

ANALYZING EVIDENCE OF ENVIRONMENTAL JUSTICE

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I. INTRODUCTION

A new and powerful movement has swept through environmental and land use law, challenging many of its basic tenets and forcing it to confront the difficult issues of *who* gets *what* kind of environmental quality, *where* environmentally undesirable land uses get put, and *why*.¹ The movement, known as environmental justice, focuses on the distributional implications of the way in which our society seeks to manage environmental threats and improve and protect environmental quality.²

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1. See Robert D. Bullard, *Conclusion: Environmentalism with Justice*, in CONFRONTING ENVIRONMENTAL RACISM, VOICES FROM THE GRASSROOTS 195, 203, 206 (R. Bullard ed., 1993); David M. Smith, *Who Gets What Where, and How: A Welfare Focus for Human Geography*, 59 GEOGRAPHY 289 (1974).

2. For an overview of the Environmental Justice Movement's concerns and goals, see, e.g., Robert D. Bullard, *Anatomy of Environmental Racism and the Environmental Justice Movement*, in CONFRONTING ENVIRONMENTAL RACISM, 15, 17-19; Bullard, *supra* note 1, at 195. The literature on environmental justice is extensive. For a survey of much of the legal literature, see Robert W. Collin, *Review of the Legal Literature on Environmental Racism, Environmental Equity, and Environmental Justice*, 9 J. ENVTL. L. & LITIG. 121 (1994). For collections of the literature, see Symposium, *Environmental Justice: The Merging of Civil Rights and Environmental Activism*, 9 ST. JOHN'S J. LEGAL COMMENT. 437 (1994); Symposium, *Third Annual Stein Center Symposium on Contemporary Urban Challenges*, 21 FORDHAM URB. L.J. 425 (1994); Symposium, *Environmental*

In the past year, the foundation of some of the environmental justice arguments was shaken by the release of a nationwide study which challenged the substantial body of evidence that locally undesirable land uses (LULUs) are disproportionately placed in communities that are predominantly populated by people of color and the poor.³ The analysis, conducted by the Social and Demographic Research Institute (SADRI) at the University of Massachusetts, studied the siting of commercial hazardous waste facilities.⁴ Those are the same facilities examined in the pioneering 1987 study by the Commission for Racial Justice (CRJ).⁵

The CRJ study gave the environmental justice movement substantial credibility and is cited as the justification for many of the environmental justice proposals considered in recent years by Congress and state legislatures.⁶ The study found a significant correlation between the number of commercial hazardous waste facilities in a zip code and the percentage of people of color in the zip code's

Justice, 5 MD. J. CONTEMP. LEGAL ISSUES 1 (1994); Symposium, *Earth Rights and Responsibilities: Human Rights and Environmental Protection*, 18 YALE J. INT'L L. 213 (1993); Symposium, *Race, Class, and Environmental Regulation*, 63 U. COLO. L. REV. 839 (1992); *Environmental Equity in the 1990s: Pollution, Poverty, and Political Empowerment* 1 KAN. J.L. & PUB. POL'Y 1 (1991); see also ROBERT D. BULLARD, UNEQUAL PROTECTION: ENVIRONMENTAL JUSTICE AND COMMUNITIES OF COLOR (1994); Bullard, *supra* note 1; ENVIRONMENTAL JUSTICE (Jonathan S. Petrikin ed., 1995); KENNETH A. MANASTER, ENVIRONMENTAL PROTECTION AND JUSTICE (1995); RACE AND THE INCIDENCE OF ENVIRONMENTAL HAZARDS: A TIME FOR DISCOURSE (Bunyan Bryant & Paul Mohai eds., 1992); TOXIC STRUGGLES: A THEORY AND PRACTICE OF ENVIRONMENTAL JUSTICE (Richard Hofrichter ed., 1993).

3. For the most recent survey of the literature, see Vicki Been, *Environmental Justice*, in P. ROHAN, ZONING AND LAND USE CONTROLS Ch. 25D.02 (1995); see also BENJAMIN A. GOLDMAN, NOT JUST PROSPERITY: ACHIEVING SUSTAINABILITY WITH ENVIRONMENTAL JUSTICE 3-25 (1994); Vicki Been, *Locally Undesirable Land Uses in Minority Neighborhoods: Disproportionate Siting or Market Dynamics?*, 103 YALE L.J. 1383, 1392-98 (1994) [hereinafter Been, *Undesirable Land Uses*]; Luke W. Cole, *Empowerment as the Key to Environmental Protection: The Need for Environmental Poverty Law*, 19 ECOLOGY L.Q. 619, 622-27 & nn.8-18 (1992); Paul Mohai & Bunyan Bryant, *Environmental Injustice: Weighing Race and Class as Factors in the Distribution of Environmental Hazards*, 63 U. COLO. L. REV. 921 (1992).

4. Douglas L. Anderton et al., *Environmental Equity: Evaluating TSDF Siting Over the Past Two Decades*, WASTE AGE, July 1994, at 83 [hereinafter Anderton, *Evaluating TSDF Siting*]; see also Douglas L. Anderton et al., *Environmental Equity: The Demographics of Dumping*, 31 DEMOGRAPHY 229 (1994) [hereinafter Anderton, *Demographics of Dumping*] (reporting results of analysis using 1980 census data); Douglas L. Anderton et al., *Environmental Equity: Hazardous Waste Facilities: "Environmental Equity" Issues in Metropolitan Areas*, 18 EVALUATION REV. 123 (1994) (reporting results of analysis using 1980 census data).

5. UNITED CHURCH OF CHRIST COMMISSION FOR RACIAL JUSTICE, TOXIC WASTES AND RACE IN THE UNITED STATES (1987) [hereinafter CRJ study].

6. See, e.g., H.R. 1924, 103d Cong., 1st Sess. (1993) ("findings" section of the bill cites the study and reports its main findings); 139 CONG. REC. S8107 (daily ed. June 24, 1993) (statement of Mr. Baucus quoting the findings of the Commission for Racial Justice, although not crediting the report, in introducing S. 1161, Environmental Justice Act of 1992, 103d Cong., 1st Sess. (1993)).

population.⁷ Areas with one operating facility other than a landfill had almost twice as many people of color as a percentage of the population as areas without such facilities had.⁸ As the number or noxiousness of the facilities in a neighborhood increased, so did the percentage of people of color in that neighborhood.⁹ In 1994, the CRJ updated its study using 1990 census data, finding that zip codes hosting one facility again had more than twice the percentage of people of color as non-host zip codes.¹⁰

The recent SADRI study reached quite different conclusions. It found that as of the 1990 census, there was no statistically significant difference between the percentages of African Americans or Hispanics in host census tracts and non-host tracts.¹¹

The CRJ study found that class differences, as measured by mean household incomes, differed less significantly than the racial composition of host and non-host zip codes.¹² SADRI, on the other hand, found that although racial composition did not differ significantly between host and non-host census tracts, there was a statistically significant difference in the percentage of families living below the poverty level.¹³

At the time the SADRI research was released, we were working on a similar study. That study focuses not on the current distribution of hazardous waste facilities, but analyzes instead the demographics of the host neighborhoods at the time of the initial siting, and then studies changes in the demographics of the communities following the siting. The purpose of that study is to shed some light on the question whether sitings themselves were disproportionate, or whether the market response to sitings led the surrounding communities to become disproportionately populated by people of color and the poor.¹⁴ The results of that study are not yet ready to be released.

