137	1.20%
M5	53.01	2678	399387	1668	62.29%	291856	73.08%	984	36.74%	107222	26.85%	26	0.97%	309	0.08%
Ran6	316.01	3536	106546	3331	94.20%	99087	93.00%	151	4.30%	6180	5.80%	47	1.30%	533	0.50%
Rob7	9601	6463	105179	3899	60.30%	38074	36.20%	1967	30.40%	26190	24.90%	19	0.30%	631	0.60%
Roc8	414	2999	83205	2431	81.06%	65996	79.32%	553	18.44%	17186	20.66%	15	0.50%	23	0.03%
W9	528.02	5059	423380	4133	81.70%	32473	76.70%	906	17.90%	87640	20.70%	0	0.00%	5081	1.20%
W10	534.04	14168	627846	11129	78.50%	454544	72.40%	2104	14.85%	123820	19.70%	563	3.90%	33.985	5.4%

	Tractpop	HS Grad	%	CountyHS	%	Countypop
G1	***3,064***	887	28.95%	68186	21.68%	314452
M2	1318	663	50.30%	296697	89.74%	330603
M3	***3911***	882	22.55%	85734	21.47%	399387
M4	1377	992	72.04%	296697	89.74%	330603
M5	***2678***	685	25.58%	85734	21.47%	399387
Ran6	2363	1228	51.97%	43573	62.05%	70226
Rob7	3983	2249	56.46%	35092	57.05%	61514
Roc8	***2999***	522	17.41%	16675	20.04%	83205
W9	3292	2791	84.78%	231650	85.36%	271387
W10	8959	8184	91.35%	360095	89.25%	403481

Income

	HHPop	<15	%	CUnder15	%	<25	%	CUnder25	%	Tract Median HH Income	County HH INcome	County HH
G1	1,161	566	48.75%	51722	45.20%	996	85.79%	83065	72.58%	16729	16473	114439
M2	780	312	40.0%	36496	18.24%	517	66.3%	70526	35.24%	18000	33830	200125
M3	1482	944	63.70%	60711	41.10%	1320	89.07%	101108	68.44%	12962	17837	147730
M4	764	186	24.3%	36496	18.24%	377	49.3%	70526	35.24%	25338	33830	200125
M5	1229	772	62.82%	60711	41.10%	1094	89.02%	101108	68.44%	10906	17837	147730
Ran6	1399	400	28.6%	9943	24.19%	676	48.3%	18470	44.93%	25576	27130	41107
Rob7	2337	935	40.0%	14293	39.54%	1475	63.1%	21991	60.83%	18245	19716	36152
Roc8	1084	705	65.04%	15276	51.40%	967	89.21%	23889	80.38%	13500	14606	29720
W9	2053	269	13.1%	27536	16.61%	641	31.2%	53647	32.36%	36411	36222	165760
W10	5001	234	4.68%	21994	9.08%	588	11.76%	44210	18.26%	65231	54988	242143

Appendix 11.2 Circle Sited

		Tractpop	County	White	%	County	%	Black	%	County	%	Hisp	%	County	%
M2	9	2,119	511433	1246	58.80%	364651	71.30%	850	40.11%	134507	26.30%	54	2.55%	6137	1.20%
	Circle	8238	511433	1903	23.10%	364651	71.30%	6253	75.90%	134507	26.30%	82	1.00%	6137	1.20%
M3	42	3911	399387	2340	59.83%	291856	73.08%	1537	39.30%	107222	26.85%	34	0.87%	309	0.08%
	Circle	6264	399387	2151	34.34%	291856	73.08%	4051	64.67%	107222	26.85%	62	0.99%	309	0.08%
M4	44	2155	511433	958	44.45%	364651	71.30%	1197	55.55%	134507	26.30%	17	0.79%	6137	1.20%
	Circle	2710	511433	663	24.46%	364651	71.30%	2032	74.98%	134507	26.30%	15	0.55%	6137	1.20%
M5	53.01	2678	399387	1668	62.29%	291856	73.08%	984	36.74%	107222	26.85%	26	0.97%	309	0.08%
	Circle	8557	399387	4275	49.96%	291856	73.08%	4114	48.08%	107222	26.85%	68	0.79%	309	0.08%

