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# Brown Fields, a Regional Incinerator and Resident Perception of Neighborhood Quality\*

Michael Greenberg, Dona Schneider & Jim Parry\*\*

## Introduction

Public opposition to the siting of hazardous and municipal waste management facilities, factories, power plants and various other locally unwanted land uses (LULUs) stopped or delayed nearly all major new facility proposals during the 1970's and 1980's.<sup>1</sup> LULU blockage has indirectly stimulated relocation of facilities to outside of the U.S. and pollution prevention activities within the nation. It has also led to the location of facilities in places already densely developed with industrial and commercial facilities; or so-called "brown fields."<sup>2</sup>

This paper focuses on the last of these three results of LULU blockage, that is, siting technological hazards in brown fields neighborhoods. The research questions and hypotheses were as follows:

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<sup>1</sup> Gary Davis & E. William Colglazier, *Siting Hazardous Waste Facilities: Asking the Right Questions*, in *America's Future in Toxic Waste Management: Lessons from Europe*, 167 (Bruce Piasecki and Gary Davis, eds. 1987); *Equity Issues in Radioactive Waste Management* (Roger Kasperson, ed. 1983); *Resolving Locational Conflict* (Robert Lake ed. 1987); David Morell & C. Magorian, *Siting Hazardous Waste Facilities: Local Opposition and the Myth of Preemption* (1982); Michael O'Hare, Lawrence Bacow & Debra Sanderson, *Facility Siting and Public Opposition* (1983); Emilie Schmeidler & Peter Sandman, *Getting to Maybe* (1988); and Allen White & Samuel Ratick, *Risk, Compensation and Regional Equity in Locating Hazardous Facilities*, 167 *Papers Region. Sci. Assn.* 29 (1989).

<sup>2</sup> Chemical Manufacturers Association, *Preventing Pollution in the Chemical Industry, 1987-1990* (1992); Mark Dorfman, Warren Muir & Catherine Miller, *Environmental Dividends: Cutting More Chemical Wastes (INFORM, Inc.)* (1992); President's Commission on Environmental Quality, *Quality Environmental Management Subcommittee, Total Quality Management: A Framework for Pollution Prevention* (1993); and U.S. Environmental Protection Agency, Office of Research and Development, *Facility Pollution Prevention Guide* (1992).

(1) To what extent did adding a new and controversial technological hazard distress residents already living in a brown fields neighborhood? We expected that many residents would be so outraged by the new hazard that it would be considered as distressing as drug dealers, abandoned houses, trash-filled streets and multiple technological hazards. We refer to this as the “outrage” hypothesis, based on a theory described by Sandman.<sup>3</sup>

(2) How rapidly would the perceptual impact of the hazard attenuate? Our expectation was that there would be a rapid decline of concern with increasing distance, physical barriers and intervening hazards drawing attention away from the new hazard. We refer to this as the “attenuation” hypothesis.

(3) To what extent were the newly added and pre-existing hazards associated with residents’ ratings of their neighborhood? We expected that these hazards would be much more strongly associated with residents’ neighborhood ratings than their personal characteristics and the presence of amenities. This is referred to as the “multiple-hazard” hypothesis.

The analysis presented here continues research which has associated residents’ perception of neighborhood quality with their perception of crime, stray animals, rowdy neighbors and other behavioral hazards; abandoned buildings, litter, trash and various other forms of blight; and incinerators, petrochemical complexes, landfills, airports and other prominent land-use hazards. The twenty neighborhoods previously investigated are brown fields located in New Jersey and eastern Pennsylvania.<sup>4</sup> The authors can certify that each of those neighborhoods contains at least one major hazard; some have more than fifteen.

Analysis of almost 1,500 responses obtained during previous studies led to three consistent observations:<sup>5</sup>

- Neighborhoods classified as being of “poor” quality by their residents were perceived as having serious crime and blight problems.
- Land-use and technological hazards were associated with respondents’ perceptions that their present neighborhood was of “fair” quality and was “worse” than their previous one.

<sup>3</sup> Peter Sandman, *Risky Business*, Natural Resources and Environmental Administration, Nov. 1989, at 6.

<sup>4</sup> Michael Greenberg, Dona Schneider & Jennifer Martell, *Hazardous Waste Sites, Stress, and Neighborhood Quality in the USA*, 14 *The Environmentalist* 93 (1994); Michael Greenberg, Dona Schneider & Daiwoo Choi, *Neighborhood Quality*, 84 *Geographical Rev.* 3 (1994); Michael Greenberg & Dona Schneider, *Hazardous Waste Site Remediation, Neighborhood Change, and Neighborhood Quality*, 102 *Env’tl Health Persp.* 542 (1994).

<sup>5</sup> Greenberg & Schneider; Greenberg, Schneider & Martell, *supra*.

- Residents' perceptions were more negative when neighborhoods had multiple problems than when they had a single physically prominent hazard.

The current research extended the previous work by surveying neighborhoods with a new and controversial technological hazard. The prior sample neighborhoods had prominent technological hazards but, with one exception, Chester (PA), that will be discussed below for comparative purposes, these hazards were in the neighborhoods for at least a decade. In other words, this was the first time we tested the outrage hypothesis.

