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ISSUES OF CLASSIFICATION IN ENVIRONMENTAL EQUITY: HOW WE MANAGE IS HOW WE MEASURE

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I. Introduction

Environmental equity[1] is an increasingly urgent issue on the national agenda.[2] Although legislation is being formulated, numerous administrative actions have placed a high priority upon environmental equity.[3] These efforts have been in response to observations of the racial, ethnic, and economic inequities throughout the 1980s.[4]

The underlying forces contributing to this interest in environmental equity and its origins are numerous and complex. They include the role of the civil rights movement in environmental justice, the shift toward grass roots environmentalism, widespread

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1. A distinction is made here between environmental equity and justice. Equity typically refers to the distribution of amenities and disadvantages across individuals and groups. Justice, however, focuses more on procedures to ensure fair distribution. Fairness refers to where one group or individual disproportionately bears the burdens of an action.

2. Several bills introducing an Environmental Justice Act have appeared before Congress over the past couple of years. *See, e.g.*, S.1161, 103d Cong., 1st Sess. (1993); H.R. 2105, 103d Cong., 1st Sess. (1993). A final version is expected to be passed in the near future. On February 11, 1994, the President signed Executive Order 12898, 59 Fed. Reg. 7,629 (1994), which called for environmental justice to be addressed in certain federal actions (federally funded and affecting human health or the environment).

3. At the federal level, see, for example, U.S. ENVTL. PROTECTION AGENCY, ENVIRONMENTAL EQUITY: REDUCING RISK FOR ALL COMMUNITIES (June 1992). The United States Environmental Protection Agency ("EPA") has established an internal Office of Environmental Equity and has formed environmental justice task forces to participate in a number of EPA initiated "comparative risk" projects.

4. U.S. GEN. ACCOUNTING OFFICE, SITING OF HAZARDOUS WASTE LANDFILLS AND THEIR CORRELATION WITH RACIAL AND ECONOMIC STATUS OF SURROUNDING COMMUNITIES (June 1, 1983); COMM'N ON RACIAL JUSTICE, UNITED CHURCH OF CHRIST, TOXIC WASTES AND RACE IN THE UNITED STATES (1987) [hereinafter UCC REPORT]; Marianne Lavelle & Marcia Coyle, *Unequal Protection: The Racial Divide in Environmental Law*, NAT'L L.J., Sept. 21, 1992.

interest in the environment, and the growing prominence of environmentally-based health issues.[5]

The environmental equity movement is now entering a new phase. Attention has turned to identifying and managing inequities where they are found. This requires information and decisions about how to define and classify inequity.

As environmental equity matures as a social issue, operationalizing concepts of race, equity, income (or economic status),[6] and the spatial location of subpopulations based on these concepts, has become a major stumbling block in both formulating environmental equity policies and managing their implementation. Major debates in the courts, administrative agencies, and citizen organizations often center around the problem of definition.

In order to explore the existence of inequity, a *first* requirement is the classification of the general population into subgroups (henceforth called subpopulations) according to some characteristics or criteria that are the focus of the equity analysis. Without such a classification, equity issues can be difficult to conceptualize. The concepts of race, ethnicity, and economic status (usually measured as income) are common bases for classifying such subpopulations for measuring inequity. Only once such groups are created, can the equity aspects of their health status and access to health prevention services and social resources be explored.[7] In spite of the frequent use of race and ethnicity as bases for classifying population subgroups, there has been little attention to or agreement on how these concepts can be operationalized.

Once subpopulation classification has been accomplished, a *second* requirement of equity studies is to locate these subgroups geographically, relative to some activity or adverse environmental condition that is hypothesized as creating an inequity.

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5. Rae Zimmerman, *Social Equity and Environmental Risk*, 13 RISK ANALYSIS 650 (Dec. 1993).

6. The definition of income is equally complex, and the problems encompass what is included in income, for whom it is reported, and problems of non-reporting and inconsistent reporting. A detailed treatment of income is beyond the scope of this Article, although some Census income data is addressed. Although a considerable amount of work has been done on income and equity, there is little consensus on approaches, and it is difficult to tell whether the debate is due to the way income is defined, how data are collected, or how boundaries are established.