Education

		Tractpop	HS Grad	%	CountyHS	%	Countypop+
M2	9	1,318	663	50.30%	296697	89.74%	330603
	Circle	5118	2547	49.77%	296697	89.74%	330603
M3	42	3911	882	22.55%	85734	21.47%	399387
	Circle	6264	1130	18.04%	85734	21.47%	399387
M4	44	1377	992	72.04%	296697	89.74%	330603
	Circle	1689	1112	65.84%	296697	89.74%	330603
M5	53.01	2678	685	25.58%	85734	21.47%	399387
	Circle	8557	1940	22.67%	85734	21.47%	399387

Income

		HHPop	<15	%	CUnder15	%	<25	%	CUnder25	%	MHHINC
M2	9	780	312	40.00%	36496	18.20%	517	66.30%	70526	35.20%	18000
	Circle	3037	1317	43.37%	36496	18.20%	2043	67.27%	70526	35.20%	14120
M3	42	3911	944	24.14%	60711	15.20%	1320	33.75%	101108	25.32%	12962
	Circle	3221	938	29.12%	60711	15.20%	1361	42.25%	101108	25.32%	9635
M4	44	764	186	24.35%	36496	18.20%	377	49.30%	70526	35.20%	25338
	Circle	946	275	29.07%	36496	18.20%	495	52.33%	70526	35.20%	16250
M5	53.01	2678	772	28.83%	60711	15.20%	1094	40.85%	101108	25.32%	10906
	Circle	3088	994	32.19%	60711	15.20%	2081	67.39%	101108	25.32%	9325

Appendix 11.3 1980 Census Data

Race

1980	Tractpop	County	White	%	County	%	Black	%	County	%	Hisp	%	County	%
G1	3,064	314452	2626	85.70%	235259	74.82%	421	13.74%	79125	25.16%	17	0.55%	68	0.02%
M2	2641	399387	434	16.43%	291856	73.08%	2187	82.81%	107222	26.85%	20	0.76%	309	0.08%
M3	3911	399387	2340	59.83%	291856	73.08%	1537	39.30%	107222	26.85%	34	0.87%	309	0.08%
M4	2382	399387	1135	47.65%	291856	73.08%	1228	51.55%	107222	26.85%	19	0.80%	309	0.08%
M5	2678	399387	1668	62.29%	291856	73.08%	984	36.74%	107222	26.85%	26	0.97%	309	0.08%
Ran6	4472	91266	4330	96.82%	85659	93.86%	123	2.75%	5575	6.11%	19	0.42%	32	0.04%
Rob7	N/A	65799	N/A	N/A	40163	61.04%	N/A	N/A	25600	38.91%	N/A	N/A	36	0.05%
Roc8	2999	83205	2431	81.06%	65996	79.32%	553	18.44%	17186	20.66%	15	0.50%	23	0.03%
W9	4348	297966	4035	92.80%	232070	77.88%	299	6.88%	65581	22.01%	14	0.32%	315	0.11%
W10	7833	297966	5192	66.28%	232070	77.88%	2611	33.33%	65581	22.01%	30	0.38%	315	0.11%

Education

1980	Tractpop	HS Grad	%	CountyHS	%	Countypop
G1	3,064	887	28.95%	68186	21.68%	314452
M2	2641	363	13.74%	85734	21.47%	399387
M3	3911	882	22.55%	85734	21.47%	399387
M4	2382	626	26.28%	85734	21.47%	399387
M5	2678	685	25.58%	85734	21.47%	399387
Ran6	4472	1247	27.88%	20806	22.80%	91266
Rob7	N/A	N/A	N/A	19293	29.32%	65799
Roc8	2999	522	17.41%	16675	20.04%	83205
W9	4348	1184	27.23%	61396	20.61%	297966
W10	7833	1753	22.38%	61396	20.61%	297966