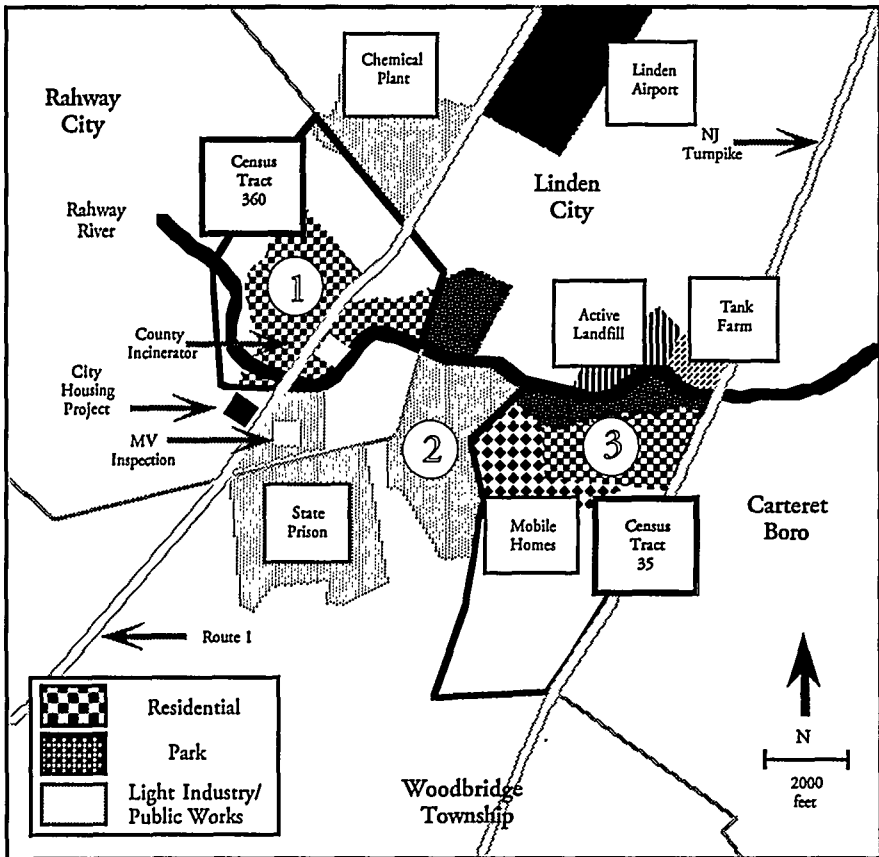
## Methods

### *Study Area*

We used four criteria to select a study area. First, we wanted a location with a new facility that could be reached by auto within two hours so we could revisit the area and meet with local officials and citizen groups. This was important for follow-up research we intend to conduct during the next decade. Second, we wanted an area that already had a variety of existing technological hazards, land uses, blight and behavioral hazards. Pre-existing hazards were needed to test the outrage and multiple-hazard hypotheses. Third, we hoped to find a new technological hazard that was supported by some residents and opposed by others. We did not want to study an area that had a facility that virtually all residents supported, nor one that almost everyone opposed because in either case, the opportunity to compare the new facility with existing crime, blight and other technological hazards would be pointless. In other words, we did not want to pick a place where the new technological hazard would obviously be at the top or the bottom of residents' perceived undesirable list. Fourth, we wanted to sample residents' perceptions within the host neighborhood and at least one other neighborhood in an adjacent political jurisdiction that was not going to receive benefits from the production facility. We wished to determine if residents of these non-host neighborhoods were angry because they received no benefits but felt some of the negative impacts. Also, we wanted the host and adjacent neighborhoods to be similar in race/ethnicity, socioeconomic status and other demographic characteristics in order to control factors that could obscure the role played by the technological hazard and other neighborhood characteristics. Finally, we wanted demographic variation within each neighborhood so that the results might be generalized to other neighborhoods.

After consulting colleagues and officials, and making initial site visits to a variety of locations, we found that the first three criteria could be satisfied, but the fourth criterion could only be partially satisfied. We could not find a brown fields neighborhood with a new and controversial technological hazard in which the residents of the host and adjacent neighborhoods had almost the same demographic profiles. This meant that we had to control for inter-neighborhood variation in demographic characteristics as part of the statistical analyses by using stepwise discriminant analysis (see analysis section below).

Figure 1  
Brown Fields Neighborhood



We chose a four-square-mile area located two miles west of New York City in central New Jersey (Figure 1). The area had a wide variety of potentially stressing characteristics located amidst and surrounding residential areas.

The new production facility was the Union County solid waste incinerator. Before opening it, Union County recycled about one-half of its municipal waste and paid over \$100 a ton for disposing of the remainder at an out-of-county site. In 1980, county officials proposed an incinerator in Linden to serve the county. Linden voters defeated the referendum. After that, a public relations firm was hired and the City of Rahway was offered \$1M a year in revenues to host the facility. On November 5, 1985, Rahway voters were asked to vote on the following question: "Are you in favor of Rahway hosting a resource recovery facility on Route 1 northbound?" Fifty-five percent of the voters (3,302 of 6,033) approved the facility. However, opponents continued to challenge the siting by arguing that too much truck traffic would be generated, by bringing in Barry Commoner, the well-known environmentalist to emphasize concern about dioxin, and by staging civil protests through their organization named RAGE (Rahway Against Garbage Environment).<sup>6</sup> As the voters of Rahway gave their consent to the incinerator through the referendum, it would be unfair to label the incinerator a LULU. On the other hand, there was vehement opposition by some elected officials and some residents who lived in the neighborhood immediately around the trash incinerator.<sup>7</sup> The 1,440 ton per day, \$280M facility began operation in February 1994. Our survey took place six months later.