The data we had for that longitudinal study allowed us to explore possible explanations for the different results reached by the CRJ and SADRI researchers. The easy explanation is that the two studies used different units of analysis: SADRI examined the census tracts in which the LULUs were located,¹⁵ while the CRJ examined the zip codes.¹⁶

7. CRJ study, *supra* note 5, at 13-14.

8. *Id.* at 13, 41-44.

9. *Id.*

10. BENJAMIN A. GOLDMAN & LAURA FITTON, TOXIC WASTES AND RACE REVISITED 3 (1994).

11. Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 84.

12. CRJ study, *supra* note 5, at 13.

13. Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 84.

14. For a discussion of the role of market dynamics in the distribution of undesirable land uses, see Been, *Undesirable Land Uses*, *supra* note 3, at 1388-92.

15. Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 83.

Indeed, SADRI reconciled its findings with those of the CRJ by showing that when host tracts were combined with other tracts within a 2.5 mile radius of the facility, their findings began to look similar to those of the CRJ.¹⁷

The differences between the units of analysis used in the studies seemed to be only part of the story, however. The SADRI study was roundly criticized by environmental justice advocates on several other grounds,¹⁸ and in the course of our longitudinal study, we had developed additional questions about the methodology of both the CRJ and SADRI studies. Accordingly, we took a hard look at the methodological choices the SADRI and CRJ researchers had made, trying to identify which of those choices affected the results, and in what fashion. What we discovered sheds some light on various criticisms of the SADRI study and defenses of the CRJ study. The broader purpose of this analysis, however, is to highlight the methodological issues researchers need to address, and to present alternative methodologies that should improve our ability to understand the nature of the distribution of environmental “goods” and “bads.”

II. COMPARISON OF HOST AND NON-HOST CENSUS TRACTS AS OF 1990

Like SADRI, we analyzed the demographics of host census tracts, not zip codes. Census tracts were more suitable for our longitudinal study for several reasons. First, we needed data from 1970 onward, because the main purpose of the longitudinal study is to examine changes over time in host communities. National zip code data became readily available only in 1980, but tract data is available for the 1970 census.

Additionally, we wanted a unit that would change as little as possible over the relevant decades, and we needed to be able to identify any changes so that the units could be reconfigured to be equivalent over time. Census tracts are intended to remain relatively stable, and when they do change, the exact nature of the changes is published. Zip codes, on the other hand, change at the convenience of the postal service, and no published record of changes is available.

16. CRJ study, *supra* note 5, at 13.

17. Anderton, *Demographics of Dumping*, *supra* note 4 at 357-59; John M. Oakes et al., *Environmental Inequity, Industrial Siting, and the Structure of American Cities*, Paper Presented at the 1995 Annual Meetings of the National Association of Environmental Professionals: Washington D.C. (June 10-13, 1995).

18. See, e.g., GOLDMAN & FITTON, *supra* note 10, at 14-15; Robert D. Bullard, *The Legacy of American Apartheid and Environmental Racism*, 9 ST. JOHN'S J. LEGAL COMMENT. 445, 467-69 (1994).

Even for cross-sectional analysis, census tracts are a more appropriate unit of analysis than zip codes.¹⁹ Census tracts are drawn up by local committees, and accordingly are more likely to reflect the community's view of where one neighborhood ends and another begins. Zip codes, on the other hand, are constructed only for the convenience of the postal service, and do not necessarily coincide with neighborhoods.²⁰ Tracts also are comparable in population, while zip codes may contain widely varying numbers of people and cover areas of widely varying sizes.²¹ Tracts reflect the area right around the facility—the area that usually will bear its worst impacts. Zip codes may extend for miles beyond the facility, into areas where many people may not even be aware of the facility's presence.

Using census tracts as the focus of analysis, we compared the means of various demographic variables for about 600 tracts hosting commercial hazardous waste treatment storage and disposal facilities (TSDFs) in 1994 to those of almost 60,000 non-host tracts. The results are presented in the Appendix, Figure 1. Unlike the CRJ study of zip codes, and like the SADRI study of census tracts, the study results show no statistically significant difference between the mean percentage of African Americans in host tracts and non-host tracts. However, the results show a substantial and statistically significant difference between the mean percentage of Hispanic persons in host and non-host tracts, unlike the SADRI study. While SADRI's analysis was limited to African American and Hispanic populations, our results show a statistically significant difference between host and non-host tracts in the mean percentage of all minorities (all races other than white, and all Hispanics, whether white or of another race).²²

The results show a considerable difference along measures of wealth and social class: host tracts have much lower median family

19. For discussions of the appropriate unit of analysis in environmental justice studies, see, e.g., Been, *Undesirable Land Uses*, *supra* note 3; Michael Greenberg, *Proving Environmental Inequity in Siting Locally Unwanted Land Uses*, 4 RISK: ISSUES IN HEALTH & SAFETY 235, 238 (1993); Rae Zimmerman, *Issues of Classification in Environmental Equity: How We Manage is How We Measure*, 21 FORDHAM URB. L.J. 633 (1994); John Fahs Bender, Note, *An Analytical Approach to Defining the Affected Neighborhood in the Environmental Justice Context*, 4 N.Y.U. ENVTL. L. REV. (forthcoming Fall 1995).

20. MICHAEL J. WHITE, AMERICAN NEIGHBORHOODS AND RESIDENTIAL DIFFERENTIATION 18-20, 289-98 (1987). See also Mark Monmonier, *Zip Codes, Data Compatibility, and Environmental Racism*, 2 GIS LAW 4, 5 (1994).

21. Tracts are supposed to contain between 2500 and 8000 residents, and have an average of 4000 people. WHITE, *supra* note 20, at 292-95.