7. Even prior to the emergence of the environmental equity movement, the health of population subgroups, including minorities, was often targeted by health professions in fields such as epidemiology and community medicine, although no particular line was drawn to distinguish equitable from inequitable conditions.

This Article addresses how concepts of race and ethnicity have been operationalized as a basis for defining and locating subpopulations (either explicitly or implicitly) for the purpose of analyzing environmental equity issues, and recommends some future directions. Part II focuses on how subpopulations are currently defined and on some problems encountered to date. The implications of these inconsistencies on the accuracy of health and environmental risk measures for a given subpopulation are addressed. Part III focuses on how spatial areas have been defined to aggregate these subpopulations within confined geographic boundaries.

II. Defining Subpopulations by Race and Ethnicity[8]

Although an extensive literature exists on the characteristics of racial and ethnic subpopulations, there is little consistency in the way these subpopulations are defined.[9] Most of the studies in this area adhere to the definitions used in existing data bases, which in most cases are based on Census data. According to one study by the Office of Technology Assessment (the "OTA") of the United States Congress, interest in and debate over the classification of people by race and ethnicity arose, in part, from the implications such definitions have on funding eligibility.[10] As the OTA notes in connection with Native American populations, many federal programs have been tied to subpopulation definitions. Some examples are, "revenue sharing, community development block grants, home energy assistance, and various social programs."[11] Many educational scholarships and grants are also tied to such definitions. A major challenge in the area of environmental equity involves the way in which subpopulations are defined as a basis for distributing the potential burdens posed by hazardous waste sites.

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8. Race and ethnicity are treated here as separate concepts, although in some literature race has been considered a subcategory of ethnicity.

9. Other equally important considerations, beyond the scope of this Article, are the lack of attention to the legitimacy of the use of racial and ethnic categories and ethical considerations in their use. *See* Newton G. Osborne & Marvin D. Feit, *The Use of Race in Medical Research*, 267 JAMA 275, 275-79 (Jan. 8, 1992). There is also the potential for stereotyping from combining ethnically categorized data with other data such as wealth, health, and education. *See* William P. Butz & Gustave J. Goldmann, *Introduction*, *in* CHALLENGES OF MEASURING AN ETHNIC WORLD-SCIENCE, POLITICS AND REALITY, PROCEEDINGS OF THE JOINT CANADA-UNITED STATES CONFERENCE ON THE MEASUREMENT OF ETHNICITY 20 (1992) [hereinafter PROCEEDINGS OF JOINT CONFERENCE].

10. OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, INDIAN HEALTH CARE 60 (Apr. 1986).

11. *Id.* at 61.

A. Concepts of Race and Ethnicity

In addressing environmental equity issues, the broad categories of race and ethnicity are most commonly used for the initial categorization of subpopulations. The United States Environmental Protection Agency (the "EPA") report on environmental equity defines race and ethnicity as follows: " 'race' differentiates among population groups based on physical characteristics of a genetic origin (i.e., skin color), and 'ethnicity' refers to differences associated with cultural or geographic differences (i.e., Hispanic, Irish)."[12]

The distinction between the concepts of race and ethnicity is often blurred, however, and has been subject to intense discussion and debate.[13] *Ethnicity* usually refers to common or shared cultures, origins, and activities (originating within the culture).[14] However, cultural identification alone is insufficient to define ethnicity.[15] Instead, the concept of ethnicity is also a result of social circumstances, in that it can be defined by people themselves.[16] For example, a person can obtain a sense of common identity when he/she leaves a homeland for another country. Moreover, ethnicity may be defined according to different criteria for different groups. For Hispanics, for example, ethnicity refers to a common identity that persons from different countries share.[17]

Defining the concept of *Race* raises a similar set of issues. Professor Stephen Gould, who has studied the classification of populations, argues that subdividing the human species into races should not be attempted because of the general difficulty involved in dividing species into subspecies.[18] In particular, he argues that "the fact of variability does not require the designation of races. There are better ways to study human differences."[19] Such distinctions, he argues, require a categorization of characteristics by location:

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12. 1 U.S. ENVTL. PROTECTION AGENCY, *supra* note 3, at 9-10.