Income

1980	Income	Tractpop	<15	%	CUnder15	%	<25	%	CUnder25	%	Med Hsehld Income	County	Countypop
G1		3,064	349	11.39%	51722	16.45%	713	23.27%	83065	26.42%	16729	16473	314452
M2		2641	406	15.37%	60711	15.20%	549	20.79%	101108	25.32%	11586	17837	399387
M3		3911	580	14.83%	60711	15.20%	898	22.96%	101108	25.32%	12962	17837	399387
M4		2382	323	13.56%	60711	15.20%	535	22.46%	101108	25.32%	18605	17837	399387
M5		2678	405	15.12%	60711	15.20%	551	20.58%	101108	25.32%	10906	17837	399387
Ran6		4472	528	11.81%	15794	17.31%	814	18.20%	26362	28.88%	12810	15527	91266
Rob7		N/A	N/A	N/A	19590	29.77%	N/A	N/A	27388	41.62%	N/A	11494	65799
Roc8		2999	466	15.54%	15276	18.36%	717	23.91%	23889	28.71%	13500	14606	83205
W9		4348	241	5.54%	41704	14.00%	762	17.53%	71828	24.11%	22666	18643	297966
W10		7833	670	8.55%	41704	14.00%	1361	17.38%	71828	24.11%	16042	18643	297966

Appendix 11.4 1990 Census Data

Race

1990		Tractpop	Countypop	White	%	County	%	Black	%	County	%	Hisp	%		County
G1	116.02	2,931	347420	2032	69.30%	249794	71.90%	739	25.20%	91719	26.40%	0	0.00%	2432	0.70%
M2	9	2119	511433	1246	58.80%	364651	71.30%	850	40.10%	134507	26.30%	54	2.50%	6137	1.20%
M3	42	3602	511433	1513	42.00%	364651	71.30%	2070	57.50%	134507	26.30%	26	0.70%	6137	1.20%
M4	44	2155	511433	958	44.50%	364651	71.30%	1197	55.50%	134507	26.30%	17	0.80%	6137	1.20%
M5	53.01	2426	511433	1077	44.40%	364651	71.30%	1293	53.30%	134507	26.30%	19	0.80%	6137	1.20%
Ran6	316.01	3536	106546	3331	94.20%	99087	93.00%	151	4.30%	6180	5.80%	47	1.30%	533	0.50%
Rob7	9601	6463	105179	3899	60.30%	38074	36.20%	1967	30.40%	26190	24.90%	19	0.30%	631	0.60%
Roc8	414	3102	86064	2429	78.30%	67904	78.90%	673	21.70%	17557	20.40%	0	0.00%	602	0.70%
W9	528.02	5059	423380	4133	81.70%	32473	76.70%	906	17.90%	87640	20.70%	0	0.00%	5081	1.20%
W10	534.04	6895	423380	5064	73.40%	32473	76.70%	1743	25.30%	87640	20.70%	82	1.20%	5081	1.20%

Education

1990		Pop25+	HSGrad	%	CountyHS	%	Countypop+25
G1		1,867	1192	63.85%	171666	76.08%	225647
M2		1318	663	50.30%	296697	89.74%	330603
M3		2233	1244	55.71%	296697	89.74%	330603
M4		1377	992	72.04%	296697	89.74%	330603
M5		1444	988	68.42%	296697	89.74%	330603
Ran6		2363	1228	51.97%	43573	62.05%	70226
Rob7		3983	2249	56.46%	35092	57.05%	61514
Roc8		2092	1047	50.05%	34027	59.18%	57494
W9		3292	2791	84.78%	231650	85.36%	271387
W10		4515	3418	75.70%	231650	85.36%	271387

Income

1990	Income	Households	<15	%	CUnder15	%	<25	%	CUnder25	%	Chshlds	ed Hsehld Income	County
G1		1,144	312	27.3%	31046	22.6%	589	51.5%	56758	41.3%	137627	24410	38373
M2		780	312	40.0%	36496	18.2%	517	66.3%	70526	35.2%	200125	18000	33830
M3		1385	524	37.8%	36496	18.2%	831	60.0%	70526	35.2%	200125	21673	33830
M4		764	186	24.3%	36496	18.2%	377	49.3%	70526	35.2%	200125	25338	33830
M5		1068	289	27.1%	36496	18.2%	645	60.4%	70526	35.2%	200125	21119	33830
Ran6		1399	400	28.6%	9943	24.2%	676	48.3%	18470	44.9%	41107	25576	27130
Rob7		2337	935	40.0%	14293	39.5%	1475	63.1%	21991	60.8%	36152	18245	19716
Roc8		1348	573	42.5%	9674	29.0%	883	65.5%	16399	49.1%	33387	18399	25402
W9		2053	269	13.1%	27536	16.6%	641	31.2%	53647	22.4%	165760	36411	36222
W10		2437	400	16.4%	27536	16.6%	699	28.7%	53647	22.4%	165760	37394	36222