22. The Census Bureau classifies by race (White; Black; American Indian, Eskimo and Aleut; Asian or Pacific Islander; and other) and by Spanish origin. Persons of Spanish origin may be of any race. We use the term "minorities" to mean all persons who are not white and all white Hispanics.

incomes and somewhat higher percentages of people living in poverty than non-host tracts. Host tracts have a much less educated population, higher levels of unemployment, lower levels of employment in the professional occupations²³ and higher levels of employment in manufacturing occupations.²⁴ Median housing value is strikingly lower in host tracts than in non-host tracts. Each of these class differences is statistically significant.

The univariate results, therefore, tend to support those SADRI findings which dispute the allegation that hazardous waste facilities currently impose a disproportionate burden on African American neighborhoods. Our results depart from or go beyond the SADRI findings, however, on other measures of racial and class differences.

To examine the correlation between each of these demographic variables and the presence of TSDFs when all of the variables are considered together and correlations among the variables themselves are controlled, we used a logit regression. The dependent variable was the presence or absence of a facility in the tract. The independent variables were eight of the demographic characteristics discussed above: percentage of African Americans, percentage of Hispanics, percentage of individuals living below the poverty line, percentage with no high school education, median family income, percentage of the labor force unemployed, percentage of the labor force employed in manufacturing occupations, and median housing value.²⁵

The logit estimations, presented in the Appendix in Figure 2A, show that the percentage of Hispanics, median housing value, and percentage of the labor force employed in manufacturing occupations are statistically significant predictors of the presence of a facility. The higher the percentage of Hispanics or the higher the percentage of persons employed in manufacturing occupations, the greater the

23. For the purposes of this analysis, professional employment means those persons employed in executive, administrative and managerial occupations (occupational codes 3-37) and those employed in professional specialty occupations (codes 43-199). The percentage of workers employed in those categories was calculated by dividing the number of persons employed in those categories by the total number of males and females age 16 or older employed in the civilian labor force.

24. Manufacturing employment is defined here as employment in precision production, craft and repair occupations (codes 503-699), as machine operators, assemblers and inspectors (codes 703-799), in transportation and mineral moving occupations (codes 803-859), and as handlers, equipment cleaners, helpers, and laborers (codes 863-889). The percentage of workers employed in those categories was calculated by dividing the number of persons employed in those categories by the total number of males and females age 16 or older employed in the civilian labor force.

25. The percentage of minorities in the tract, and the percentage of the labor force employed in professional occupations were excluded from the analysis because they were so highly correlated with, respectively, the percentage of African Americans and Hispanics and the percentage of the labor force employed in manufacturing occupations.

probability that the tract hosts a facility. The higher the median housing value, the lower the probability that the tract hosts a facility.

Our logit specification did not attempt to model the siting process, for several reasons. First, we lacked data on factors such as access to transportation that probably are quite important in the siting decision. Second, our goal was not to explain the reasons why sites are chosen, but to explore whether they are being chosen in a manner that has a disproportionate impact upon people of color and the poor. Nevertheless, we included a population density variable in the regressions reported in the Appendix in Figure 2B. The decision to locate a facility is likely to turn in part upon the population density within a proposed host community because sites with greater density put more people at risk (other things being equal), increase the number of people who may oppose the site, and may increase the costs of buying out and relocating residents. The univariate analysis shows that population density is substantially lower in host sites, and that the difference is highly significant. Population density also is highly correlated, positively, with several of the demographic variables, such as the percentage of African Americans, so its omission from the regressions could hide the effect of those variables. Accordingly, we were comfortable adding the density variable to the regression of demographic variables, even without a fully specified model of the siting process.

With the density variable, the regressions show that the percentage of African Americans, Hispanics, unemployed persons and persons employed in manufacturing occupations all are significant predictors of the presence of a facility (the higher the variable, the higher the likelihood that the tract hosts a facility). The percentage of individuals with incomes below the poverty line and the population density are significant, but negative predictors: the higher the variable, the lower the likelihood that the tract hosts a facility. Adding the population density variable to the regression accordingly reduces the significance of median housing value, and increases the significance of the percentage of African Americans in the host tracts.

The univariate analysis and the multivariate analysis considering population density reveal that the percentage of Hispanics, unemployment rates, and the percentage of the workforce employed in manufacturing occupations are significantly different in host and non-host tracts and are significant predictors of the location of TSDFs. The multivariate analysis considering population density also reveals that the percentage of African Americans is a significant predictor of the presence of facilities. The comparison of means and the regressions therefore reveal a greater correlation between the racial demographics

of a census tract and the presence of TSDFs than did the SADRI study.²⁶

What is different about our analysis? What explains the results that differ from the SADRI findings, and why do these results deserve greater credibility than the SADRI findings? The analyses presented in this article address five major methodological issues:

1. How reliable was the data the SADRI and CRJ studies used?
2. Did SADRI's decision to compare host tracts only to non-host tracts with at least one facility in Metropolitan Statistical Areas (MSAs) or rural counties affect the findings?
3. Are certain types of facilities more prone to impose a disproportionate burden upon people of color or the poor than others?
4. Does the nationwide comparison of the demographics of host tracts to those of non-host tracts present a different picture of the distribution of facilities than more localized comparisons?
5. Would closer attention to the distribution of the population around the demographic means of the host and non-host tracts reveal more about who is bearing the burden of the facilities than simple comparisons of means?

III. THE RELIABILITY OF THE DATA USED

As noted previously, the CRJ and SADRI studies, as well as this analysis, examined the location of TSDFs.²⁷ Both the CRJ and the SADRI studies used the directory of commercial TSDFs published by Environmental Information Ltd., *Environmental Services Directory* (ESD) as their databases. The CRJ's most recent study, *Toxic Wastes and Race Revisited*, identified 530 TSDFs from the 1992 ESD.²⁸ The

26. SADRI's multivariate analysis found that "race and ethnicity have no significant association with TSDF location. Industrial employment stands out with a strong, positive relationship. The only other significant associations are for housing value and percent of housing built prior to 1960, both relationships being negative." Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 92.

27. The CRJ defined commercial TSDFs as "facilit[ies] (public or private) that accept[] hazardous waste from a third party for a fee or other remuneration, for the specific purpose of treating, storing or disposing of that waste, except captive facilities . . . [(those facilities established by a specific company to accept only that firm's own waste products.)]" CRJ study, *supra* note 5, at 65 (citing EPA definition). SADRI defined commercial TSDFs as those "which [are] privately owned and operated and which receive[] waste from firms of different ownership." Anderton, *Demographics of Dumping*, *supra* note 4, at 232 & n.7.