13. Robert A. Hahn, *The State of Federal Health Statistics on Racial and Ethnic Groups*, 267 JAMA 268, 268-71 (Jan. 8, 1992).

14. FRANK D. BEAN & MARTA TIENDA, THE HISPANIC POPULATION OF THE UNITED STATES 7 (1987). A 1992 conference on the theme of measuring ethnicity summarized the various dimensions of the term ethnicity as encompassing a number of dimensions: race, ancestry, identity, origin, birthplace, parental birthplace, language, and mother tongue. *See* Butz & Goldmann, *supra* note 9, at 15.

15. BEAN & TIENDA, *supra* note 14.

16. *Id.*

17. *Id.* at 8.

18. STEPHEN J. GOULD, EVER SINCE DARWIN 231-36 (1977). The reference to Gould's work in the context of population classification has been underscored by Hahn, *supra* note 13, at 268.

19. GOULD, *supra* note 18, at 232.

"When we decide to characterize variation within a species by establishing subspecies, we partition a spectrum of variation into discrete packages with distinct geographic borders and recognizable traits."[20]

The difficulties in defining the concepts of race and ethnicity often result in a blurring of the distinction between the two concepts. This confusion led the U.S. Bureau of the Census, which routinely collects information on the attributes of the U.S. population, to separate questions pertaining to race and ethnicity in their population surveys.[21] For example, when a question regarding Spanish/Hispanic identification was introduced in 1970, it was separated in the Census from questions about race.[22]

Before discussing the major issues in racial and ethnic classification, it is important to distinguish between the terms "misclassification" and "inconsistent classification." These two terms have typically been used to characterize deficiencies in the quality of racial and ethnic minority classification systems in the U.S. The two terms are actually quite distinct. Misclassification implies there is some standard of measurement (procedural standard or threshold standard) that is being violated in some way. Inconsistent classification means that comparisons among minority populations at two points in time and at different places are being distorted by differences in classification methodologies. The issue of a standard is not directly relevant to inconsistent classification.[23]

This Article focuses primarily on inconsistent classification because standards for racial and ethnic definition currently present impossible choices, and enjoy little consensus.

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20. *Id.* at 233.

21. Nampeo R. McKenney & Arthur R. Cresce, *Measurement Experiences of the U.S. Census Bureau, in* PROCEEDINGS OF JOINT CONFERENCE, *supra* note 9.

22. U.S. BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION AND HOUSING, CONTENT DETERMINATION REPORTS, RACE AND ETHNIC ORIGIN 3 (1991).

23. Sugarman has underscored the relationship among concepts of misclassification, inconsistent classification, and the absence of accepted classification standards in the context of defining Native American populations:

> Although we have used the term misclassification to refer to cases in which racial classification was inconsistent in the two data sets, there is no widely accepted, scientifically valid definition that can be used as a "true" standard by which to classify race conclusively as American Indian.

Jonathan R. Sugarman, et al., *Racial Misclassification of American Indians: Its Effect on Injury Rates in Oregon, 1989 through 1990*, 83 AM. J. PUB. HEALTH 683 (May 1993).

B. Issues in Racial and Ethnic Classification

Some of the key issues that arise in racial and ethnic classification are (1) the number of categories into which a given subpopulation is further subdivided, (2) the basis upon which an individual is assigned to a racial or ethnic category, (3) whether standard procedures can be devised for such assignments, and (4) given a desirable standard or method of classification, how easy it is to operationalize.