Besides the incinerator, the Rahway-Carteret study area contains a large state maximum-security prison, an active landfill, a facility that holds petrochemical products (tank farm), a sewage plant, a large chemical manufacturing and research facility, a state motor vehicle inspection station, junkyards, and a public housing project. The New Jersey Turnpike and Route 1, two of the most heavily used roads in the U.S., pass through the area. Airplanes from a small airport (within a mile) and Newark International Airport (5 miles to the north) send aircraft over the area at intervals of 30 to 40 seconds. Finally, drug problems in Rahway were confirmed by local news stories and residents. Previous research suggests that the presence of illegal drug sales is associated with crime and great concern on the part of local residents.<sup>8</sup>

<sup>6</sup> *The Outcome in Union*, Star Ledger, Nov. 6 1985, at 30; Gordon Bishop, *Era of Mass-Burn Facilities May Be Over*, The Star-Ledger Apr. 25, 1994, at 17; and Ann Parker, *Officials Lack Concern for Residents Health*, The Daily Journal, Nov. 7 1985, at 4; and *Selling of Resource Recovery*, The Daily Journal, Nov. 8 1985, at 1.

<sup>7</sup> Bishop, *supra*.

<sup>8</sup> Greenberg, Schneider & Choi, *supra* note 4.

We subdivided the study area into three zones (Figure 1), each with a different physical orientation to the incinerator. The names we chose for these zones are east Rahway (zone 1), mobile home park (zone 2), and suburban Carteret (zone 3). These names are convenient labels, not official place names. The brief descriptions that follow are our observations of each zone supplemented by census data and conversations with residents.

Residents of census tract 360 in Rahway ("east Rahway" or zone 1) look directly at the massive incinerator located between Route 1 and the Rahway River (Figure 1, zone 1) any time they leave their home to go shopping, visit a friend, or go to work. The tract contains many other potentially bothersome characteristics. For example, Route 1 bisects east Rahway, bringing continuous noise and congestion to the area. Automobile noise is exacerbated by aircraft flying just to the east. A large chemical manufacturing and research facility forms the northern border of the tract. A public housing project sits on the southwest edge. A motor vehicle inspection station and a large state maximum security prison form the southern border, and warehousing, light industry, and the Rahway River are the southeast and eastern edges. We observed some trash and litter, and a few derelict properties in east Rahway, but they were far less prevalent than we have observed in other stressed neighborhoods.<sup>9</sup>

Despite other potential hazards, we expected that the massive incinerator would be the most bothersome hazard visible to east Rahway residents because of its physical presence and the controversy surrounding its siting. Part of the controversy was caused by the racial and economic composition of east Rahway's population. In 1990, 55% of the tract population of 4,316 was black, compared to 13% of the remainder of Rahway and 19% for Union County as a whole. In 1989, the per capita income of east Rahway residents was \$14,762, 82% of the \$17,921 for the remainder of Rahway and 75% of the \$19,600 in Union County. Given these data, facility proponents faced environmental racism charges.

Census tract 35 in Carteret contains our other two study zones. They are our adjacent neighborhoods. In Middlesex County, these receive no monetary benefits from the site. Further, municipal waste from Middlesex County does not go to the Rahway incinerator. Garbage trucks from outside of Carteret carry waste through the borough to the incinerator in Rahway, while borough garbage trucks pick up local trash and carry it to a more distant site.

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<sup>9</sup>

*Id.*

None of west Carteret's 2,794 residents were reported as black in the 1990 census, a marked contrast with east Rahway. The per capita income of west Carteret's residents was \$17,804, or 21% higher than east Rahway's. Tract 35 is also surrounded by potentially distressing characteristics. The western part of tract 35 is our "mobile home park" neighborhood (Figure 1, zone 2). Its residents face contrasting environments. Joseph Medwick Park and the Rahway River form an attractive northern edge. The park contains modern recreation facilities, including tennis courts and baseball fields. Some residents, however, can see the active landfill and tank farm in Linden on the north side of the Rahway River. To the west and south, residents face a major east-west road carrying considerable truck traffic, a large concentration of warehousing and light industry, and local recreational facilities that some pointed to as the source of noise and rowdy people. When mobile home park residents look into their neighborhood, they see some dwelling units that are not in good condition, rutted roads in need of repair, and some trash and litter. Jets from Newark Airport seem to be constantly flying over the mobile home park neighborhood. We noted more potentially distressing characteristics in and around the mobile home park than in east Rahway. Consequently, we expected the mobile home park neighborhood to have a high proportion of fair and poor quality ratings. The incinerator is located about a mile away, and we expected it to cause less stress in the mobile home park than in east Rahway because it is less visible and because there are so many other intervening local stresses to attract residents' attention.

The "suburban" neighborhood of Carteret (zone 3) is bordered on the west by the mobile home park (Figure 1). Medwick Park and the Rahway River dominate the northern edge of this suburban area. Residents can easily stroll or bike to this attractive recreational space. Yet those reaching the park have an unobscured view of a remarkably ugly and active landfill and tank farm across the river. For example, students attending a neighborhood school look through the widely spaced trees in Medwick Park and see a bulldozer moving garbage around the landfill.