28. GOLDMAN & FITTON, *supra* note 10, at 19-20. The CRJ checked data from the ESD against FINDS (an EPA database with the names, addresses, and EPA identification number of facilities regulated under EPA's various programs), and eliminated facilities that could not be confirmed in FINDS. *Id.* at 20.

SADRI study identified 520 commercial TSDFs that were operating in 1992 from the ESD.²⁹

Our study also began with the ESD, but in the course of our work we became concerned that the ESD might not represent an accurate listing of commercial TSDFs. First, the ESD appeared to understate the universe of commercial hazardous waste TSDFs. It identified less than 500 facilities being regulated under RCRA³⁰ as commercial hazardous waste TSDFs, while the EPA's database, RCRIS (Resource Conservation and Recovery Information System), identified more than 600 facilities as being TSDFs that received off-site waste (a proxy for commercial status). Consequently, the ESD potentially understated the universe of facilities by as much as 17%.

In addition, the ESD listings seemed skewed toward the potentially least bothersome facilities.³¹ The ESD included more than eighty facilities that identified themselves as not being subject to the requirements RCRA imposes upon hazardous waste TSDFs.³² Such facilities include, for example, companies that recondition the clean empty drums that once held hazardous waste. While such facilities may be a nuisance to those living nearby, many are much less burdensome than such regulated hazardous waste TSDFs as landfills and incinerators.³³

Similarly, the ESD included more than seventy sites that were identified as mobile treatment facilities, for which the address listed was the headquarters of the firm, where no hazardous waste was treated, stored, or disposed of. The inclusion of such facilities could potentially skew the results of any environmental justice study by understating the extent of any disproportionate siting.

To resolve those difficulties, we painstakingly constructed a database using both the ESD and the RCRIS: drawing from each the information we could verify by cross-referencing the other, incorporating other sources of information about TSDFs, and surveying facility personnel. We began by pulling information from RCRIS on 600 facilities that RCRIS identified as having a "TSD indicator"³⁴ and

29. Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 86.

30. Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901-6987 (1988 & Supp. V 1993).

31. Our reservations about using the ESD are not meant as criticisms of Environmental Information Ltd. or the ESD. The ESD clearly indicates that it includes facilities which would not be classified as hazardous waste TSDFs under RCRA.

32. 40 C.F.R. § 270.1(c)(2).

33. For further discussion on this issue, see text accompanying note 39.

34. RCRIS contains a "TSD Indicator" code (in the Handler2 file, activity segment, HTSD field) indicating that the handler is engaged in the treatment, storage or disposal of hazardous waste. The code is derived from the "notification" forms the handlers complete as part of their

receiving waste from off-site sources.³⁵ After eliminating government or university facilities and facilities located outside the continental United States, and after adding in data about Florida and West Virginia facilities, which RCRIS inadvertently failed to code, we had 612 facilities.

We then turned to the ESD. The 1994 ESD, a later version than that used by the CRJ or SADRI, listed 771 facilities in the continental United States. Almost 400 of the ESD facilities were not on the RCRIS list of facilities identified as TSDFs with off-site waste receipts. Conversely, of the facilities identified by RCRIS, more than two hundred were not listed in ESD. To determine which of the facilities appearing on only one of the lists should be included in our database, we compared the ESD list with the entire RCRIS file to identify facilities that were contained in RCRIS, but did not have one of the two indicators—TSDF universe and off-site waste receipt—that had defined our original extract. This resulted in 110 matches for facilities that had a TSDF indicator in RCRIS, but had not appeared in our extract because they were missing an “off-site receipt” indicator (the proxy for commercial status). We included all those facilities in the database because the fact that the facility had chosen to be listed in the ESD assured us that it was in fact commercial, despite the missing “off-site receipt” indicator.

The remainder of the facilities included in the ESD directory, but missing a TSDF indicator, or missing from the RCRIS entirely, turned out to be the facilities mentioned earlier: those the EPA exempts from the hazardous waste TSDF regulations, such as temporary storage and transfer facilities, mobile facilities, drum reconditioners, waste oil

obligation to inform the EPA of their status, from the “Part A” permit applications handlers were required to file in order to remain in operation, and from the Biennial Reports periodically required of handlers. Almost 6000 facilities had the TSD indicator code.

RCRIS has an additional code indicating that the handler is in the “storage/treatment universe” (Handler1 file, HAND-KEY segment, HUSTORTRT field). That code is triggered only if the TSD indicator shows that the handler is a TSD other than an incinerator, and the TSD activity is identified as RCRA-regulated, and the facility has storage/treatment process codes that have been verified. Only 2091 facilities had the storage/treatment universe code, and only 325 of those also had the off-site waste receipt code. We therefore were concerned that the use of the storage/treatment universe code would understate the universe of TSDFs, and opted to use the more inclusive TSD indicator code. While that code had not been verified to the same degree as the “storage/treatment universe,” we were confident that any facilities erroneously classified as TSDFs by the indicator would be identified through our cross-checks and telephone survey.

35. To identify facilities that received waste from off-site sources, we used the off-site waste indicator (Handler1 file, hand_key segment, Edgeoff_site field). That field contains a code indicating whether the facility accepts hazardous waste from any off-site source(s), accepts waste from only a restricted group of off-site generators, is verified to be non-commercial, or has an unknown commercial status.

recyclers, and facilities that manage medical waste. Because those facilities are treated by EPA regulations as different from the usual commercial hazardous waste TSDF, we put them into a separate "exempt" category. About 250 facilities fell into that category.³⁶

For the facilities that were listed as TSDFs receiving off-site waste in RCRIS, but were not included in ESD, we attempted to verify that the facilities were indeed operating commercial TSDFs by phoning the facility.³⁷ Through these checks, we eliminated about eighty of the facilities because they had closed or were in the process of closing, or because they no longer had working phone numbers. Another forty were eliminated because they were not commercial or did not currently accept hazardous waste for treatment, storage, or disposal, or because they had never in fact opened. The resulting list contained 608 facilities, approximately 125 of which did not appear in the most recent version of the ESD. The process of verifying the regulatory status and current operating status of the facilities resulted in about 425 facilities being eliminated from the database, approximately 300 of which were facilities listed in the ESD.

The accuracy of the database depended not only on including all the facilities currently operating and excluding closed facilities,³⁸ but also upon the quality of the addresses given for each facility. Because the address determines the census tract to which the facility is assigned, errors in the addresses could produce significant errors in any demographic analysis. Both the ESD and the RCRIS databases contained numerous address errors, and the ESD sometimes provides the address of a facility's business or sales office, rather than the address of the facility itself. To remedy such inconsistencies, we verified as many addresses as possible through phone surveys of more than two-thirds of the facilities. The resulting database is one that is much more accurate, both in capturing the complete universe

36. The exempt database, after corrections for facilities that had closed, had no current phone listing, or were not listed in FINDS, included 142 facilities.