First, an important issue in racial classification is how existing categories of race and ethnicity, adopted to collect data on subpopulation characteristics, are subdivided. One disadvantage of having numerous subcategories is that it makes the overall grouping less meaningful as a basis for identifying a given subpopulation. In addition, studying such highly variable subpopulations may prove unmanageable. For example, the number of racial and ethnic subcategories delineated by the U.S. Bureau of the Census varies widely from one subpopulation to another.[24] As an illustration, the Asian category contains ten major subcategories and another nineteen categories are designated as "Other Asian." The Pacific Islander category consists of three major subcategories and seventeen subcategories as "Other Pacific Islander." Close to six hundred subcategories are listed within the category of American Indian. Each subcategory represents a different tribe. The category Hispanic, or Spanish, is subdivided into about three dozen categories by continent and country of origin. Thus, not only do different ethnic and racial groups vary in their number of subcategories, but the basis or criterion for the subdivisions often differs as well. For Asians, Pacific Islanders, and Hispanics the basis is usually country of origin; for Native Americans, it is tribes. The criterion seems to reflect a geographic focus. Moreover, the number of subcategories for a given ethnic group is different for the 100% Census set versus subcategories for different Census population reports and data sets.

Second, there is the issue of who should decide how individuals are to be placed into racial and ethnic categories, and how standardized the procedures should be. Prior to 1980, census-takers or enumerators reported race and ethnicity based on their own observations.[25] Since 1980, the Census has allowed the respondent to

24. U.S. BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION AND HOUSING app. H, H-1 to H-8 (1991).

25. Hahn, *supra* note 13, at 268-69.

designate his or her race and ethnic group. Currently, "the concept of race as used by the Census Bureau reflects self-identification; it does not denote any clear-cut scientific definition of biological stock. The data for race represent self-classification by people according to the race with which they most closely identify."[26]

Studies of infant mortality identify still other sources of categorization.[27] Information on race and ethnicity for births, for example, is often obtained from parents or other informed individuals. Deaths, however, while commonly reported by next of kin, are more frequently reported by others, often unrelated to the individual, such as funeral home directors.[28] Furthermore, for a given individual, death certificate classifications rarely refer back to birth certificate classifications.[29]

Third, the criteria for classification, and the extent to which these criteria are standardized, are important considerations for consistency across different data sets. The criteria currently in use for racial and ethnic classification vary widely, and there is little agreement on what constitutes a valid standard. *Blood quantum* is a widely used approach, particularly for defining members of the Native American population. Blood quantum is a measure of the percentage of one's parentage that can be ascribed to a particular subpopulation. This measure is an attempt to quantify mixed parentage. Its precision depends on the accuracy of an individual's knowledge of his or her ancestry. In addition to the measurement problem, there is little consensus on its use as a standard.[30] Another approach to racial classification uses *visible physical features*, such as skin color rather than blood quantum. What makes racial and ethnic classification via physical features or blood quantum particularly difficult is the range of values that these features can assume along a scale. A scale is necessary for characteristics such as blood quantum and visible physical features since they are not

26. U.S. BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION AND HOUSING, DEFINITIONS OF SUBJECT CHARACTERISTICS app. B, B-28 to B-29 (1991). The origin of the federal protocol for the delineation of race is the Office of Management and Budget (OMB) Federal Statistical Directive No. 15.

27. *See* Robert A. Hahn, et al., *Inconsistencies in Coding of Race and Ethnicity Between Birth and Death in U.S. Infants*, 267 JAMA 259 (Jan. 8, 1992).

28. *Id.*

29. *Id.*

30. The State of Louisiana, for example, sets relatively low limits on blood quantum to categorize a person as a member of the Black population.

dichotomous variables like gender.[31] Another approach taken is the *self-identification* method used by the Census.[32]

Fourth, even if standard procedures for categorizing race and ethnicity were agreed upon, operationalizing these standards poses problems. For example, although procedures have been codified by the National Center for Health Statistics (NCHS) of the Public Health Service within the U.S. Department of Health and Human Services, procedures actually used for reporting of race and ethnicity vary. The classification of race and ethnicity on birth certificates versus death certificates illustrates the degree of variability.

Much of the investigative work in this area has been conducted on infants who died shortly after birth, for whom linked birth-death statistics were readily available. For *birth certificates*, procedures since 1989 assign the race and ethnicity of the mother to her infant.[33] In general, however, procedures for reporting race on birth certificates prior to 1989 were extremely complex and variable.[34] On the one hand, they overemphasized minority representation when parents were known, and on the other hand, had uncertain impacts when parents were unknown. The procedures overestimated minority representation in that if one parent was a member of a minority population, that population was assigned to the infant, even if the other parent was white.[35] Where both parents were members of minority populations, the race/ethnicity of the father was assigned to the infant. If no parent information was available, "the infant was assigned the race of the infant in the preceding NCHS computer file record."[36] Although the judgmental and arbitrary nature of the procedures used where parents were not known may appear troublesome, the procedures were at least based on statistical protocols which lend some consistency to the process. In fact, very few cases fell into the category of unknown parents: under 0.1-0.2% in the early 1980s.[37]

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31. Osborne & Feit, *supra* note 9, at 275.