The massive noise barrier, the New Jersey Turnpike and large utility towers are the eastern border of the suburban neighborhood. We noted the location of the largest and probably most expensive of the neighborhood houses up against the 60-foot-high concrete block noise barrier. The suburban area's properties appeared carefully tended. Local shops and



restaurants seemed to be busy. Overall, our observations of the suburban neighborhood indicated it to be a pleasant, small town surrounded by virtually every kind of technological and land use hazard in the United States' repertoire. The incinerator, located about one mile to the west, can only be seen from a few homes. We expected that some residents of this suburban neighborhood would be distressed by the incinerator and the other surrounding land uses, but might consider the area as a whole to be a good place to live.

To summarize, we chose three neighborhoods in two municipalities in central New Jersey that we expected to reflect the impacts of locating a massive, controversial technological hazard in an area already affected by, technological hazards and behavioral and blight problems.

### *Survey Questions*

The U.S. Department of Commerce's biannual **American Housing Survey for the United States**<sup>10</sup> (AHS) provided the format for our survey questions. Although the AHS focuses primarily on housing conditions, it asks Americans about bothersome neighborhood conditions and for their overall neighborhood rating. In the AHS, people define their neighborhood. For example, they are asked if odors and smoke exist in their neighborhood. If the answer is yes, they are asked if the smoke and odors bother them, and then if smoke and odors are so bothersome that the respondent wants to leave. The AHS also asks if the present neighborhood is better, the same, or worse than the residents' previous one.

The AHS does not include all the potentially distressing neighborhood characteristics present in our study area. It asks about the existence of odors or smoke, non-residential land uses, motor vehicle noise and heavy traffic, litter, streets in disrepair, building conditions, and crime. Using the same format, we asked questions about other characteristics that might bother people in our neighborhoods: noise from airplanes, traffic congestion and noise, a landfill, tank farm, large utility towers with wires, recreational areas that might attract rowdy people, and, of course, a large county incinerator. The total number of potentially distressing neighborhood characteristics was 21. The county incinerator was number 11 on the survey form, and no mention of it was made in the cover letter.

The AHS also asks about neighborhood characteristics that might attract people. Using their question format, their set of potentially attractive

<sup>10</sup> U.S. Department of Commerce, 1983, 1985, 1987, 1989 & 1991 American Housing Survey for the United States.

characteristics, and adding a few additional ones that made sense for our brown field neighborhoods, we used 10 potential attractions as dichotomous variables (yes-no), asking for example, if respondents live in this neighborhood because it was convenient to their job. Convenience to friends and relatives, the availability of leisure activities, public transportation, a hospital, shopping, good schools, and other public services and the availability of a dwelling unit at an affordable price, were other potential attractions we investigated.

Demographic characteristics are associated with people's perceptions of neighborhood quality.<sup>11</sup> Consequently, we asked respondents to categorize their age, sex, educational achievement, status as a home owner or renter, and length of residence in the neighborhood. Educational achievement was particularly important as a surrogate for income or socioeconomic status. These demographic characteristics were independent variables in the statistical analyses.

Siting a LULU can stress residents and lead them to engage in public activity. We suspected that stress and activism, like the demographic characteristics, might be associated with perceptions of neighborhood quality. To measure these possibilities, we used the question developed by the Centers for Disease Control for behavioral risk factor surveys. It asks respondents to rate their own health on a scale from excellent to poor. To assess a possible association with activism, we asked respondents to indicate if they had engaged in five activities, such as attending a public meeting, voting in a local election or contacting an official about a problem.

#### *Distribution and Analysis of Survey*

The cover letter, survey instrument and a stamped return envelope were distributed in brown envelopes. We attempted to place a packet in the door of every residence in east Rahway within one-quarter mile of the incinerator. In the mobile home park area and suburban Carteret, we placed one at each residence within one-quarter mile from the Rahway River and the New Jersey Turnpike.

Answering the research questions and testing the hypotheses involved a multi-step process. First, to evaluate the outrage and attenuation hypotheses, we compared the relative stress caused by the incinerator and the 20 other neighborhood characteristics by calculating the proportion

<sup>11</sup> Angus Campbell, Philip Converse & Willard Rodgers, *The Quality of American Life: Perception, Evaluations, and Satisfaction* (1976) and Gary McClelland, William Schulze & Brian Hurd, *The Effect of Risk Beliefs on Property Values: A Case Study of a Hazardous Waste Site*, 10 *Risk Anal.* 485 (1990).

of respondents in each of the three zones that found the 21 potentially distressing characteristics “so bothersome” that they “want[ed] to leave” We expected the incinerator to be most bothersome in east Rahway and less bothersome in the mobile home park and suburban Carteret.

Second, to further evaluate the outrage and attenuation hypotheses, we divided respondents in each neighborhood into those who claimed to be bothered or wanted to leave as a result of the incinerator and those who did not. We then identified the proportion of respondents in each zone who rated their neighborhood as excellent, good, fair and poor. Bothered residents of east Rahway were expected to have the highest proportion of poor neighborhood quality ratings. Residents of suburban Carteret who were not bothered were expected to have the lowest.

