

## ***SUPERFUND SITES AND RACE: EVIDENCE FROM HOUSTON***

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### **ABSTRACT**

The environmental justice (EJ) movement in the United States has raised concerns that environmental racism may have been a factor in the siting of toxic facilities. Census tract data from the 1970, 1980, 1990, and 2000 Census for tracts within a 5-mile radius of ten Superfund sites in the Houston Harris County, Texas area are analyzed. The evidence presented indicates that, rather than the presence of minorities attracting these sites, the designation by EPA of these sites as Superfund sites may have attracted post-siting minority move-in. **JEL Classification:** Q53

### **INTRODUCTION AND BACKGROUND**

The Civil Rights movement of the 1960s raised awareness in communities of color that discrimination may occur in other areas than those of housing, employment and educational opportunity. An issue that came under increased scrutiny in the 1970s and 1980s was that of possible discrimination against communities of color in the siting of transfer, storage, and disposal facilities (TSDFs). If indeed predominantly African-American or Hispanic neighborhoods were disproportionately targeted for TSDF sites, this would constitute a form of institutional racism that should be addressed with the appropriate remedial policies at all levels of government. A landmark protest in 1982 against the siting of a landfill in Warren County, North Carolina brought national attention to the issue. A grassroots movement composed of local community activists sprang up (Wright 1999). Bullard (1983) first documented that municipal waste disposal facilities in Houston were sited in predominantly African-American neighborhoods. The U.S. General Accounting Office (1983) found that three of four landfills studied in the Southeastern United States were located in predominantly African-American neighborhoods. The United Church of Christ's (UCC) *Toxic Wastes and Race* report (1987) concluded that there is significant evidence of environmental racism across the United States. The updated report (2007) concluded that the evidence has become stronger and the problem of environmental racism is now worse than it was in 1987. The UCC studies, especially the 2007 report, concluded that most toxic facilities in the US were sited near predominantly African-American or other minority communities, and that race was a significant factor in choosing these sites. In 1993, the US Environmental Protection Agency (EPA) formed its National Environmental Justice Advisory Council (NEJAC) "...in order to obtain independent advice and recommendations from all stakeholders involved in the environmental justice (EJ) dialogue" (2006). President Bill Clinton issued Executive

Order 12898 in 1994, ordering each Federal agency to develop and make public an EJ strategy (1994).

The quest for environmental justice and against environmental racism has raised an array of important empirical questions concerning the siting and impact of toxic facilities on their host communities. Are the locations of those sites chosen because of race or are other factors equally or more important? Substantial empirical work has been done on this and related questions. Since the late 1980s a number of empirical studies of this interesting and important question have been published. This literature is reviewed, summarized, and discussed extensively in Szasz and Meuser (1997), Pastor, et al. (2001), and Bowen (2002). Some of these studies analyzed national data, while others focused on specific regions or cities. Some have explored the possibility that the siting of these facilities occurred before minorities move into the area and that low land prices in proximity to these facilities attracted low income and/or minority residents to locate there. In their study of this question, Pastor, et al. (2001) concluded that, in the Los Angeles area, "...minorities attract TSDFs but TSDFs do not generally attract minorities."

In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also commonly known as "Superfund," to finance emergency responses and the cleanup of the nation's most seriously polluted sites. The law mandated that the polluter or polluters of a hazardous site are responsible for cleanup costs, to the extent that those responsible entities could be identified. The Law also provided temporary emergency federal funding for the cleanup of chemical wastes if responsible parties could not be found or were unable to pay (Lannetti 1998).

**TABLE 1**  
**NATIONAL PRIORITIES LIST (NPL) SITES IN HARRIS COUNTY, TX**

Number	Site	HRS Score	Area (in acres)	Operated between
	Sikes	61.62	185	1960-1968
3	Crystal	60.90	6.8	1968-1981
4	Geneva	59.46	13	1967-1984
5	Brio	50.38	58	1957-1982
6	Sol-Lynn	39.65	1	1965-1975
7	South Cavalcade	38.69	66	1910-1962
8	Highlands	37.77	6	1950-1961
9	North Cavalcade	37.08	23	1946-1961
10	Harris-Farley	33.94	2	1958-1959

As part of the Superfund program, the EPA created a Hazard Ranking System (HRS). The HRS is the scoring system used in the program to assess the relative threat associated with actual or potential releases of hazardous substances. The EPA uses the HRS "...to assign each site a score ranging from 0 to 100 based on the likelihood that contaminants have been or will be released from the site, the

physical and toxicological characteristics of the contaminants present at the site, and the human population or sensitive environments actually or potentially exposed to a release from the site" (US Department of Energy 1994). Sites with a 28.5 or greater HRS score are eligible to be included in the EPA's National Priorities List (NPL). Sites listed on the NPL are known as Superfund sites.

