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RACE, REGION AND RISK: AN EXAMINATION OF MINORITY PROXIMITY TO NOXIOUS FACILITIES

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Race, Ethnicity, and Noxious Facilities: Environmental Racism Revisited

INTRODUCTION

The past decade has given rise to terms like environmental racism (UCC, 1987), eco-racism (Rees, 1992), and environmental inequities (Bullard, 1987; Mohai and Bryant, 1992) to characterize a disproportional distribution of environmental disamenities among minority communities. The issue actually surfaced earlier in the work of Berry, et al (1977) on the social burdens of pollution and in air pollution studies by Freeman (1972) and the Council on Environmental Quality (1971). Much of the literature supports the contention that racial and ethnic minorities and low-income groups bear a disproportionate burden of risk from hazardous activities and substances in the environment.

Many of the studies addressing the distribution of disamenities across racial/ethnic or income groups are limited in scope, typically applying a case study approach to one environmental hazard, such as air pollution, in a limited geographical area. This provides depth, but does not develop findings that are generalizable to other areas or to the U. S. as a whole. For example, the GAO examined the concentration of minority population at four waste facilities in the South (1983) and McCaull (1976) analyzed air pollution patterns in the Washington, D.C. area. Air pollution and, to a lesser extent, hazardous waste facilities have been the main focus of such studies since 1970.

Eleven of the fifteen studies summarized by Mohai and Bryant (1992) dealt only with air pollution, (Council on Environmental

Quality, 1971; Freeman, 1972; Harrison, 1975; Kruvant, 1975; Zupan, 1975; Burch, 1976; Handy, 1977; Asch and Seneca, 1978; Gianessi, et al., 1979; Gelobter, 1986, 1989), one dealt only with solid waste (Bullard, 1983) and two dealt only with hazardous waste (U.S. GAO, 1983; UCC, 1987). One of the studies dealt with toxic fish consumption (West et al., 1992) as a hazard and only one of the fifteen dealt with multiple hazards (Berry, et al., 1977). In the fifteen studies examined, Mohai and Bryant found that ten supported the contention that the burden of environmental hazards appeared inequitable across income groups. Similarly, eleven showed inequitable distribution by race. In addition, they found that race was more important than income in six of the fifteen studies. The distribution of geographical areas covered in the studies is as follows: a single urban area (6), multiple urban areas (5), a region (1), a state (1) or the nation (4). The loci total more than 15 because of overlaps within studies.

The United Church of Christ, Commission for Racial Justice (UCC) commissioned the most comprehensive analysis of hazardous waste site locations to date (1987). It is national in scope, disaggregated to the zip code area, and covers 27 commercial hazardous waste facilities and about 10,000 uncontrolled hazardous waste sites. Though this study is more broadly-based, it's conclusions with regard to the charge of racism have been contested because "of the twenty-seven areas with commercial hazardous waste landfills surveyed . . . twenty-one (78 percent) were populated by a greater percentage of whites than minorities" (Rees, 1992).

The GAO and UCC studies cited above were used as the basis for an article titled "Toxic Waste and the African American Community," (Bullard and Wright, 1989). In the GAO study, the percentage of African Americans in the host communities, located in North and South Carolina and Alabama, ranged from 38 to 90 percent. While African Americans comprised over 50 percent in 3 of the 4 communities, in absolute terms the total population of these communities was only 3,007. In the case of the UCC study sites discussed by Bullard and Wright, only 3 of the 9 sites had majority African American populations and one of the sites had a majority of Latino residents. The actual population numbers are not provided, with the exception of Emelle, AL at 626 (duplicated in the GAO study). Thus, the size of the "African-American community" examined is actually very limited.

The argument is made that a majority of the hazardous landfill capacity of the South is represented by the "4 landfills in minority zip code areas." The implication seems to be that negative effects are restricted to narrow geographic (zip code) areas and thus minority populations bear a disparate burden. In reality, noxious facilities, including disposal sites, may affect wider areas. This can occur physically through release of toxic substances or economically through stigmatization of the area. While serious equity issues are suggested by these findings, there is room for question.

THEORETICAL FRAMEWORK.