37. We also checked our lists against other lists of facilities provided by trade organizations and others. See, e.g., Environmental Protection Agency, Office of Solid Waste and Emergency Response, Combustion Emissions Technical Resource Document (draft, May 1994) (listing commercial hazardous waste incinerators, cement kilns, and lightweight aggregate kilns); Cement Kiln Recycling Coalition, *Plant Locations Using Waste-Derived Fuel* (1994); Pat Costner & Joe Thornton, *Playing with Fire: Hazardous Waste Incineration* (Greenpeace 1991) (list of eighteen hazardous waste incinerators then operating); CRJ study, *supra* note 5, at 66 (listing twenty-seven hazardous waste landfills).

38. Closed facilities had to be excluded because thousands of facilities have closed over the years but cannot be easily identified. To include known closed facilities, without being able to include the many that we cannot identify, could skew the results of any analysis significantly. Both the CRJ and the SADRI studies also excluded facilities known to have closed.

of facilities that are properly classified as commercial TSDFs and in getting the addresses and locations of those facilities correct.

What difference did all this careful checking make? The difference is hard to quantify because we used a more recent ESD than did the SADRI and CRJ studies. Therefore, our database, even before any changes produced by our accuracy checks, was somewhat different from both those studies.

To get some idea of the differences, however, we examined the demographics of the areas surrounding 144 facilities listed in the ESD that were eliminated from our database because they were exempt from regulation as hazardous waste facilities.³⁹ The results are presented in the Appendix, Figure 3. The demographics of those facilities look very similar to those of the non-host tracts, except that the exempt facility hosts had significantly lower median housing values and lower levels of education than the non-hosts. Inclusion of those facilities, therefore, had the potential to skew the results of any environmental justice study away from a finding that facilities are sited disproportionately in communities of color.⁴⁰

The conclusions of any study are only as good as the data used for the study. We believe that our database is much more accurate than that used by either the CRJ or the SADRI researchers, and that our results therefore stand on firmer ground.

IV. LIMITATION TO METROPOLITAN STATISTICAL AREAS OR RURAL COUNTIES WITH AT LEAST ONE FACILITY

One of the major criticisms of the SADRI study was that it artificially limited its comparison to those non-host tracts in MSAs or rural counties with at least one facility.⁴¹ SADRI's reasoning for not including other non-host tracts was that only tracts in the same MSA as a facility can serve as possible alternative sites for the same market.⁴² Critics argued, however, that alternatives for the site might be located much more broadly.⁴³

39. See *supra* notes 31-33 and accompanying text. Approximately 250 facilities were eliminated because they were exempt from regulation as hazardous waste facilities. Of these, approximately 100 were either closed, or would have been eliminated from the CRJ study, and possibly from the SADRI study, because they did not appear in the FINDS database that the CRJ used to check the regulatory status of the facilities.

40. No intimation is being made that the inclusion of the exempt facilities was intended to bias the analysis. At any rate, since both CRJ and SADRI relied upon the ESD, both studies would have been biased in the same direction.

41. GOLDMAN & FITTON, *supra* note 10, at 14; Bullard, *supra* note 18, at 467.

42. Anderton, *Evaluating TSDF Siting*, *supra* note 4, at 92, 96, 100.

43. GOLDMAN & FITTON, *supra* note 10, at 14; Bullard, *supra* note 18.

Our analysis is based on a comparison between all host and all populated non-host tracts within the continental United States. When we compared our host tracts to SADRI's limited set of non-host tracts, about 18,000 non-host tracts dropped out of the analysis. The results are presented in the Appendix, Figure 4.

Dropping those tracts from the analysis had several effects. First, the percentage of African Americans in the non-host tracts increased. As a result, the mean percentage of African Americans in non-host tracts actually was higher than for host tracts, although the difference was not statistically significant. The percentage of Hispanics in the non-host tracts also increased and, consequently, there was no statistically significant difference in means. The percentage of poor individuals living below the poverty line in the non-host tracts fell, resulting in an increase in the statistical significance of the difference in means. The median family income and median housing value in the non-host tracts increased, making the difference in means between host and non-host tracts greater.

The SADRI limitation reduces the differences between host and non-host tracts in racial terms, and even changes the direction of the difference in the case of African Americans. The SADRI methodology, while deservedly controversial, raises a very important issue about the analysis of environmental justice. Researchers have not developed a good model of how facilities are sited, and thus it is difficult to specify with any degree of precision which non-host tracts are viable alternative sites for the facilities. Until such a model is specified and agreed upon, it is impossible to evaluate whether the SADRI limitation is appropriate. We are trying to develop a model that would help us compare the host tracts to other tracts that really are alternatives; the results of that research will be presented in the near future.

V. FAILURE TO DIFFERENTIATE BETWEEN DIFFERENT TYPES OF FACILITIES

Professor Bullard has criticized the SADRI study because it "does not breakout the different types of TSDFs. The study design operates as if all TSDFs are the same, yet landfills and incinerators are very different from storage facilities. Specifically, no data is provided on the siting of hazardous waste incinerators."⁴⁴ Our breakout of the

44. Bullard, *supra* note 18, at 468. Professor Bullard's criticism was directed in part to the fact that SADRI's initial research was funded in part by Waste Management Incorporated, which owns and operates hazardous waste facilities, including the types of facilities that

most troublesome facilities—landfills, incinerators, and kilns—reveals that there are some differences between the tracts hosting the most noxious facilities and other host tracts. The results are presented in the Appendix, Figure 5.

Comparison of means tests show that tracts containing landfills, incinerators, and kilns have higher percentages of African Americans and the poor than both non-hosts and hosts of other facilities. None of the differences is statistically significant, however. Statistical significance depends in part upon the number of observations that went into the calculation. Because the number of landfills and incinerators is fairly low, it would take a larger difference in means to register as statistically significant than for the universe of all facilities, assuming a constant variance (standard deviation).⁴⁵ The tracts hosting landfills, incinerators, and kilns do have much lower median family incomes, median housing values, and median rents than either the non-hosts or other facilities. Those differences generally are statistically significant.

The charge, then, that the SADRI research was biased because it failed to analyze the most troublesome facilities separately is not borne out by study. The breakout reveals no statistically significant differences on the percentage of African Americans and the percentage of poor living near the facilities. There are differences in the areas surrounding those least desirable facilities, but the differences lie in the property values surrounding the facilities and in the level of income and educational attainment of the facilities' neighbors.