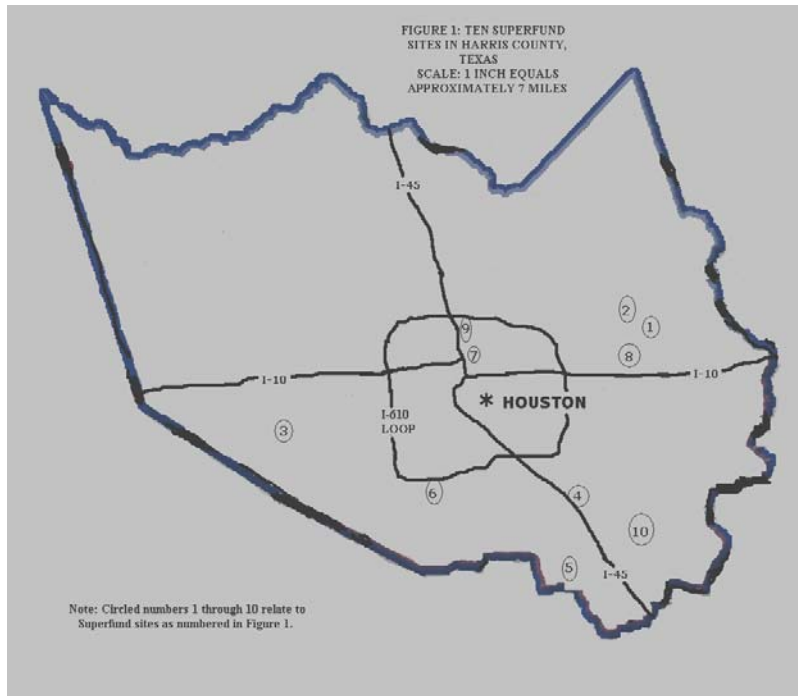
This study investigates the likely causal relationship between the location of toxic waste sites and the minority population density around them using census tract data for Ten Superfund sites in the Houston Harris County, Texas area. Table 1 presents the list of the Superfund sites used in this study as well as their size, level of toxicity, and the dates through which they were being operated.

## **DATA AND EMPIRICAL RESULTS**

The data used in this study are from census tracts located within a 5-mile radius around the ten sites and covers four census periods from 1970 to 2000. "CBD" represents the shortest driving distance from the census tract to Houston's central business district (downtown). The variables for the analysis were chosen to assist in investigating how the location of the site and the location of the tract are related in terms of neighborhood characteristics. The six neighborhood characteristics used in the study are good indicators of neighborhood quality.

The census tracts are divided into two groups – those within 2.5 miles of a Superfund site, and those between 2.5 and 5 miles of a site. These groups are herein referred to as the "Inner Circle" and "Outer Circle." The mean values of census variables for Inner and Outer circles are presented in Table 2 for comparison. The selection of a 5-mile radius zone around superfund sites, and a 2.5-mile radius zone as a measure of closeness, is based on an analysis of the results of earlier hedonic studies on the impact of superfund sites on housing values. Boyle and Kiel's survey of the literature (2001) reported that most superfund studies find the maximum distance of negative impact to be no more than 2.5 miles. The lone exception to this in the literature is Kohlhase (1991), who found that the negative impact goes up to 6.2 miles. However, Aydin and Smith (2008) raise questions about Kohlhase's findings by using a similar data set for the same area to report that the maximum impact goes no further than 2.5 to 3 miles, regardless of the functional form employed. Therefore this study excludes census tracts farther than 5 miles from superfund sites, as the negative impact is not expected to reach any farther than 3 miles. A 2.5 miles radius is used as a convenient boundary to determine the closeness of the census tract to the nearest Superfund site. It should be noted that proximity to the toxic waste site is a relative measure. For example, due to the higher population density in the region, Pastor et. al (2001) use both a 0.25-mile and a 1-mile radius in their study of the Los Angeles area. Different definitions of "closeness," such as 1 mile, 2 miles and 3 miles, were also tried by the authors of this study and the regression results did not differ significantly from what is reported in this paper.