A framework for the relevant questions can be found within the broad literature of stratification, especially that relating to "structured social inequalities" (Heller, 1987). The phenomenon of residential differentiation or segregation is more narrowly applicable but still within this context of mainstream stratification literature. Kraus states that "underlying residential differentiation is the fact that grade of dwelling, meaning type and condition of lot, condition of structure, number of rooms, and the condition and use of adjoining properties generally rises with occupational rank" (1976, p. 169). That race and ethnicity are also linked with spatial distribution and residential segregation is seen clearly in works by Denton and Massey (1988). It seems clear that "residential location affects the cost and quality of housing" and "the level of exposure to unhealthy and unsanitary conditions," (Beeghley, 1989).

Additionally, there is room for consideration of the relationship of race/ethnicity and power (Weber, 1920; Lenski, 1966). Weber, in discussing class, status, and power also introduced the concept of "life chances" which incorporates a sense of the probabilistic nature of outcomes. Dahrendorf expanded on this notion, building on Weber's concepts of "future chances," and "preferential chances" toward the concept of "life chances" (Dahrendorf, 1979). Wilson concluded further that "class has become more important than race in determining black life chances in the modern industrial period" (Wilson, 1978, 1980). If the claims of environmental racism are true, then Della Fave's argument that "The

meek shall not inherit the earth" (1980, p.955) might more appropriately be restated as "The meek shall not inherit an unpolluted, non-toxic earth." At least one question that may legitimately be raised is whether or not the "meek" shall be defined in terms of class or race and ethnicity.

SCOPE OF THE STUDY

This study expands the scope of prior studies by employing county-level data for the entire nation and including a broad range of facility types associated with environmental disamenities. In addition, it addresses the issue of the distribution of noxious facilities among white and non-white populations in an attempt to determine the relative exposure to risk among different racial and ethnic groups, thus addressing the question of whether the data support the claims of environmental racism: ". . . minorities are shouldering an unequal share of the burdens of hazardous waste" (Godsil, 1991, p.396). In addition, we will also explore the relative importance of nonurban versus urban residence.

In systematically approaching our task we first describe the distribution of noxious facilities in the U.S. Second, we examine the distribution of minority population subgroups by U. S. Census region including the proportion residing within MSAs. Third, we test whether or not there are significant differences in the proportion of minority subgroups in counties with and without noxious facilities. Fourth, we examine the relationship between a measure of facility concentration and the percentage of subgroups residing in counties with noxious facilities. Finally, we make a preliminary attempt to

isolate the role of race and ethnicity, by controlling for income and housing value.

METHODS

Data Sources

This section presents a brief summary of the data and their origins. The facility types included range from manufacturing plants to toxic waste sites to electricity generating plants, all of which are located in the 48 contiguous states. Information on the location of chemical manufacturing plants, petroleum production and petroleum refining facilities, plastics and rubber manufacturing plants, pulp mills, smelters, and incinerators is taken from the 1985 National Acid Precipitation Assessment Program Inventory. Chemical weapons storage site locations are from Rouse (1988) and locations of radiation-related research facilities, radioactive waste disposal and inactive industrial sites, and uranium mill tailings sites are from the Department of Energy 1991 Annual Report on environmental restoration activity. Electric generating plant locations are developed from various Energy Information Administration forms and documents, and liquefied natural gas storage sites and terminal locations are from an Institute of Gas Technology listing. Commercial hazardous waste disposal sites and National Priorities List/Superfund site locations are taken from U.S. Environmental Protection Agency listings. Demographic data used in our analysis are from the 1990 Census of Population and Housing Summary Tape File 3A.

Variables

Unit of Analysis. The unit of analysis for this study is the county. We begin with 3,111 counties and independent cities in the contiguous United States. One county is omitted because it is a new county for which some data items were not available.

Facility density: The number of facilities of a particular type per square mile is used to standardize the facility measure since county size varies by several orders of magnitude. For analysis, the facilities are divided into three broad categories: production, energy, and disposal. The PRODUCTION category consists of facilities that typically contribute substantially to the economic base in their local area. Most are also major sources of air emissions that reduce ambient air quality, contributing both to acid precipitation and airborne toxics exposures. The ENERGY category includes all types of electric generating plants, plus liquefied natural gas storage sites. These facilities represent a form of economic infrastructure, but most also generate emissions that diminish air quality. The third category, DISPOSAL, is composed of active facilities or inactive sites that contain or dispose of hazardous waste materials, including radioactive materials. These may pose risks to the public through either air- or water-borne contaminants. Of the 4,410 facilities, almost half are in the production category, with the remainder split about equally between energy and disposal facilities.