Third, we used stepwise multivariate discriminant analysis to enhance understanding of the interrelationship of perceived neighborhood quality, multiple neighborhood characteristics, including the incinerator, and respondent characteristics. This allowed us to evaluate the multiple-hazard and outrage hypotheses while accounting for demographic factors.

Discriminant analysis chooses the independent variables that most strongly differentiate among the categorical dependent variable of perceived neighborhood quality. The dependent variable for the discriminant analysis was the categorical variable “neighborhood rating” with four categories: excellent, good, fair, and poor. The discriminating variables were the 21 neighborhood characteristics, the 10 factors that might attract people to a neighborhood, the five demographic characteristics, and self-rated health and civic activities. In addition, each respondent’s neighborhood was recorded as a dichotomous variable (1 or 0) to capture unique characteristics of the zone that are not captured by the neighborhood hazards and amenities in the survey.

We expected a relatively low response rate and a response biased toward specific subpopulations, because in our previous studies of 20 neighborhoods, disproportionately low response rates were associated with low educational attainment, multiple unit dwellings, and lack of fluency in English. Follow-ups in these neighborhoods did not substantially improve the response rate, nor did attempts at phone surveys (more than 20% in several of these neighborhoods did not have phones). Because of these anticipated problems, a return between 20 and 30% was expected in the Rahway-Carteret area.

We illustrate the dilemma of getting many unbiased responses in these neighborhoods by explaining why we did not prepare the instrument in other languages, despite the fact that the 1990 U.S. Census indicated that 7.9% of the population in the two census tracts reported that they did not speak English well. Conversations with local residents suggested that to get a larger representation from these communities the instrument would have to be translated to Spanish, Hungarian, and Polish. A single multiple-language instrument or multiple instruments in different languages delivered to the door would have been more costly and cumbersome, and might have had little impact on the overall response rate because as one elderly woman stated: "I can't be bothered with sorting through all your papers." The only feasible alternative for raising the response rate was to offer a fee for the return of surveys. Even then, some residents suggested that small fees might not work in neighborhoods where the population does not trust outsiders.<sup>12</sup>

In addition, in almost all of our previous studies, respondents were disproportionately female, educated at least through high school, homeowners, and older on average than residents of the host census tract. We expected the same bias in Rahway-Carteret. Accordingly, we intended to compare demographic characteristics of Rahway-Carteret respondents and census tract residents, and then re-estimate the values of several important variables to determine if the results were representative of the census tract population as a whole.

## Results

We distributed 1,495 surveys on July 1 and 5, 1994. A total of 360 usable surveys were returned by October 9, 1994. The 24% response rate exceeded the return of a typical one-time mailed survey<sup>13</sup> and was within the range of response we had anticipated. We were also not surprised to find that compared to residents of the study area, our respondents were disproportionately over 50 years old (48% vs. 37%,  $p < .01$ ); female (66% vs. 53%,  $p < .01$ ); homeowners (83% vs. 66%,  $p < .01$ ); and high school graduates (88% vs. 76%,  $p < .01$ ). Length of residence in the area was the only demographic characteristic in which respondents almost perfectly matched census tract residents.

<sup>12</sup> See Raymond Lee, *Doing Research on Sensitive Topics* (1993) for discussions of the problems of sampling sensitive populations.

<sup>13</sup> J. Wanzer Drane, *Imputing Nonresponses to Mail-Back Questionnaires*, 134 *Am. J. Epidemiology* 908 (1991).

Our previous research found that gender, age, length of residence, education, and home ownership have not been important discriminators of perceived neighborhood quality in stressed neighborhoods.<sup>14</sup> This also held true in the Rahway-Carteret area. The discriminant analysis (discussed below) found that length of residence was the only statistically significant discriminating characteristic at  $p < .05$ . Nevertheless, to confirm that finding, we re-estimated the proportion of excellent, good, fair and poor quality ratings by weighting respondents' ratings by the actual census tract demographic characteristics. The largest potential bias was introduced by the under-representation of the 18- to 30-year-old population among respondents. When we adjusted the aggregate neighborhood quality ratings to reflect the actual age composition of the population, the proportion who rated the study area as excellent, good, fair, and poor changed from 6.4%, 57.3%, 31%, and 5.3% to 6.7%, 52.7%, 35.3%, and 5.3%, respectively. We also re-estimated the relationship between poor neighborhood quality and the proportion of respondents who were so distressed by the incinerator that they wanted to leave. The proportion of those who were highly distressed and rated their neighborhood as being of poor quality rose from 27.7 to 29.0%. Readjustments for differences between respondents and the actual tract populations in gender, education, and residential tenure also produced negligible changes which actually tended to cancel each other out. Overall, the fact that our respondents were disproportionately female, older, more formally educated and homeowners had no observable effect on the results. However, non-respondents could have different ratings than respondents by age, gender and other demographic characteristics. Hence, it is essential that we underscore the possibility that the following analysis may not represent the views of all the residents of the Rahway-Carteret study area.

#### *Attenuation and Outrage Hypotheses*

Table 1 shows evidence of outrage and attenuation. East Rahway contains the incinerator, and its residents were more than twice as likely to want to leave as a result of the incinerator than residents of the mobile home park and suburban Carteret. Forty-six percent of east Rahway residents said they wanted to leave as a result of the trash-burning facility. While praising her Rahway neighborhood, one respondent described the impact of the incinerator:

<sup>14</sup> Greenberg & Schneider; Greenberg, Schneider & Martell; and Greenberg, Schneider & Choi, *supra* note 4.