VI. THE COMPARISON TO NATIONAL MEANS

Comparison of host tracts to the average of non-host tracts across the nation may smooth out differences between host tracts and their surrounding areas. Host tracts in a particular area could have a 14% African American population, for example, which could be four times that of the surrounding metropolitan area, yet equal to the national average. Although the host tract is disproportionately sited in comparison to its metropolitan area, it looks unproblematic when compared to the country as a whole. Conversely, a host tract in a particular area could have a percentage of African Americans that is much higher than the national average and, therefore, appear to be the victim of disproportionate siting, even though the host tract's percentage is in line with the average of the state or metropolitan area.

Professor Bullard identified as most troublesome. See Anderton, *Demographics of Dumping*, *supra* note 4, at 229.

45. Even combining all landfills, incinerators, and kilns fails to produce statistically significant differences in the means of the percentages of African Americans and the poor.

Regions of the country, as well as states and cities within those regions, differ markedly in their racial composition. The percentage of African Americans, for example, varies from slightly more than 2% in the New England states to 25% in the east south central states.⁴⁶ The percentage of Hispanic persons varies from less than 1% in the east south central states to more than 20% in the Pacific region.⁴⁷ Sitings that are disproportionate at the state or MSA level, therefore, can be hidden by comparing host tracts to the national average of non-host tracts.

Both SADRI and the CRJ recognized the potential for national averages to hide disparities at less aggregated levels. SADRI compared host tracts to non-host tracts within the same Environmental Protection Agency region (the EPA divides the country into ten regions for purposes of administrative and regulatory convenience). SADRI found that the average percentage of African Americans was significantly lower in host tracts in the north mid-Atlantic states (EPA region II), but otherwise was not significantly different. The percentage of Hispanics was significantly higher in host tracts only for the southwest (EPA region IX).⁴⁸ The CRJ compared host zip codes to non-host zip codes within the same state, finding disparities to be highest in Kansas, Kentucky, Tennessee, Indiana, Nebraska, Michigan, and Alabama.⁴⁹ Determining whether a comparison of host tracts to their surrounding regions or MSAs is more appropriate than a nationwide comparison depends on how location decisions actually are made. As noted previously, researchers haven't agreed upon a model of the siting process. Facilities may have restricted their siting choice to the state or metropolitan area in which they eventually located because of proximity to customers, availability of transportation networks, regulatory climate, or other geographically specific factors.⁵⁰ On the other hand, the facilities may have been able to locate almost anywhere in the United States.

To determine whether a more limited comparison would change the nature of any disparities shown between host and non-host tracts, we calculated the ratio of the demographics of host sites to the demographics of all non-host sites within the state and within the

46. MARK T. MATTSON, *ATLAS OF THE 1990 CENSUS* 101 (1992) (designating Tennessee, Alabama, and Mississippi as the east south central region).

47. *Id.* at 109.

48. Anderton, *Demographics of Dumping*, *supra* note 4, at 239 & Figure 1.

49. GOLDMAN & FITTON, *supra* note 10, at 10.

50. SADRI's decision to limit comparison non-host tracts to those in areas that had at least one facility would be on firmer ground if facilities felt their site choices were restricted to nearby tracts. See *supra* notes 41-43 and accompanying text.

MSA. If the host tract had a 30% African American population, for example, while the non-host tracts within the state had 15%, the ratio was 2:1. We then calculated the mean of those ratios and tested to see whether that mean was significantly different from one, the ratio that would result if the host tract and non-host tracts had the same demographics. The results are presented in the Appendix, Figure 6.

We found that those demographic variables of the host tracts that were significantly different from the demographics of the non-host tracts at a national level continued to be significantly different at a state level. The percentage of African Americans in the host tracts continued to be insignificantly different from the percentage of African Americans in non-host tracts.

The picture changes, however, when the comparison is drawn between host tracts and non-host tracts within the same MSA. The percentage of African Americans in the tracts remains insignificantly different. The percentage of Hispanics remains significantly different, but the difference narrows. The difference between the percentage of the poor in the host and non-host tracts increases, and becomes more statistically significant.

The most interesting changes, however, are in the financial variables. The difference between the median family incomes in host and non-host tracts narrows considerably, and loses statistical significance. Similarly, the difference between median housing value in the host and non-host tracts narrows, and drops in statistical significance from the 99% to the 95% confidence levels.

The similarity between the median family incomes of the host and non-host tracts within the same MSA calls into question both the extent to which siting disparities are related to class and the extent to which that relationship is inappropriate. The sitings had a disproportionate impact upon those with lower incomes than their non-metropolitan neighbors. But within a metropolitan area, there was little difference between the median family incomes in host and non-host tracts. Accordingly, any injustice lies in the placement of LULUs within metropolitan areas instead of in more rural areas or in smaller cities outside metropolitan areas, rather than in the placement of LULUs within the host city itself. There are substantial and non-controversial reasons for placing LULUs in the less densely populated areas of an MSA, however. For example, facilities in the cities are likely to be closer to the waste sources, which reduces the risk of accidents in transport.

Similarly, the fact that the difference between the median housing values in host and non-host tracts narrows considerably when only the host MSA is studied, calls into question both the extent to which

sitings may be based on class, and the extent to which sitings may be having a negative impact on surrounding property values.

These problems illustrate the need for further discussion about what constitutes environmental injustice. If the siting of TSDFs has a disproportionate impact on poorer families only because most facilities are located in urban areas, and their urban neighbors are poorer than people living outside urban areas, then the remedy may lie in changing the allocation of power among cities and between local, state, and federal governments, rather than by reforming the nature of the siting processes. The definition of the relevant comparison group accordingly has implications both for determining whether facilities are cited disproportionately and if so, for determining the nature of the remedy.

VII. FAILURE TO EXAMINE THE DISTRIBUTION OF THE POPULATION AROUND THE MEANS

Both the CRJ and the SADRI researchers focused their reports on comparisons of means and regression analyses based upon those comparisons.⁵¹ The mean is simply the average, and an average tells us little about the dispersion of the numbers around the average.

A comparison of means may show, for example, that host tracts have significantly lower mean family incomes, but will not show whether the mean is being pulled down in host tracts by the presence of many poor families, or by the absence of rich families. The two distributions may have different implications for environmental justice advocates. To gain a more sophisticated understanding of exactly how undesirable land uses are being sited, it is necessary to examine not only the means of the demographic variables, but also how the distribution of the facilities matches the distribution of the population around the mean.