Minority Concentrations. Minority concentrations are measured as the percentage of the total population of each county that are African American, Latino, or Asian. Native Americans are not

included because of the relatively small population size of this group.

MSA Status. Because of the potential influence of urban location we distinguish between counties which are located within the boundaries of Metropolitan Statistical Areas (MSAs) and those that lie outside the MSA. The MSA is a Bureau of the Census designation.

Median Household Income. This measure is taken from the U. S. Bureau of the Census, STF3A, and is the midpoint in the distribution of household incomes within each county.

Median Housing Value. Also taken from the U. S. Bureau of the Census, STF3A, this is the midpoint of the distribution of owner-estimated values of owner-occupied housing.

Description of the Data

Distribution of Facilities. The numbers of facilities included in this analysis are listed by type in Table 1. The distribution of these categories of facilities among the U.S. Bureau of Census Regions is also shown in Table 1. More than a third of the facilities are located in the South, which contains a high proportion of both the production and energy facilities. In the case of disposal facilities, the North East has the largest proportion of the total and since it is the region with the smallest land area, the disposal sites density is highest there.

The concentration of facilities also varies considerably within regions and is highly skewed. Nationwide, 57% of counties do not have any of the study facilities which means that all 4,410 facilities are located in just 1,336 counties. The majority of the counties with

facilities have just one or two. Less than 2% of counties have ten or more facilities, of all types combined, but some have more than 50.

(Table 1 about here)

Distribution of Minority Populations. Table 2 shows that minority populations are also distributed unequally among, and within, the Census Regions. More than half of the U.S. population of nearly 30 million African Americans resided in the South in 1990. Only 9% were located in the West, with the remainder of the population split between the North Central and North East Regions. Hispanics, with a total population of 21.8 million, were concentrated in the West, where 45% lived. The North Central Region contained the smallest proportion of the population, 7.6%. Asians were also concentrated in the West where about half of the total resided, and the rest of the over 3 million total Asian population was split nearly equally among the remaining three regions. Almost half of all Native Americans also lived in the West and only about 6% in the North East, giving that region the lowest percentage of the Native American population. Native Americans constitute the smallest of these population subgroups, with under two million persons. For this reason, Native Americans are excluded, as a separate group, from the subsequent analysis.

(Table 2 about here)

In addition to the variation in minority populations as a percentage of the U.S. and regional totals discussed above, there are differences in the way minority subgroups are distributed as a

percentage of each region's population and as a percentage of the populations of MSA counties. Table 3 presents the regional distribution of U.S. total and minority populations. It then presents the minority population as a percentage of the total for each region and the nation, and the minority population as a percentage of the urban population. The last column shows the percentage of the total minority population in each region that is urban. Over 98% of the minority population in the East lives within an MSA, while only 72% of Southern minorities are urban.

(Table 3 about here)

Analysis

Test of Differences Between Counties With and Without Facilities. As previously stated, 57% of the counties initially included in this study have none of the 4,410 facilities. If an inequitable or disproportionate exposure to hazardous facilities exists, based on race or ethnicity, then mean percent total minority population and the mean percentage of each of the subgroups should be significantly larger in those counties with facilities than in those counties without facilities. To test this contention we used the t-test for differences between means testing first for homogeneity of variance and calculating the t-test and degrees of freedom appropriately. This allowed us to test a series of hypotheses of the form H_o: $\mu_1 = \mu_2$, H_a: $\mu_1 > \mu_2$. Where μ_1 is the mean percent minority in counties with facilities and μ_2 is the mean percent minority in

counties without facilities. A significant t-test allows the rejection of the null hypothesis, affirming the relationship reflected in the alternative.

The results for the U.S. as a whole and each of the four regions are summarized in Table 4. In all but one case we reject the null hypothesis that the percentages of minority population in counties with and without facilities are equal. For African-Americans in the South we cannot reject the null hypothesis at $\alpha < .05$. In the South there is a tendency for the minority populations to be more dispersed than in other regions (with the possible exception of a fairly dispersed population of Hispanics in the West).

The evidence is considerable, if not overwhelming, for a finding of environmental inequities based on race/ethnicity from the preliminary testing of mean differences. Given these results, we proceed with the analysis assessing only those counties which contain hazardous facilities.