Right now, the way things are, it's not a bad neighborhood. I like it. The thing that really brings it down is the incinerator. It's an eyesore.

Another respondent wrote:

Everything is okay except for the incinerator. It gives off a gas smell — very scary. We get a hissing sound and don't know if it's going to explode. I call people on the phone, and they get nasty.

A third accused the politicians of "destroying his property" and wrote:

I bought my house for \$180,000. A couple of weeks later, property went down \$20,000. The noise and smell is horrific. It's disgusting. We need landscaping.

Motor vehicle noise and heavy traffic (22%) and odors or smoke (21%) also distressed more than 20% of the neighborhoods' population so much that they wanted to leave. There was a statistical connection between wanting to leave as result of the incinerator, motor vehicles, and odors and smoke. In east Rahway, the location of the incinerator, 76% of respondents (32 of 42) who were bothered by motor vehicle noise and heavy traffic were also bothered by the incinerator. This compared to 41% (29 of 70) of mobile home park and suburban Carteret residents ( $p < .001$ ). Ninety-two percent of east Carteret respondents (34 of 37) who were bothered by odors and smoke were also bothered by the incinerator compared to 60% (41 of 68) of other respondents ( $p < .001$ ). A female homeowner living in east Rahway linked them in her note to us:

It [the incinerator] is unhealthy. Sometimes I can smell the fumes and hear a lot of noise. Some garbage trucks drop garbage on the streets. You have to pick it up yourself. It couldn't get any worse.

Overall, a higher proportion of east Rahway residents wanted to leave due to the incinerator than because of any other potential neighborhood characteristic ( $p = .01$ ).

Suburban Carteret (zone 3) respondents were much less troubled by stressors than their east Rahway counterparts. Airplane noise was the only problem that caused more than 20% to want to leave. The incinerator caused 18% of respondents to want to leave.

While most mobile home (zone 2) residents live within a mile of the incinerator, few can see it because of obstructions. This may explain why the 21% who wanted to leave as a result was much lower than the corresponding proportion in east Rahway (46%) and much closer to that of suburban Carteret (18%). Mobile home park residents were also more stressed by aircraft (31%), and secondarily by the nearby tank farm (21%), odors and smoke (20%), and motor vehicle noise and heavy traffic (20%).

Table 1  
 Neighborhood Problems That Cause Residents to Want to Leave, Study Area, 1994

Characteristic (n=360)	Percent of Respondents Who Wanted To Leave as a Result of Stress			
	Study Area	East Rahway Zone 1	Mobile home park Zone 2	Suburban Area Zone 3
Trash incinerator	28	46	21	18
Airplane or train noise	22	16*	31	21
Odors or smoke	19*	21*	20	18
Motor vehicle noise, heavy traffic	17*	22*	20	13
Oil refinery and tank farm	15*	7*	21	18
Chemical plant, other mnfg.	10*	9*	13	9
High crime rate	7*	12*	6*	3*
Landfills, hazardous waste sites	7*	9*	5*	7*
Jail, prison	6*	10*	8	2*
Dogs, cats or other uncontrolled animals	6*	9*	10	3*
Junkyard, gasoline station, other nonresidential	6*	12*	8	1*
Litter or trash	6*	12*	9	<1*
Streets, roads, sidewalks in disrepair	5*	5*	10	1*
Occupied buildings in poor or dangerous condition	4*	3*	10	2*
Recreational facilities that attract rowdy people	4*	12*	1*	0*
Unfriendly neighbors	4*	4*	6*	4*
Sewage or water treatment plant	4*	5*	3*	4*
Abandoned houses	2*	4*	4*	0*
Abandoned factories/businesses	2*	<1*	5*	<1*
Right-of-way for a utility	2*	5*	0*	0*
Inadequate street lighting	1*	2*	3*	0*

\*Proportion wanting to leave as a result of the incinerator is significantly higher than this neighborhood characteristic at  $p < .01$ .

### *Multiple-Hazard and Outrage Hypotheses*

#### *• Initial analyses*

The major concern of this study was the relationship of neighborhood quality to the incinerator and to other neighborhood characteristics within the study area. For perspective, we provide comparative data for the U.S., northern New Jersey, and the south Chester-Marcus Hook area in eastern Pennsylvania. Chester-Marcus Hook is an area severely stressed by crime, abandoned properties and other forms of blight, two petrochemical complexes, and numerous other production facilities.<sup>15</sup> It also hosts an incinerator that burns county trash.

<sup>15</sup> Greenberg, Schneider & Choi, *supra* note 4.

The neighborhood quality ratings of the entire Rahway-Carteret study area fell between the aggregate ratings of residents of the U.S. and northern New Jersey on the one hand, and the highly stressed residents of the Chester-Marcus Hook area on the other (Table 2). Specifically, 36% of this study area's respondents rated their neighborhoods as fair or poor compared to 12% of northern New Jersey's, 14% of the United States' as a whole, 57% of Chester-Marcus Hook's and 80% of the two most beleaguered south Chester neighborhoods.