Figure 1 shows the location of the 10 sites examined in this study on a map of Harris County, Texas. In Figure 1, downtown Houston's Central Business District is noted by the large asterisk. The North and South Cavalcade sites are very close to downtown, inside the I-610 Loop. The others are all within 15 miles of downtown, and two of them, Geneva and Sol-Lynn, are less than a mile from an Interstate highway.



To address the potential “sample bias” problem in the data, an arbitrary location with a 5 mile radius around an imaginary site center and far enough from the nearest superfund site in the north east part of Houston with similar economic and demographic characteristics was determined as a control site. The logistic and OLS regression results, however, did not reveal similar results to the findings of Table 3 and 4. For example, the minority move-in between 1970 and 2000 was found to be significant with respect to CBD and other demographic characteristics but it was not associated with the distance to the site center. This finding suggests that sample bias is not a significant problem in this study.

Table 2 illustrates the pivotal nature of the advent of Superfund legislation in 1980. The data suggest that prior to 1980, the toxic nature of the sites may have been suspected, but was generally unknown to their host communities, or may have been ignored by residents due to lack of information about the seriousness of the situation. However, after the mid-1980s when the sites became known as Superfund sites, the pattern changes. An important goal of this study is to determine whether or not certain neighborhood characteristics are related to the likelihood of a census tract being in the Inner circle rather than the Outer circle, given the presence of a Superfund site nearby.

**TABLE 2  
COMPARISON OF CENSUS TRACTS WITHIN A 5-MILE RADIUS  
OF SUPERFUND SITES IN HOUSTON**

Variable	Census tracts within 2.5 mile radius of Superfund site (Inner circle)	Census tracts between a 2.5 and 5 mile radius of Superfund site (Outer Circle)
CBD	12.45	12.52
5		
<u>1970:</u>		
% African American	21.6	24.0
% Hispanic	12.8	13.7
% Blue Collar	68.3*	60.5*
% High School Graduate	53.0	56.6
% Owner Occupied Housing	62.3	64.6
Average Family Income	11,233**	12,678**
<u>1980:</u>		
% African American	34.2*	27.7*
% Hispanic	18.8	15.8
% Blue Collar	63.8**	56.6**
% High School Graduate	65.4*	70.2*
% Owner Occupied Housing	58.1	62.4
Average Family Income	25,754**	29,175**
<u>1990:</u>		
% African American	43.9***	36.0***
% Hispanic	27.2***	21.2***
% Blue Collar	58.5*	53.4*
% High School Graduate	67.9*	72.3*
% Owner Occupied Housing	52.6*	56.8*
Average Family Income	39,930***	49,236***
<u>2000:</u>		
% African American	47.3***	39.5***
% Hispanic	38.7***	31.9***
% Blue Collar	52.6**	45.8**
% High School Graduate	66.2***	72.7***
% Owner Occupied Housing	54.2*	59.1*
Average Family Income	54,745***	71,172***
Sample Size	84	291

*Note:* Asterisks denote statistical significance at the one (\*\*\*), five (\*\*), and ten (\*) percent level.

As can be seen from Table 2, there was no significant difference in neighborhood characteristics from 1970 to 1980. Then, it is clear that neighborhood characteristics started to change after 1980. One can expect the Inner circle neighborhoods to be less attractive if people are aware of the environmental disamenity and are concerned about it. Table 1 suggests that many of the ten sites were in operation prior to 1970 or had been closed by then. It would be problematic, therefore, to infer that these TSDFs were sited because of the race of neighborhood inhabitants. The modest rise in minority populations from 1970 to 1980 could be due

to the boom that occurred in the Houston economy and the resulting immigration during the 1970s. In support of this concept, Kohlhasse (1991) and Aydin and Smith (2008) suggest that the rather substantial increases in minority move-in towards both the Inner and Outer circles post-1980 is a result of the "announcement effects" of the sites being placed on the NPL.