32. *See supra* text accompanying note 9; RICHARD D. ALBA, ETHNIC IDENTITY: THE TRANSFORMATION OF WHITE AMERICA ch. 2 (1990) (clearly distinguishing ethnic identity and ethnic ancestry). This point is also underscored by Butz & Goldmann, *supra* note 9, at 18.

33. Hahn, *supra* note 27, at 260. Procedures for the coding of Hispanic origin apparently used this method even prior to 1989.

34. *Id.*

35. *Id.*

36. *Id.*

37. *Id.*

The reporting of race and ethnicity on *death certificates* reflects another set of similar procedural issues.[38] Where parents are not immediately available at the child's death, next of kin are often asked to assign race and ethnicity. In practice, a funeral director or other medical person makes the assignment. Furthermore, "[i]n the absence of death certificate information on race (approximately 0.2% of all death certificates from 1983 through 1985), the decedent is assigned white race if the race of the preceding decedent in the NCHS mortality computer file is white; otherwise, black race is assigned."[39] The Hahn study found an underestimation of minority affiliation at death with the default most commonly used being white.

The Hahn study found that, for a sample of infants who died within a year of birth, inconsistencies in the classification of infants by race and ethnicity at birth versus at death were greatest for minorities, particularly Hispanics. The percent of infants classified differently at birth than at death was 1.2% for whites, 4.3% for blacks, and 43.2% for other races.[40] Inconsistencies in classification at birth versus death were 3.5% for non-Hispanic Whites, 3.3% for non-Hispanic Blacks, and 30.3% for Hispanics.[41]

Procedures for categorizing race in records other than birth and death certificates also show a high degree of variability. For example, hospitals vary in their policies on enumeration of race and ethnicity of patients; their classification may be based on what the patient or the hospital staff reports.[42] Such procedures can produce many distortions in infant mortality statistics for minorities. Where corrections were made, a recomputation of the rates has shown that biases cause an underreporting of infant mortality rates for minorities.[43]

C. Classification Issues for Particular Subpopulations: The Example of Native Americans

The case of Native Americans further illustrates the issue of inconsistent classification. It raises some specific instances where inconsistent classification has influenced the portrayal of social and

38. *Id.*
39. *Id.*
40. Hahn, *supra* note 27, at 261.
41. *Id.*
42. Sugarman, *supra* note 23, at 683.
43. Hahn, *supra* note 27, at 261.

economic characteristics in a subpopulation. This has had serious implications for public policy.

OTA, in its report on the health of the Native American population, stated: "[t]here are at least as many definitions of who is an Indian as there are Federal agencies whose constituencies include Indians."[44]

According to the OTA, many definitions of Native American are contained in legislation.[45] At the Federal level, several agencies use different definitions. For example, Indian Health Service (IHS) estimates are based on Census estimates of Native Americans.[46] These estimates, however, are based on Native Americans who live on or near reservations recognized by the federal government.[47] The Bureau of Indian Affairs (BIA), concerned with the enumeration of Native American employment and earnings, uses a variety of sources of data, not necessarily restricted to the IHS data base, to enumerate Native American populations.[48] Tribal membership is not a criterion for Native American identification in either the IHS or BIA estimates. Thus, in the IHS figures, Native American populations will not include tribe members that are not on or near federal reservation areas. On the other hand, the BIA estimates will overestimate Native American populations as they will include persons who live on or near reservations and are not Native Americans.[49] Although proposals have been put forth in Congress to change the eligibility rules for assignment to the Native American category and to make the IHS and BIA procedures consistent, they have been defeated.[50]

Tribal membership as a basis for classification is a difficult criterion to use alone. It may underrepresent the Native American population or at least produce inconsistent estimates. The OTA report suggests some reasons for the underrepresentation.[51] For

44. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 10, at 59.