Within our study area, perceptions of the incinerator differed among zones. East Rahway and mobile home park respondents bothered by the incinerator had the highest proportion of poor and fair ratings (51% and 78%, respectively). Suburban Carteret residents had the lowest proportions, regardless of whether they were bothered or not (39% and 18%, respectively). Respondents who were not bothered by the incinerator and lived in east Rahway and the mobile home park fell between.

Stress attributed to the incinerator was clearly associated with lower neighborhood-quality ratings. In fact, those bothered by the incinerator who reside in east Rahway and the mobile home park manifested an aggregate neighborhood-quality rating that was similar to the multiple-hazard Chester-Marcus Hook area. But it might be wrong to attribute to the incinerator all of the differences in perceived neighborhood quality between those bothered and not bothered by the incinerator. For example, our previous research identified multiple problems as more strongly associated with a poor neighborhood quality rating than any single land use. Many other problems could be correlated with the perceptions of the incinerator, and at least partly explain the results of Table 2. For example, if crime was rampant in zone 1 but not in zones 2 and 3, the decrease in crime rather than increasing distance from the incinerator could explain improvement in neighborhood quality.

• *Discriminant analysis*

Discriminant analysis is a systematic way to capture associations among multiple neighborhood characteristics and neighborhood quality. Thirty-three of the 41 possible discriminating variables were statistically significant discriminators compared to the two expected by chance ( $p = .05$ ).



Table 2  
 1994 Neighborhood Quality in Study Area  
 with Zones Controlled for Stress Caused by Incinerator and Comparative Data

Area	Percent Rating of Neighborhood Quality and 95% Confidence Limits			
	Excellent	Good	Fair	Poor
Zone 1, East Rahway				
Bothered (n=71)	2.8 (-1.0,6.6)	46.5 (34.9,58.1)	36.6 (25.4,47.8)	14.1 (6.0,22.2)
Not Bothered* (n=42)	2.4 (-2.2,7.0)	69.0 (55.0,83.0)	23.8 (10.9,36.7)	4.8 (-1.7,11.3)
Zone 2, Mobile home park				
Bothered (n=27)	0.0 (0,0)	22.2 (6.5,37.9)	66.7 (48.9,84.5)	11.1 (-0.7,23.0)
Not Bothered (n=54)	7.5 (0.5,14.5)	49.1 (35.8,62.4)	39.6 (26.6,52.6)	3.8 (-1.3,8.9)
Zone 3, Suburban Carteret				
Bothered (n=39)	2.6 (-2.4,7.6)	59.0 (43.6,74.4)	35.9 (20.8,51.0)	2.6 (-2.4,7.6)
Not Bothered (n=127)	11.9 (6.3,17.5)	69.8 (61.8,77.8)	17.5 (10.9,24.1)	0.8 (-0.7,2.4)
-----				
Total study area <sup>6</sup> (n=360)	.4 (3.9,8.9)	57.3 (52.2,62.4)	31.0 (26.2,35.8)	5.3 (3.0,7.6)
-----				
Chester-Marcus Hook (1993)	5.6 (n=286) <sup>b</sup> (12.5,21.1)	37.1 (2.9,8.3)	40.6 (31.5,42.7)	16.8 (34.9,46.3)
U.S. (1991)		33.6	52.6	11.2
Northern New Jersey (1991) <sup>c</sup>	2.6 32.9	54.7	9.7	2.7

<sup>a</sup> Includes anyone who indicated lack of awareness of the incinerator.

<sup>b</sup> Source: Greenberg, Schneider & Choi, note 8.

<sup>c</sup> Source: U.S. Department of Commerce, note 10. Northern New Jersey includes Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex and Union Counties (NJ).

The seventeen variables in Table 3 were able to discriminate among neighborhood quality ratings. Ordered by statistical significance as measured by F-values, variables with a positive or negative correlation of >0.25 with at least one of the three discriminant functions are reported.

Correlations between the two discriminant functions and the variables help understand respondents' aggregate evaluation of their neighborhoods. The first function identified respondents who rated their neighborhood as poor or fair. It describes people who were distressed by multiple problems. Ordered by the correlation between the variable and the first function,

these problems were motor vehicle noise and heavy traffic ( $r = .570$ ); junkyard, gasoline stations and other nonresidential activities ( $r = .466$ ); odors or smoke ( $r = .448$ ); crime ( $r = .422$ ); the trash incinerator ( $r = .348$ ); the massive prison complex ( $r = .331$ ); and litter or trash ( $r = .284$ ). These respondents perceived that their present neighborhood was worse than their previous one ( $r = .514$ ). They disproportionately lived in the mobile home park ( $r = .299$ ) and not in suburban Carteret ( $r = -.315$ ).

Table 3  
Discriminant Analysis of Neighborhood Quality, Problems,  
Attractions and Personal Characteristics

Variable ( $n=360$ )	F- value	Correlation of Variable with Function <sup>a</sup>		
		Poor & Fair Quality <sup>b</sup>	Poor Quality <sup>c</sup>	Excellent Quality <sup>d</sup>
Motor vehicle noise and heavy traffic	26.7	.570		
Present neighborhood is worse	23.5	.514		
Odors or smoke	17.8	.448		
Junkyard, gasoline station, other nonresidential	16.3	.466		-.274
Trash incinerator	13.6	.348	.254	
High crime rate	13.1	.422		-.331
Litter or trash	12.0	.284	.637	-.251
Live in suburban Carteret	10.2	-.315		
Recreational facilities that attract rowdy people	7.9		.547	
Good schools	7.5		.338	
Jail, prison	6.6	.331		
Convenience to religious activities	6.0			.350
Live in mobile home park neighborhood	5.9	.299		-.273
Sewage plant	5.3		.493	
Live in east Rahway	3.8		.350	
Perceived good health	3.1			.500
Lived in neighborhood for a long time	2.1			.315

<sup>a</sup> Variables with a positive or negative correlation of  $>0.25$  with at least one function are shown.