To examine the distribution, we looked at how the non-host tracts are distributed in terms of the major variables we examined: the percentage of African Americans, percentage of Hispanics, percentage of all minorities, percentage of poor, median family income, median housing value, and percentage with no high school education. For each variable, we broke the numbers down into deciles or, in some cases, even finer distributions. In other words, we looked at how many of the non-host tracts in the United States have African

51. SADRI reported in a footnote that it had compared "variable distributions for TSDF tracts and quartile values derived from tracts without facilities, using chi-square goodness-of-fit tests" but that "[t]hese tests provided no substantial insights beyond those produced by the Wilcoxon rank-sum tests." Anderton, *Demographics of Dumping*, *supra* note 4, at 247 n.22.

American populations of 0% to 10%, how many have African American populations of more than 10%, but less than 20%, and so on. We then looked at how many of the host tracts fell within those same deciles.

Assuming that a “fair” distribution of the facilities is one in which the distribution of the facilities was proportionate to the distribution of the population,⁵² we calculated the number of facilities that would be located in a particular type of neighborhood if there were a proportionate distribution of facilities. If neighborhoods with 0% to 10% African American populations make up 73% of the non-host tracts, for example, then a proportionate distribution would be achieved if 73% of the facilities were located in those tracts.

Our analysis of the distribution revealed several interesting results. Looking first at the distribution of tracts by their percentage of African Americans (see Appendix, Figure 7), the distribution of the population is slightly different from the distribution of the facilities. The difference is statistically significant at the 95% confidence level.

At the far end of the graph, where the African American population is 10% or less of the tracts’ population, the percentage of facilities is *lower* than the percentage of non-host tracts. In neighborhoods with African American populations of more than 10% but less than 70% African American populations, there is a *higher* percentage of facilities than of non-host tracts. In tracts that are virtually all African American, the trend reverses and there is a *lower* percentage of facilities than of non-host tracts.

In terms of raw numbers (see Appendix, Figure 8), if the distribution of facilities followed the distribution of the population, there would be twenty-four more facilities sited in the neighborhoods with no or very few African Americans. In neighborhoods where African Americans made up more than 10% but less than 70% of the population, there would be thirty-four fewer facilities. Neighborhoods with African American populations of more than 70% would have ten more facilities.

Similarly (see Appendix, Figure 9), neighborhoods with Hispanic populations of more than 20% are bearing more than their fair share of the facilities: they host about thirty-five more facilities than they would if facilities were distributed in the same way as the population.

In terms of income (see Appendix, Figure 10), lower and middle income neighborhoods are bearing an unfair share of the facilities.

52. For discussions of what fairness means in the context of environmental justice, see for example, Vicki Been, *What’s Fairness Got To Do With It? Environmental Justice and the Siting of Locally Undesirable Land Uses*, 78 CORNELL L. REV. 1001 (1993), and sources cited therein.

Neighborhoods with a median family income of less than \$10,000 are bearing fewer facilities than their percentage of the tracts. However, neighborhoods with a median family income of \$10,001 to \$40,000 bear a greater share of the facilities than they constitute in society. Those neighborhoods are bearing sixty-two (about 15%) more facilities than would be proportionate. (See Appendix, Figure 11).

Analysis of Figure 12 (see Appendix) reveals stark disparities regarding educational attainment. Those neighborhoods in which more than 70% of the population graduated from high school bear *less than or equal to* their proportionate share of the facilities. Neighborhoods in which 30% to 70% of the population have no high school diploma bear *more than* their proportionate share. To quantify those numbers, neighborhoods in which 30% to 70% of the population do not have a high school diploma have seventy more facilities than their proportionate share would warrant, an excess of 14%.

These numbers capture the distribution of neighborhoods only along one dimension: the percentage of African Americans, median family income, and so on. But, of course, neighborhoods differ along many dimensions at one time. To test how income and race together are related to the distribution of income, we broke the host and non-host tracts down by the joint distribution of the percentage of African American and median family income. The results are presented in the Appendix, Figure 13. That analysis shows, more clearly than any of the prior cross-sectional research, who is currently bearing a disproportionate share of undesirable facilities.

As indicated above, neighborhoods with median family incomes between \$10,001 and \$40,000 are bearing a disproportionate share of the nation's hazardous waste facilities. (See Appendix, Figure 10). Of these neighborhoods, tracts in which there are few or no African Americans host about 10% more facilities than their share of the population as a whole. (See Appendix, Figure 13). Tracts within the income group and with African American populations of between 10% and 60% host about 40% more facilities than their proportionate share. Neighborhoods with African American populations of 60% to 80% bear only their proportionate share, and neighborhoods with African American populations of 90% bear less than their proportionate share. If all neighborhoods with more than 10% African American populations are considered together, they bear 30% more facilities than their proportionate share of all tracts in the population.

There is no firm agreement on what percentage of African Americans constitute an "African American neighborhood," so it is difficult to draw clear lines about which neighborhoods should be counted in any analysis of siting disparities. Nor is it clear how the

fact that tracts with very high percentages of African Americans have fewer facilities than their proportion in society should affect the findings about more racially integrated tracts. In addition, the significance of this analysis depends upon further study of whether the host neighborhoods with low African American populations are in fact populated by other people of color, rather than non-Hispanic whites. The distributional analysis presented here cannot address that issue, although we are in the process of studying that issue with other econometric tests.

Figure 13 (see Appendix) shows that tracts within the burdened income group, including those that might be considered African American neighborhoods, bear more than their share of the nation's facilities. It does not reveal, however, whether that burden is distributed disproportionately by race. To help us to illuminate that issue, Figure 14 (see Appendix) further compares the actual distribution to the distribution of tracts with the specified characteristics across society as a whole. Figure 14 compares the actual distribution to the distribution that would occur if the admittedly disproportionate number of facilities imposed upon tracts with median family incomes of \$10,001 to \$40,000 were distributed proportionately within those tracts according to race. The tracts with median family incomes of \$10,001 to \$40,000 hosted 463 facilities. If those facilities were distributed within the income set in proportion to the distribution of African Americans within the set, 15 fewer (3%) would be located in tracts with more than 10% African Americans than are in fact located in those tracts. In other words, if you assume the disproportionate burden imposed upon the tracts to be a function of income, the burden should be distributed within those tracts without regard to race. Because the distribution by race within the income group is only very slightly different from a proportional distribution, the analysis provides evidence that the disproportionate burden imposed upon these income groups is more a function of income than race.