Appendix 11.5 2000 Census Data

Race

2000		Tractpop	County	White	%	County	%	Black	%	County	%	Hisp	%	County	%
G1	116.02	3,279	421048	1501	45.70%	271686	64.50%	1098	33.48%	123253	29.30%	524	15.90%	15985	3.8%
M2	9	2224	695454	143	6.42%	445250	64.00%	1709	76.84%	193838	27.90%	124	5.50%	44871	6.5%
M3	42	3625	695454	733	20.20%	445250	64.00%	2766	76.30%	193838	27.90%	88	2.40%	44871	6.5%
M4	44	2410	695454	749	31.00%	445250	64.00%	1502	62.32%	193838	27.90%	92	3.80%	44871	6.5%
M5	53.01	2773	695454	816	29.40%	445250	64.00%	1525	54.99%	193838	27.90%	625	22.50%	44871	6.5%
Ran6	316.01	3657	130454	3461	94.80%	116370	89.20%	89	2.43%	7342	5.60%	47	1.20%	8646	6.6%
Rob7	9601	8009	123339	4173	52.10%	40460	32.80%	2414	30.14%	30973	25.10%	932	11.60%	5994	4.9%
Roc8	414	3221	91928	2089	64.80%	71735	78.00%	936	29.05%	18291	19.90%	173	5.30%	2825	3.1%
W9	528.02	5636	627846	3909	69.30%	454544	72.40%	1398	24.80%	123820	19.70%	275	4.80%	33.985	5.4%
W10	534.04	14168	627846	11129	78.50%	454544	72.40%	2104	14.85%	123820	19.70%	563	3.90%	33.985	5.4%

Education

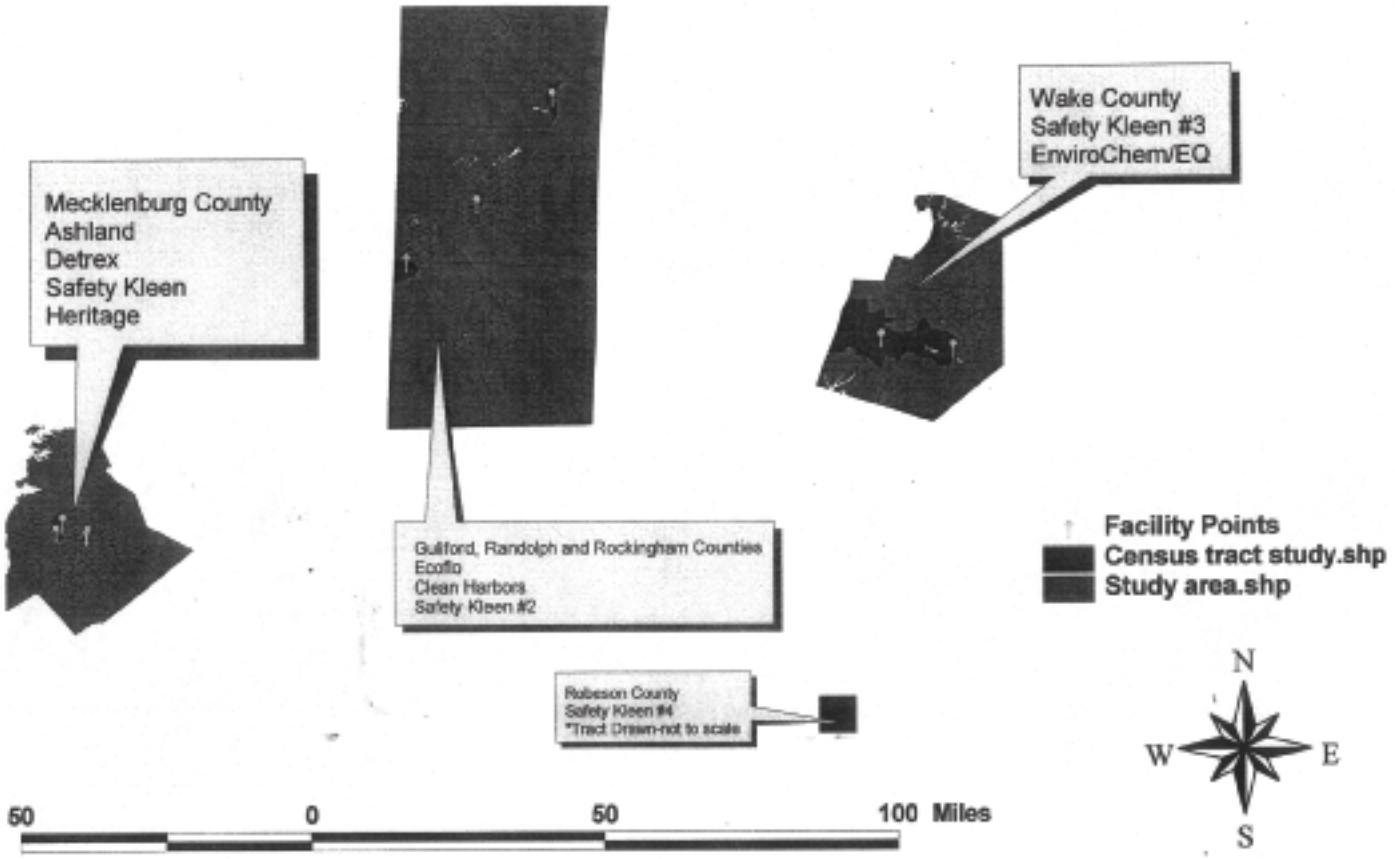
2000	Tractpop+2	HS Grad	%	CountyHS	%	ountypop+25
G1	2028	1246	61.44%	228582	82.97%	275494
M2	1293	624	48.26%	393161	86.38%	455163
M3	2155	1356	62.92%	393161	86.38%	455163
M4	1501	1109	73.88%	393161	86.38%	455163
M5	1647	1127	68.43%	393161	86.38%	455163
Ran6	2586	1628	62.95%	61191	69.97%	87450
Rob7	4985	2909	58.36%	51465	69.12%	74458
Roc8	2146	1269	59.13%	43719	68.88%	63470
W9	3812	3225	84.60%	360095	89.25%	403481
W10	8959	8184	91.35%	360095	89.25%	403481