<sup>b</sup> The canonical correlation of function 1 was 0.657, and the average standardized score of the poor and fair neighborhood quality respondents with function 1 were Z scores of 1.29 and 1.06, respectively.

<sup>c</sup> The canonical correlation of function 2 was 0.312, and the average standardized score of the poor neighborhood quality respondents with function 2 was a Z score of 1.34.

<sup>d</sup> The canonical correlation of function 3 was 0.197, and the average standardized score of the excellent neighborhood quality respondents with function 3 was a Z score of 0.97.

The second discriminant function identified respondents who rated their neighborhood as poor quality. These respondents were stressed by litter or trash ( $r = .637$ ); recreational facilities that attracted rowdy people

( $r = .547$ ); the nearby sewage plant ( $r = .493$ ); and the incinerator ( $r = .254$ ). They disproportionately lived in east Rahway ( $r = .350$ ), the location of the incinerator. A female resident of east Rahway connected these characteristics in her note:

Rahway used to be a nice place. Now it's nothing. It's a rough place to raise kids. The streets are terrible. I can't sit in the tv room or den anymore with the windows open because of the trash, smell, and noise, and the drug peddlers hanging around in the park. Go-go bars! At night they have a few drinks, leave bottles and cans. I wake up in the morning and find empty beer cans and bottles. The incinerator brings valuation of property down.

The final function described respondents who perceived themselves to be in good health ( $r = .500$ ); they were attracted by nearby religious activities ( $r = .350$ ) and good schools ( $r = .338$ ); were not troubled by crime ( $r = -.331$ ); junkyards and other nonresidential land uses ( $r = -.274$ ); or litter or trash ( $r = -.251$ ). They have lived in their neighborhood for a long time ( $r = .315$ ) and not in the mobile home park ( $r = -.273$ ).

Overall, 68% of respondents who rated their neighborhood as poor wanted to leave as a result of the trash-burning facility compared to 41 who rated it as fair, 18% who rated it as good, and only 9% of respondents who rated their neighborhood as excellent. But as the discriminant analysis showed the incinerator was not the only serious problem. The average respondent who rated his/her neighborhood as poor wanted to leave as a result of five problems. The average fair response was associated with 3.3 problems, and the average good or excellent rating with less than one.

### Discussion and Conclusions

The results support all three hypotheses. With respect to attenuation, the new incinerator was the most distressing hazard in the east Rahway host area. It was not so in the mobile home park or suburban Carteret; only 20% in two adjacent neighborhoods in Carteret wanted to leave as the result of it — compared to 46% of east Rahway respondents.

Measured by its F-value of 13.6, the incinerator was the fifth strongest discriminating variable of neighborhood quality in the study area, and a prominent correlate of fair or poor quality rating in two of the three discriminant functions. Furthermore, three of the four stronger discriminating variables (motor vehicle noise and heavy traffic, odors and smoke and present neighborhood is worse) were probably at least partly linked to the new and controversial incinerator. In other words, the new technological hazard not only outraged residents of east Rahway, but there was also considerable concern in the two adjacent neighborhoods.

Despite the political and physical prominence of the incinerator, poor and fair quality neighborhood ratings were also associated with multiple other problems, including crime, the presence of the prison, the sewage plant and recreational facilities that attract rowdy people. Amenities and personal demographic characteristics were much less important than perceived hazards.

We plan to revisit this study area during the next decade to monitor changes in property values, and in racial, ethnic, age and income status of residents. Our distressing working hypothesis is that the new facility will lead to rapid deterioration of the neighborhood because private investors with other choices will choose not to invest in a neighborhood with a prominent technological hazard, except perhaps to site LULUs. A second goal of future research in places like east Rahway is to determine precisely how funds from benefits packages are used. Even though the Rahway project did not explicitly focus on neighborhood benefits, phone and face-to-face conversations with almost 100 residents convinced us that residents were aware of the economic benefits to the city as a whole but unaware of benefits to their neighborhood. In short, do benefits packages help the neighborhood? Or does the LULU lead to a descending spiral of perceived neighborhood quality among residents and outside investors that is accelerated by each additional siting of a LULU? Third, we want to learn precisely what about the facility bothers people. Is it the odor, noise and/or litter? Is it fear of health effects? Is it declining property values? Which of these most distresses people? As part of such an effort, the environmental record of the new technological hazard and other hazards should be examined to determine if resident perceptions match scientific measurements of risk.

Our research to date also underscores the need for similar studies in a variety of densely developed and industrialized settings in the U.S. and other industrialized nations. We need a data base to generate and test theories that relate behavioral, natural and technological hazards, investment policies and neighborhood change in multiple-hazard neighborhoods. Such research is particularly important in brown fields neighborhoods that have been recently traumatized by new hazards if we are to understand the realities underlying feelings and charges of environmental inequity.



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