Correlation Analysis of relationships between key variables.

Consistent with Wilson's earlier work (1978) which suggests a "declining significance of race," some have asked whether the inequitable distribution of environmental disamenities or hazards is not more appropriately explained by economic factors such as poverty, income, wealth and property values. Our attempt to answer such questions begins with an examination of the zero order correlations between facility density in each of the hazard categories, the percentage of minorities and the percentage of minority sub-groups within all counties in which facility density is greater than zero.

Table 5 presents the zero order correlations for the U.S. as a whole and for each of the four census regions. Examining the correlations for the U.S. as a whole first, we see that although the majority of the values are significant at $p < .001$, the magnitude of the correlation is in the low range. The possible exception ($r=.3921$) reflects the relationship between percent Asian-American and Energy Facility Density.

(Table 5 about here)

In the correlations at the regional level we see an immediate increase (compared to the national level) in the correlation for Percent Black in every hazard category and in every region except the South, with r values ranging from .4585 (Production/West) to .7041 (Production/North Central). This, as is the case with other minority groups as well suggests that the relationship between race/ethnicity and facility density is masked by regional differences when we attempt to measure it at a national level.

For other regions and facility categories increases are less dramatic, but do appear in all regions but the South. These occur, not only in the production category, but also in the disposal and energy types. There are several correlations above the .70 level for Asian-Americans (Disposal in the West and Disposal in the North East) and above the .60 level for African Americans (Energy in the West and North Central and Disposal in the North East). The correlations, as was the case with the tests for differences in counties with and without facilities, provide evidence of a fairly consistent relation-

ship between race/ethnicity and facility density in counties with noxious facilities. Where there is inconsistency, the zero order correlations point to the need to further explore what this relationship means for Hispanics in the West and South, given the non-significant correlations. Similarly, there appears to be a lower degree of association (correlations) for African-Americans in the South.

As stated above, questions have been raised concerning whether or not seeming inequities can legitimately be attributed to economic rather than racial/ethnic factors. In a study in St. Louis, for example, Boerner and Lambert suggest that the "*dynamics of the housing market are largely responsible for the disproportionate exposure of poor and minority residents to environmental nuisances*" (1995). They further state that "the data from St. Louis show that housing values are significantly lower in census tracts hosting undesirable facilities than in other tracts" (1995, p.24).

Our primary interest lies in the relationship between facility density and minority populations; we examine these factors in the light of market situations. Partial correlations provide one method of exploring the relationship between two variables of interest by controlling for the influence of at least one other variable. Table 6 presents the second order partial correlation coefficients for facility density and racial/ethnic proportions for counties **with** noxious facilities while controlling for median household income and median housing value.

(Table 6 about here)

In the West, Midwest (North Central) and East it appears clear that the relationship between the proportion of African Americans and facility density remains moderate to strong and always significant, at $\alpha < .01$ even when income and housing value effects are removed from the relationship. This suggests that, at least in these regions the inequitable proximity of hazardous facilities cannot be explained in terms of income or housing value. For Hispanic Americans, high and significant correlations occur only in the East when these factors are controlled. They are highest for Disposal and Energy types of facilities with correlations of .6913 and .7094, respectively and moderate for Total Density (.4100). The total density relationship is suppressed by the non-significant relationship in the production category.

Asian Americans have the highest associations in the West and East. In the West the correlation is highest for Energy facilities with $r = .8279$, but with a high and significant correlation of .6566 for disposal facilities. In the East, correlations for all categories are moderate to high with a range from .3942 to .7454. These results point to the likelihood that something more than economics is driving the disproportionality.

There were, however, several surprising findings in this analysis. First, though the total density was significant ($r=.1394$, $\alpha < .05$), the correlations for the relationship between % Black and facility density in all three categories in the South were non-

significant when controlling for income and housing value. They had been weak, but significant in the zero order correlations, ranging from .1507 ($\alpha < .05$) to .1991 ($\alpha < .01$) in the zero order correlations. The reduction to non-significance is an indication that, at least in the South, the distribution of disamenities may be related to economic variables.

Considering the prior extensive work by Bullard (cf Bullard, 1983), Bullard and Wright (1989) the GAO (1983) and the UCC (1987), this finding appears anomalous. One possible explanation involves the rural nature of much of the South with a concomitantly dispersed population and the fact that 59% of Southern counties have no hazardous facilities as defined in this study. At the same time, the South has the lowest percentage of minorities living within MSAs (77.05%).