Income

	Household	<15	%	CUnder15	%	<25	%	CUnder25	%	ounty Hshlds	Median Household Income
G1	1192	227	19.04%	23667	14.03%	445	37.33%	45115	26.74%	168710	33700
M2	699	198	28.33%	21717	7.94%	276	39.48%	28701	10.49%	273561	28173
M3	1313	306	23.31%	21717	7.94%	566	43.11%	28701	10.49%	273561	27868
M4	884	125	14.14%	21717	7.94%	261	29.52%	28701	10.49%	273561	35000
M5	1129	160	14.17%	21717	7.94%	461	40.83%	28701	10.49%	273561	28991
Ran6	1477	288	19.50%	7769	15.34%	534	36.15%	14996	29.61%	50637	34479
Rob7	2900	905	31.21%	12102	27.74%	1492	51.45%	19685	45.12%	43628	24139
Roc8	1299	282	21.71%	7688	20.75%	498	38.34%	13340	36.01%	37048	32250
W9	2347	148	6.31%	21994	9.08%	425	18.11%	44210	18.26%	242143	44806
W10	5001	234	4.68%	21994	9.08%	588	11.76%	44210	18.26%	242143	65231

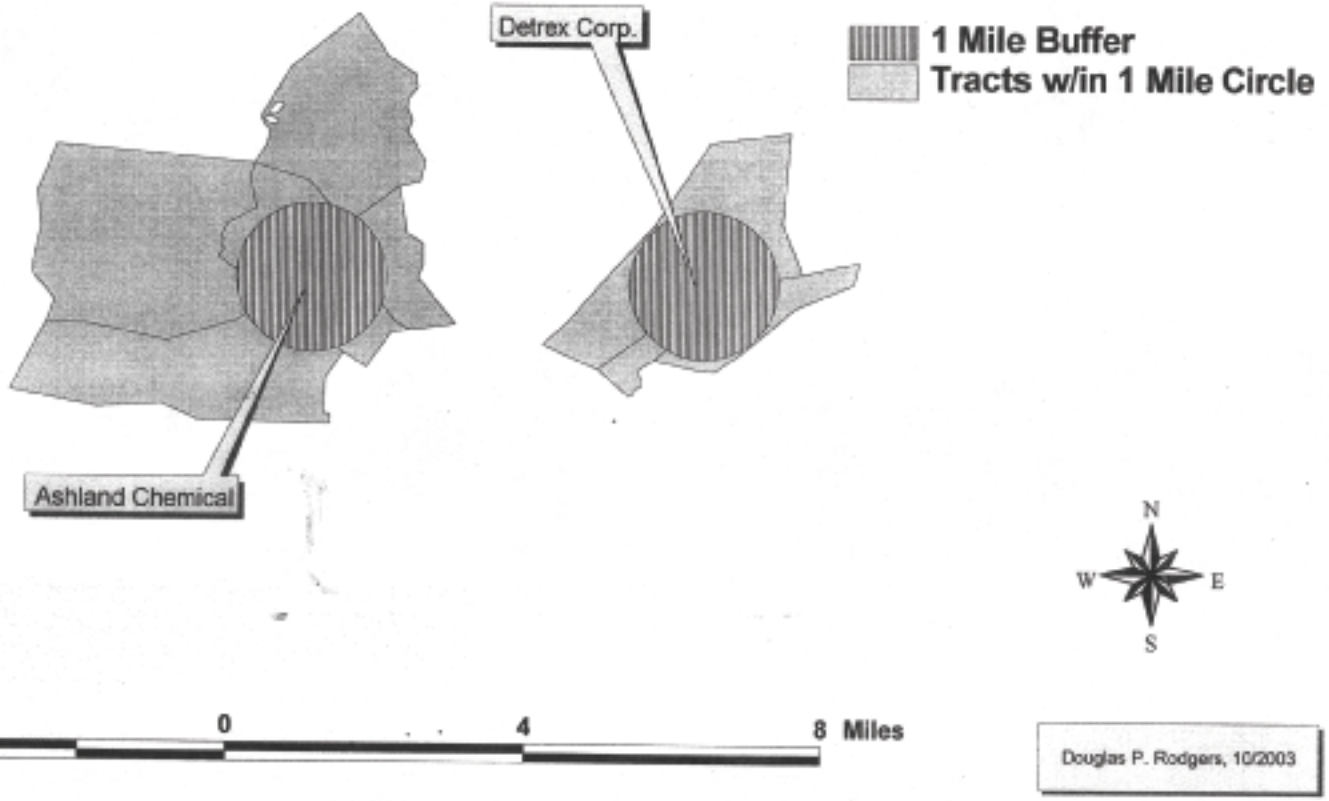
Appendix 11.6

Study Area

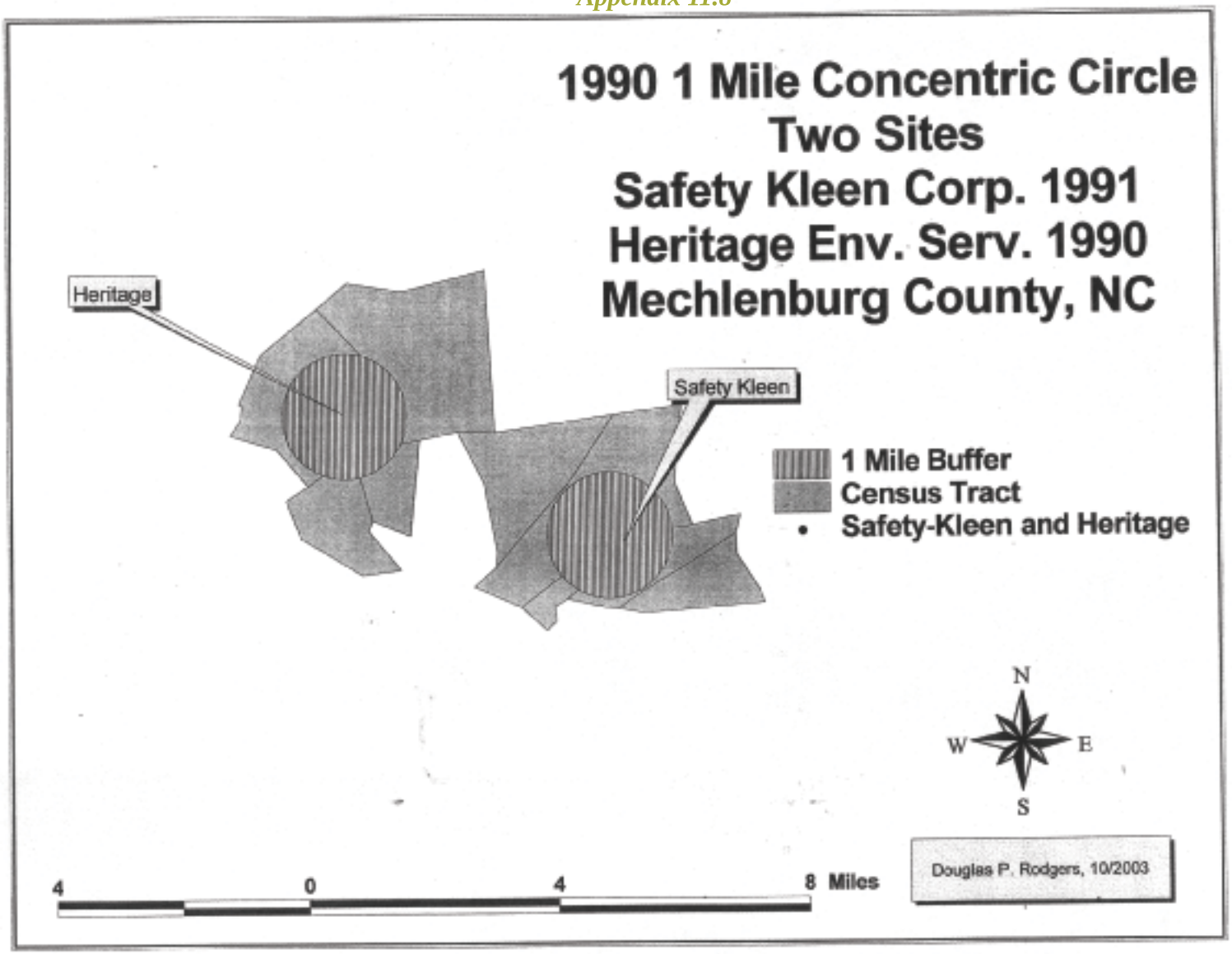


Appendix 11.7

1980 1 Mile Concentric Circle
Ashland Chemicals, 1984
Detrex Corp., 1983
Mecklenburg County, NC



Appendix 11.8



Appendix 11.9 Study Sites