45. *Id.* at 60.

46. *Id.* at 61.

47. There were about 32 reservation States as of 1985. *Id.* at 63.

48. *Id.* at 61-63.

49. *Id.*

50. Telephone interview with Anthony D'Angelo, Director, Division of Program Statistics, Indian Health Service, United States Department of Interior (Dec. 10, 1993). The categorization issue arises in the provision of contract services, such as health care, to Native Americans. To receive such services, a Native American must have residency in tribal lands and socioeconomic ties to a tribe. The IHS tried to eliminate the requirement for establishing socioeconomic ties (but still require residency), leaving it up to the tribe to determine its own eligibility rules.

51. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 10, at 63-64.

instance, different tribes use different criterion for membership. Individual Native Americans may not join tribes for personal or political reasons. Further, membership rolls may be opened infrequently.

Inconsistencies in infant mortality studies also occur in the coding of the Native American category on birth and death certificates. For example, "more than one third of the infants in the United States whose birth certificates are coded as American Indian and who die within the first year of life are classified as members of other races on their death certificates, resulting in factitiously low American Indian infant mortality rates."[52]

Other sources of inconsistent enumeration of the Native American population appear in state records. These include the assignment of the mother's race if a child is born out-of-wedlock and the confusion between Native Americans and other races in certain parts of the country (with Hispanics, for example, in California).[53]

Still another source of inconsistent enumeration occurs when blood quantum is used in conjunction with tribal membership to categorize individuals as Native Americans. Even if one can agree conceptually on a percentage of one's heritage (blood quantum) that is Native American, practices among tribes vary considerably. Some tribes have minimums of twenty five percent for membership, while others base their memberships on "descent from a tribal member without regard to proportion of Native American heritage."[54] Governmental classification practices introduce still other variations geographically. For example, "until recent years, Canada excluded from tribal rolls the children of Indian women who married non-Indians."[55]

As with other races, intermarriage makes classification particularly difficult for Native Americans. In 1985, the Bureau of the Census reported that the intermarriage rate was over fifty percent, an increase of twenty percentage points over the 1970 rate.[56] This is particularly problematic for classification via blood quantum, since, as the OTA notes, Native Americans rely heavily upon the blood quantum concept to define members.[57]

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52. Sugarman, *supra* note 23, at 681.

53. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 10.

54. Sugarman, *supra* note 23, at 682 (quoting the April 1986 OTA study, INDIAN HEALTH CARE, *supra* note 10).

55. Jeanne Guillemin, Book Review, 70 SOC. FORCES 280 (1991).

56. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 10, at 74.

57. *Id.*

D. Policy Implications for Health Statistics

The classification issues recounted above have potentially serious implications for public health and environmental health policy, since they affect the reported incidence rates for health and injury in subpopulations. If these biases appear in the general health and injury categories, they are also likely to appear in measures of environmental health. Thus, in formulating a health rate, the definitions of the numerator and of the denominator must be kept consistent. Otherwise, inconsistent classification can have extreme effects on the health rates. For instance, in a study of injury rates among Native Americans in Oregon, the IHS method of classifying Native Americans produced injury rates that were sixty eight percent higher than injury rates produced using the classification of Native Americans by the Oregon Injury Registry.[58]

The infant mortality rate is the number of deaths of infants born in a given time period, usually within a year of birth, divided by the total number of births in that same population in the same time period. Where such a rate is stratified by race and ethnicity, it is important that the method of classifying race and ethnicity of those infants that died be consistent with the method used for classifying their births. When translating the classification problems encountered under Hahn's analysis into the impact upon health rates, significant contrasts emerge in the effect on rates categorized by race and ethnicity. The Hahn study found that adjusting the infant mortality rates with the post-1989 method of assigning the race of the mother to the infant had considerable effects on the rates for minority populations: infant mortality rates were "2.1% lower for whites, and higher for all other groups [after adjustment]—3.2% for Blacks, 46.9% for American Indians, 33.3% for Chinese, 48.8% for Japanese, 78.7% for Filipinos, and 8.9% for Hispanics."[59]