The picture that emerges from this analysis is much different than either the SADRI results or the CRJ results. Unlike the SADRI study, these results show that many neighborhoods with percentages of African American populations greater than the national average are bearing a disproportionate share of the nation's facilities. Unlike the CRJ study, however, these results show that almost as many neighborhoods with few African Americans also are bearing a disproportionate share. Indeed, Figure 14 reveals that within the most affected income group, the burden is only slightly different for neighborhoods with more than 10% African Americans than for those with very few African Americans. That undermines CRJ's conclusion

that race, not class, is the most important correlate of the location of undesirable facilities.

VIII. CONCLUSION

We have tried to illuminate where assumptions and methodological choices may be either obscuring or exaggerating problems of environmental justice. While the most accurate analysis of environmental issues must await the longitudinal analysis that we have underway, several conclusions can be drawn from our work thus far. First, the SADRI study's results are not biased by its failure to break out the analysis by type of facility. Second, SADRI's analysis decreases the importance of race as an explanatory variable, by limiting the comparison to non-host tracts in metropolitan areas or rural counties that already have one facility. Whether SADRI's limitation is appropriate depends upon further analysis about where those who are locating TSDFs look for alternative sites.

Third, comparing the demographics of host tracts to the means of non-host tracts in the same state reveals the same relationships as a nationwide analysis. When host tracts are compared only to non-host tracts in the same metropolitan area, however, differences in median family incomes and median housing values between host and non-host tracts narrow and lose much of their significance, while the percentage of Hispanics remains strikingly different.

Finally, a more sophisticated comparison of the distribution of facilities to the distribution of neighborhoods with particular demographic characteristics reveals that certain types of neighborhoods—those with median family incomes between \$10,001 and \$40,000, those with African American populations between 10% and 70%, those with Hispanic populations of more than 20%, and those with lower educational attainment—are being asked to bear a disproportionate share of the nation's facilities. Analysis of the joint distribution of income and percentage of African Americans in the population suggests that income explains most of the disparity. Multivariate analysis, however, suggests that race is a better predictor of facilities than income. In total, the analysis also reveals that environmental injustice is not a simplistic PIBBY—"put it in Black's backyards."⁵³ It suggests, instead, a much more ambiguous and complicated entanglement of class, race, educational attainment, occupational

53. ROBERT D. BULLARD, *DUMPING IN DIXIE: RACE, CLASS, AND ENVIRONMENTAL QUALITY* 5 (1990).

patterns, relationships between the metropolitan areas and rural or non-metropolitan cities, and possibly market dynamics.

APPENDIX

FIGURE 1

Comparison of Means Demographics of All Host Tracts, as of 1990 Census

Variable	Host Tracts	Non-Host Tracts	Ratio of Host to Non-Host	Significance
% African American	14.39	13.46	1.07	<95%
% Hispanic	10.34	7.83	1.32	99%
% Minorities (all nonwhite races, and white Hispanics)	27.21	24.17	1.13	95%
% Poor	15.69	14.59	1.08	95%
Median Family Income	\$31,602	\$34,586	0.91	99%
% No High School Diploma	31.23	26.55	1.18	99%
Median Housing Value	\$76,125	\$96,808	0.79	99%
% Employed in Professional	19.34	24.57	0.79	99%
% Employed in Manufacturing	33.46	27.52	1.22	99%
Mean Population Density	1749	5076	0.34	99%

* Statistically significant at 95% confidence level

**Statistically significant at 99% confidence level

FIGURE 2-A

Logit Regression Analysis Demographic Variables, Without Consideration of Population Density

Variable	Coefficient	Standard Error	T Score	Significance (P>\t\)
% African-American	.0036241	.0021877	1.657	0.098
% Hispanic	.0093931	.0029039	3.350	0.000**
% Poor	-.0112701	.0073247	-1.539	0.124
% No High School Diploma	-.0052379	.0058567	-0.894	0.371
Median Family Income	.0115458	.007128	1.620	0.105
Median Housing Value	-.0032531	.0011795	-2.758	0.006**
% Unemployed	.0219905	.0116523	1.887	0.059
% Employed in Manufacturing Occupations	.041623	.0053491	7.781	0.000**
Constant	-6.035288	.3326286	-18.144	0.000**

Log likelihood: -2978.05

Number of Observations: 57889

Chi2 (8 degrees of freedom): 148.87

P > chi2: 0.000

Pseudo R2 = 0.0244

** Significant at the 99% confidence level

FIGURE 2-B

Logit Regression Analysis Demographic Variables, Considering Population Density

Variable	Coefficient	Standard Error	T Score	Significance (P>\t\)
% African-American	.0116226	.0023176	5.015	0.000**
% Hispanic	.0201611	.002849	7.076	0.000**
% Poor	-.0250853	.0073889	-3.395	0.000**
% No High School Diploma	-.0014387	.0058139	-0.247	0.805
Median Family Income	-.0026182	.0071752	-0.365	0.715
Median Housing Value	.0009327	.0011834	0.788	0.431
% Unemployed	.0379051	.0107789	3.517	0.000**
% Employed in Manufacturing Occupations	.0331349	.0053752	6.164	0.000**
Population Density	-.0001602	.0000177	-9.049	0.000**
Constant	-5/451763	.3294394	-16.549	0.000**

Log likelihood: -2909.8542

Number of Observations: 57889

Chi2 (9 degrees of freedom): 285.26

P > chi2: 0.000

Pseudo R2 = 0.0467

**Statistically significant at 99% confidence level

FIGURE 3
Comparison of Non-Hosts, Hosts, and Exempt

Variable	Non-Hosts	Hosts to Exempt	Hosts to TSDFs
% African American	13.46	13.50	14.39
% Hispanic	7.83	7.24	10.34 **
% Poor	14.59	13.53	15.69 *
Median Family Income	34586	34404	31602 **
% No High School Diploma	26.55	29.58 **	31.23 **
Median Housing Value	96808	81726 **	76125 **

* Significant at the 95% confidence level

** Significant at the 99% confidence level

FIGURE 5
Characteristics by Facility Type

Variable	Non-Hosts	Landfills	Incinerators	Kilns	Other
% African American	13.46	15.78	16.48	14.82	14.23
% Hispanic	7.83	13.58	7.08	2.0 **	10.94 **
% Poor	14.59	17.38	17.77	16.84	15.42
Median Family Income	34586	30292	26834 **	28416 **	32138 **
% No High School Diploma	26.55	30.71	33.82 *	34.91 **	30.88 **
% No College Degree	56.82	62.75 *	67.13 **	70.83 **	63.32 **
Median Housing Value	96808	60786 **	52081 **	50097 **	85430 **

* Significant at the 95% confidence level

**Significant at the 99% confidence level