The facilities to study are as follows:

Ecoflo Inc.
2750 Patterson Street.,
Greensboro, NC 27407
(336) 855-7925
Guilford (COUNTY)
116.02 (TRACT)
Sited-5/85

Detrex Corp.
3114 CullmanAve
Charlotte, NC 28206
Mecklenburg
53.01
Sited-8/83

EQ Industrial Services/EnviroChem*
1005 Investment Services
Apex, NC 27502
(919) 363-4700
Wake
534.04
*EQ purchased EnviroChem in 2003.
Sited-2003, EnviroChem-Sited 5/93

Heritage Environmental Services
4132 Pompano Rd.
Charlotte, NC 28216
Mecklenburg
44
Sited-9/90

Clean Harbors
208 Watlington Industrial Dr
Reidsville, NC 27320
Rockingham
414
Sited-11/87

Safety Kleen Corp.
2320 Yadkin Ave.
Charlotte, NC 28205
(704) 375-0098
Mecklenburg
9
Sited-6/91

Safety Kleen Corp.
6225 Old Stage Road
Raleigh, NC 27603
(919) 772-6622
Wake
528.02
Sited-9/90

Safety-Kleen Corp.
6182 Old Mendenhall Rd
Archdale, NC 27263
Randolph
316.01
Sited-8/91

Safety Kleen Corp.
Highway 301 North
Saint Paul's, NC
(910) 865-5081
9601
Robeson
Sited-8/91

Ashland Chemical Inc.
3930 Glenwood Drive
Charlotte, NC 28208
(704) 392-2122)
Mecklenburg
42
Sited 7/84