A similar anomaly may exist for Hispanics in the West, although in this case, the association was significant only for the disposal facility category and that at a low level ($r=.0894$, $\alpha < .05$). This is a region with a high percentage of Hispanics, but one in which this population sub-group is also somewhat dispersed.

Another surprise was the high correlation between Percent Asian-Americans and facility density in the West and the East. We have not encountered evidence of the exposure of this population sub-group to environmental hazards anywhere in the literature and yet the highest correlation in this study was between Percent Asian-American and energy facility density in the West ($r=.8279$). This finding may be the result of the urban concentration of Asian-Americans. As

previously indicated in Table 3, nearly 90% of all minorities in the West reside within MSAs.

The most consistent pattern of environmental inequity seems to exist in the East where the partial correlations are moderately high and significant for all population subgroups and all hazardous categories except one (Percent Hispanic and Production Facility Density). This is understandable considering that the East has the highest percentage of counties with at least one noxious facility (74%) and the highest percentage of minorities living within MSAs (98.53%).

To further explore the impact of urban residence on disproportionality, we calculated the second order partials for facility density and race/ethnicity by region for URBAN counties with noxious facilities, controlling for Median Household Income and Median Housing Value. Although the results of partialling seem somewhat inconclusive, there is a suggestion that urban residence, may have a significant influence on the strength of the relationships. The relationship between facility density and Asian Americans in the West remained fairly strong. The relation for Hispanics increased to a significant level for energy facility density in the West ($r= -.5066$, $\alpha < .01$). The inverse direction, seems to indicate that Hispanics may, in fact, be somewhat more dispersed and residing outside of MSAs when economically possible.

Table 7 about here

Conclusion

Although the level of aggregation may be at too high a level to detect some of the nuances of association possible when examining census tracts or block groups, the employment of a facility density measure is sensitive to variation in both geographic size of counties and number of facilities. The attempt to employ data across a variety of facility types provides a means of identifying multiple point sources of possible exposure. This has implications for the desirability of subsequently addressing problems of multiple and cumulative exposure.

Further work to identify the nature of the causes of what, in this study, appear to be anomalies, is needed. Similarly, the effect of various levels of aggregation and disaggregation of data and units of analysis must be explored. Any doubt that there is a significant racial/ethnic effect at work should be quickly dispelled by examining the relationship of % White to facility density (See Table 6). This relationship is perhaps the most consistent in every situation except where analysis is limited to MSAs, and in the South. That these correlations are consistently negative in direction and significant in magnitude indicates a need for further research. Perhaps the long history of residential proximity (same counties, same towns) with social distance are sufficient to explain the apparent anomaly in the South.

TABLE 1 Number of U.S. Facilities by Category and Percentage by Region

FACILITY TYPE	NUMBER	PERCENT OF FACILITIES BY REGION*			
		WEST	NORTH CENTRAL	NORTH EAST	SOUTH
Chemical manufacturing plants	609				
Military chemical weapons storage sites	7				
Petroleum production	323				
Petroleum refining	310				
Plastics and rubber manufacturing	132				
Pulp mills	272				
Radiation-related research facilities	26				
Smelters	382				
TOTAL PRODUCTION:	2061	17.6	24.4	11.5	46.6
Coal-fired generating plants	458				
Gas-fired generating plants	241				
Geothermal generating plants	4				
Liquefied natural gas storage sites	78				
Nuclear generating plants	119				
Other generating plants	13				
Petroleum-fired generating plants	170				
TOTAL ENERGY:	1083	12.6	31.5	17.1	38.9
Commercial hazardous waste disposal	27				
Incinerators	53				
National Priorities List/Superfund sites	1129				
Radioactive waste disposal	7				
Radioactively contaminated inactive industrial sites	29				
Uranium mill tailings sites	21				
TOTAL DISPOSAL:	1266	18.9	27.2	31.2	22.8
TOTAL FACILITIES:	4410	16.7	26.9	18.5	37.8

* U.S. Bureau of Census Regions

Table 2. Distribution of Minority Population Subgroups by U.S. Census Region, 1980 (Thousands of Persons and Percentage of U.S. Subgroup Population)

REGION	AFRICAN AMERICAN		HISPANIC		ASIAN		NATIVE AMERICAN	
	1000s	%	1000s	%	1000s	%	1000s	%
West	2761	9.24	9844	45.15	3341	51.23	858	44.61
Central	5700	19.08	1659	7.61	757	11.61	350	18.23
East	5606	18.76	3638	16.69	1320	20.24	124	6.47
South	15813	52.92	6661	30.55	1101	16.88	590	30.69
TOTAL	29881	100.00	21803	100.00	6521	99.60	1923	100.00

Note: Percentages may not sum to 100 due to rounding.