Table 3 presents the logistic regression results. The dependent variable in Table 3 is the likelihood of a census tract being in the Inner circle given the existence of the toxic site within 5 miles of it. As shown in the table, tracts more densely populated with African-Americans are more likely to be closer to the Inner circle. At first glance, this would support the claims of "environmental racism" raised by EJ activists. However, the coefficient for the percentage of African-Americans is insignificant in 1970, is slightly significant in 1980, and is highly significant in 1990 and 2000. In addition, all other census variables, with the exception of average family income, show a similar pattern. This clearly suggests that whatever process that caused the transformation of these neighborhoods must have begun in the 1980s. As mentioned above, previous literature on the same Superfund sites and their impact on housing values in Houston support this finding. Kohlhasse (1991) found that in 1975, a number of years before the creation of the Superfund program, there was no significant evidence of negative impacts of these sites on home prices nearby. Then after 1980, when Superfund sites began to be identified as such, home prices near these sites were significantly and negatively affected by as much as 16%. As the distance from a site increased, home prices increased about \$2360 per mile from the site up to a distance of about 6.2 miles. Interestingly, in the case of the Harris-Farley site where the initial clean up process was well underway by 1985, Kohlhasse found only a slightly negative and statistically insignificant relationship between price and distance from Harris-Farley. Based on this finding, she suggested that cleanup efforts might quickly reverse negative perceptions of an environmental disamenity. However, since this conclusion was based on the analysis of a single, relatively small site, it was probably premature. Moreover, Aydin and Smith (2008) extend the Kohlhasse study by using more recent data and find that the negative impacts of proximity to Superfund sites not only continued but also increased in terms of magnitude even after most sites were cleaned up.

**TABLE 3**  
**LOGIT RESULT PREDICTING PROXIMITY TO THE SUPERFUND SITE**

Variables	1970	1980	1990	2000
CBD	0.021	0.042	0.039	0.032
% African American	0.416	0.667*	0.756***	0.836***
% Hispanic	-0.127	0.688*	0.575***	0.577***
% Blue Collar	0.549*	0.871**	0.862***	0.764***
% High School Graduate	-0.020	0.221	-0.289**	-0.305***
% Owner Occupied Housing	0.121*	-0.013	-0.211**	-0.186**
Average Family Income (in \$000's)	-0.116**	-0.228***	-0.256***	-0.299***
Log Likelihood	-199.1	-215.8	-244.0	-249.7
LR $\chi^2$	14.6**	16.5**	22.9***	21.5***
Sample Size	375	375	375	375

Note: Asterisks denote statistical significance at the one (\*\*\*) , five (\*\*), and ten (\*) percent level.

It is worth mentioning here that the Aydin and Smith (2008) study also divides the overall negative proximity effect into two parts, a direct and an indirect effect. They find that direct effects due to proximity diminished over time as a result of the clean up process as was suggested by Kohlhase. By the same token, they also find an ever-increasing indirect effect, which can be explained through the resulting deterioration in neighborhood characteristics following the dissemination of knowledge of hazardous sites and their risks to the public. In other words, they suggest that most likely following the EPA announcements of Superfund sites in Houston, higher-income and more-educated people who are the highest bidders in the housing market moved out of these areas, depressing home prices, and attracting lower-income and minority residents. This claim is supported by the minority move-in regression results presented in Table 4.

**TABLE 4  
REGRESSION RESULTS PREDICTING MINORITY MOVE-IN**

Variables	from 1970-1980	from 1970-1990	from 1970-2000
Distance to the nearest Superfund site	-0.004	-0.020***	-0.033***
CBD	-0.018***	-0.021***	-0.019***
% White in 1970	-0.146*	0.279**	0.542**
% Blue Collar in 1970	0.132**	0.105*	0.135**
% High School Graduate in 1970	-0.223***	-0.356**	-0.469***
% Owner Occupied Housing in 1970	0.099*	0.205***	0.299**
Average Family Income in 1970 (in \$000's)	-0.010**	-0.020***	-0.029***
F-test	23.5***	26.8***	29.5***
Adjusted R <sup>2</sup>	0.32	0.40	0.44
Sample Size	375	375	375

*Note:* Asterisks denote statistical significance at the one (\*\*\*), five (\*\*), and ten (\*) percent level.