Source: 1983 County and City Data Book

Table 3. Total and Minority Population Distribution by Region; Minority Population Percentage of Total and of Urban Regional Population; and Percentage of Minority Population that is Urban

Region	Total Population (1000s)	Total Minority Population (1000s)	Minority % of		% of Minority Population that is Urban
			Region Total	Region Urban	
West	51,127,810	21,689,564	42.42	45.51	91.47
Central	59,668,632	9,287,077	15.56	19.87	91.34
East	50,809,229	12,347,624	24.30	26.50	98.53
South	85,445,930	26,490,118	31.00	33.69	77.05
Total U.S.	247,051,601	69,814,383	28.26	31.59	87.23

Table 4. Differences in Percent Minority Population Between Counties With and Without Facilities for the U.S. and Regions.

GROUP	FACILITY STATUS	MEAN %	STD. DEV.	T	DF	SIG.
Area: US						
Black	With	9.32	13.60	2.28	3109	<.021
	Without	8.13	15.07			
Hispanic	With	5.25	11.50	3.70	2757.6	<.001
	Without	3.75	10.70			
Asian	With	0.93	1.70	11.70	1641.19	<.001
	Without	0.35	0.70			
Area: West						
Black	With	1.78	2.80	6.32	221.20	<.001
	Without	0.42	0.90			
Hispanic	With	12.84	13.90	2.18	412	<.028
	Without	9.60	15.90			
Asian	With	2.17	3.60	5.51	221.59	<.001
	Without	0.68	1.10			
Area: North Central						
Black	With	3.20	5.80	7.97	496.39	<.032
	Without	0.78	2.40			
Hispanic	With	1.56	2.60	4.66	587.85	<.001
	Without	0.89	1.50			
Asian	With	0.66	0.80	9.31	520.41	<.001
	Without	0.26	0.40			
Area: North East						
Black	With	4.85	6.90	3.66	130.49	<.001
	Without	1.65	5.10			
Hispanic	With	3.06	4.60	1.98	215	<.049
	Without	1.55	5.60			
Asian	With	1.32	1.60	6.55	203.21	<.001
	Without	0.40	0.40			
Area: South						
Black	With	17.36	16.50	1.22	1329	<.224 ns
	Without	16.23	18.40			
Hispanic	With	5.97	14.20	1.96	1122.98	<.050
	Without	4.55	12.30			
Asian	With	0.60	0.80	6.70	1063.43	<.006
	Without	0.33	0.70			

Table 5. Zero Order Correlations for Facility Density and Racial/Ethnic Subgroup Proportions by U. S. and Regions for Counties with Noxious Facilities

REGION	FACILITY CATEGORY	% AF-AM	% HISPAN	% ASIAN	% Minority
Total U.S.	Product	.1993 #	-.0431 ns	.2121 #	.0935 **
Total U.S.	Disposal	.2593 #	.0894 *	.2989 #	.2398 #
Total U.S.	Energy	.1964 #	.0467 ns	.3921 #	.1851 #
West	Product	.4585 #	.0587 ns	.4676 #	.1127 ns
West	Disposal	.4701 #	.0356 ns	.7114 #	.1642 ns
West	Energy	.6003 #	.0209 ns	.8644 #	.1788 ns
No. Central	Product	.7041 #	.2174 **	.3672 #	.6620 #
No. Central	Disposal	.5901 #	.3235 #	.4329 #	.5820 #
Central	Energy	.6569 #	.1603 *	.3463 *	.5401 #
North East	Product	.5954 #	.5295 #	.6212 #	.6340 #
North East	Disposal	.6198 #	.6285 #	.7007 #	.7226 #
North East	Energy	.5566 #	.6097 #	.5690 #	.6556 #
South	Product	.1507 *	-.0978 ns	.1901 #	.0078 ns
South	Disposal	.1991 **	.0120 ns	.2445 #	.1671 *
South	Energy	.1855 *	-.0651 ns	.1936 #	.0831 ns

* p < 0.05 level ** p < 0.01 level # <.001 ns: not significant

Table 6. Second Order Partial Correlations for Facility Density and Racial/Ethnic Subgroup Proportions by Region for Counties with Noxious Facilities, Controlling for Median Household Income and Median Housing Value

REGION	FACILITY CATEGORY	% AF-AM	% HISPANIC	% ASIAN	% MINORITY	% WHITE
West	Total	.3259 #	.0097 ns	.5874 #	.1293 ns	-.2119 &
West	Product	.4348 #	.0822 ns	.4842 ns	.1256 ns	.1296 ns
West	Disposal	.3798 #	-.0365 ns	.6566 #	.0846 ns	-.1662 ns
West	Energy	.5136 #	-.0225 ns	.8279 #	.1379 ns	.2348 *
N.Central	Total	.6306 #	.0743 ns	.1423 &	.4842 #	-.5636 #
N.Central	Product	.6463 #	.1792 *	.2711 #	.5938 #	-.6327 #
N.Central	Disposal	.2799 #	.2097 #	.4314 #	.2944 #	-.2850 #
N.Central	Energy	.4187 #	.0949 ns	.0756 ns	.3046 #	-.3464 #
N.East	Total	.4731 #	.4100 #	.4253 #	.5111 #	-.5081 #
N.East	Product	.2640 *	.1916 ns	.3942 #	.2917 **	-.3029 **
N.East	Disposal	.5589 #	.6913 #	.7454 #	.7106 #	-.6593 #
N.East	Energy	.5297 #	.7094 #	.5767 #	.6963 #	-.6401 #
South	Total	.1394 *	-.0405 ns	.0942 ns	.0629 ns	-.1255 &
South	Product	.0718 ns	-.1142 *	.1570 &	-.0675 ns	-.0205 ns
South	Disposal	.1214 ns	-.0653 ns	.1328 ns	.0452 ns	-.0984 ns
South	Energy	.0860 ns	-.0938 ns	.2587 #	-.0154 ns	-.0611 ns

* p < 0.05 level ** p < 0.01 level & p < .005 # p < .001

Table 7. **Second Order Partial Correlations for Facility Density and Racial/Ethnic Subgroup Proportions by Region for URBAN Counties with Noxious Facilities, Controlling for Median Household Income and Median Housing Value**

REGION	FACILITY CATEGORY	% AF-AM	% HISPANIC	% ASIAN	% MINORITY	% WHITE
West	Total	.3002 *	-.1461 ns	.5401 #	.0018 ns	-.1998 ns
West	Product	.2930 *	.0333 ns	.1180 ns	.0993 ns	-.1558 ns
West	Disposal	.2099 ns	-.2745 ns	.5719 #	-.1143 ns	-.0962 ns
West	Energy	.3182 ns	-.5066 **	.8269 #	-.3608 ns	-.0678 ns
N.Central	Total	.6474 #	.1762 *	.0723 ns	.5852 #	-.6266 #
N.Central	Product	.5796 #	.1075 ns	.0771 ns	.5145 #	-.5626 #
N.Central	Disposal	.2341 *	.0269 ns	.2564 *	.2119 *	-.2404 *
N.Central	Energy	.4432 #	.2759 **	-.0681 ns	.4278 #	-.4288 #
N.East	Total	.4436 #	.3772 #	.4306 #	.4837 #	-.4819 #
N.East	Product	.2328 ns	.1632 ns	.3838 #	.2630 ns	-.2749 *
N.East	Disposal	.4807 #	.6330 #	.6899 #	.6495 #	-.5773 #
N.East	Energy	.3898 #	.3505 #	.3458 **	.4251 #	-.4124 #
South	Total	.2816 #	-.0804 ns	.0662 ns	.1217 ns	-.2603 #
South	Product	.1189 ns	-.0571 ns	.0461 ns	-.0205 ns	-.0836 ns
South	Disposal	.1808 ns	-.1074 ns	.0166 ns	.0547 ns	-.1512 ns
South	Energy	.1582 ns	-.1031 ns	-.0724 ns	.0058 ns	-.1357 ns

* p < 0.05 level ** p < 0.01 level & p < .005 # p < .001