Table 4 presents OLS regression results predicting minority move-in to the Outer and Inner circles. Here the dependent variable is the percentage change in the minority population in the census tract from the base year of 1970, to 1980, 1990, and 2000, respectively. Percentage change in minority is defined as the sum of the percentage change in African-American and percentage change in Hispanic populations in the census tract. Explanatory variables are straight-line distance to the nearest Superfund site from the center of the census tract, driving distance to the CBD and census values from the 1970 census including percentage White population. The coefficients suggest that the higher the initial White population of a census tract in 1970, the lower the minority move-in from 1970-1980, but the higher the minority move-in from 1970-1990 and 1970-2000. This finding is in line with previous findings of the effects of announcements on relatively wealthy and educated populations in the area, as the White population has the highest income and education level among the inhabitants of the tracts prior to 1980. In addition, the data show that minority move-in increased in tracts with higher Blue Collar populations and higher Owner Occupied Housing and with a less educated and lower income population in 1970.

It should be noted that both Kohlhase (1991) and Aydin and Smith (2008) found no significant relationship between the distance to the toxic site and housing prices prior to the EPA's designation of Superfund sites in 1980. This strongly suggests that people in these neighborhoods either did not know about the sites, or were not aware of the potential dangers. Both papers established that the perceptions and the valuations of the people in these areas significantly changed only after the EPA announcements, whether the sites were still in operation or not. In fact, most of these sites had ceased operations by the mid-1970s. This study does not control for whether the sites were, or were not, in operation. However, an OLS regression in addition to the one in Table 4 was run with an additional variable to control for the amount of time that had passed since the sites had closed. This was done to test for the possibility that people could react differently if a site was not in operation for a long time, as compared to a site that was in operation or had recently suspended operations. The results were not significantly different than those in Table 4 and the variable "Time passed" was found to be not significant at the 5% level ( $p$ -value = 0.61).

## **CONCLUSION**

Well-intentioned EJ advocates since at least 1982 have promoted the notion that the presence of African-Americans or other minorities significantly affected decisions concerning the siting of TSDFs in communities in the United States. The advocates generally are making an ethical case for environmental justice, and their argument is not disputed here. However, the analysis of ten Houston Superfund sites presented in this study does not support representations that environmental racism was a factor in the location of these sites. The Houston data instead suggest that a much more complex set of factors is at work than race alone.

This study underscores the necessity of great caution in the analysis of siting decisions of TSDFs, especially those now designated as Superfund sites. It is well established that there is a high correlation between minority residential choices and hazardous toxic waste sites or landfills. However, studies that analyze the data in a "snapshot" fashion or single point in time are likely to miss the dynamics and context of neighborhood change and may not reliably detect the direction of causality. This study provides an insight on the question of which came first, TSDFs or minorities.

It is worth noting that this study's findings cannot be extended to the case of landfills. There is a clear distinction between toxic waste sites and landfills. Toxic waste sites generally are hidden, well disguised, and in many cases do not emit an odor to warn the residents nearby. Potential residents of neighborhoods near toxic waste sites ordinarily are unable to assess their health risks of living there. This can be seen by "before and after" analysis of home prices following the discovery or dissemination of information by the authorities regarding the existence of a site. By contrast, landfills are known and felt by residents due to their odor and open presence. Therefore, landfill siting decisions are generally made by the authorities with some type of consideration for, and input from, residents of nearby neighborhoods.

This study suggests that most likely the existing residents and newcomers to the areas of this study were not fully aware of the existence of the Superfund sites, at least before 1980. Even if these individuals knew about a nearby site, it is likely that they were not aware of the full extent of the dangers posed by living near it. This claim is supported by the  $t$ -statistic comparisons, logit and OLS regression analyses



implemented in this study and also by Kohlhase (1991) and Aydin and Smith (2008). These findings generally agree that, prior to the early 1980s announcements, there was not a significant difference in census variables and home prices with respect to distance from toxic waste sites. However, the findings differ significantly beginning from the early 1980s to 2000.

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