The pre-1989 method of classification of race and ethnicity had the effect, among infants who died in the first year, of underestimating white births and overestimating white deaths, thereby overestimating white infant mortality rates and underestimating these rates for minority populations.[60]

Thus, there have been some dramatic inconsistencies in the manner in which race and ethnicity have been defined. These have, in turn, led to substantial variations in the measurement and interpre-

58. Sugarman, *supra* note 23, at 681.
59. Hahn, *supra* note 27, at 259.
60. *Id.*

tation of health statistics. A future direction for research is to determine how widespread this problem is.

III. Geographic Boundaries for Equity: Waste Management

Once subpopulations are defined, the next step in an equity analysis for a specific area is to define the location of subpopulations relative to the location of the activity, condition, or impact area potentially producing an inequitable situation. In setting the geographic boundaries for this equity analysis, two issues must be addressed. The first is distance-related—a determination must be made as to how far these boundaries should be from the activity to characterize the impact on the community. The second is the need to determine how fine a level of data aggregation is needed to ensure the greatest accuracy.

Current literature and court cases have used different, but parallel, approaches to aggregating population data. Current literature that addresses environmental equity issues in spatial frameworks aggregates social and economic data for racial and ethnic groups at many different geographic levels. The geographic levels that have been used, where Census data is the data source, include counties, municipalities,[61] zip codes,[62] service areas,[63] and Census tracts, block groups, and blocks. The results of social and economic data analyses for subpopulations can vary considerably according to the geographic unit chosen for the data, just as they can vary with the subpopulation definition used.

The use of spatial analysis in the courts to define boundaries for equity arguments in the waste management area has been as variable as the results of literature studies.[64] Even where similar units of analysis are chosen, e.g., census tracts, differences in how these units are combined have produced substantial differences in the portrayal of the prevalence of minority populations relative to the location of waste sites.

Defining communities for analysis of environmental equity requires consideration of a number of geographic and boundary issues. Questions regarding the geographic selection and

61. Rae Zimmerman, Risk and Public Controversy at Hazardous Waste Sites, Final Report to the Office of Solid Waste and Emergency Response, U.S. Envtl. Protection Agency, Jan. 15, 1992 (rev. Feb. 1992); *see also* Zimmerman, *supra* note 5.

62. UCC REPORT, *supra* note 4.

63. Michael R. Greenberg, *Proving Environmental Inequity in Siting Locally Unwanted Land Uses*, 235 RISK—ISSUES IN HEALTH & SAFETY 235 (1993).

64. *See infra* notes 97-139 and accompanying text.

organization of social and economic characteristics around an unwanted activity in a community are critical not only to general equity considerations arising in connection with environmental policy and management, but are important requirements for many specific environmental programs as well. Environmental impact statements for facility siting under the National Environmental Policy Act[65] and state versions of it,[66] for example, routinely analyze neighborhood and socioeconomic conditions and impacts, which require the choice of geographic units for the aggregation of data. Guidelines are typically unavailable in both programs for the selection of these geographic units. The results have been highly variable.

The issues raised, which focus on how large an aggregate is used, are as follows:

(1) the use of the boundaries of political jurisdictions to spatially define communities and, if these are used, the selection of a particular jurisdiction;

(2) the use of non-jurisdictional spatial units, such as those used by the Bureau of the Census,

(3) the specification of alternative criteria for spatial definition of communities that pertain to the physical extent of a particular environmental problem, and

(4) the selection of standards of comparison regardless of the geographic area chosen.

A. Choosing Political Jurisdictions

Political jurisdictions (e.g., cities, towns, or boroughs) often encompass an area that is too large to capture a facility's immediate neighborhood. On the other hand, these jurisdictions represent a sense of political identity (if not neighborhood identity) and are managed by public officials who are often directly involved in facility decisions.[67] Political jurisdictions are consistent with a common sociological use of the term community, encompassing "a shared sense of place," identity, and "a set of organizations" that meet the area's needs, and these criteria may or may not imply geographically coterminous areas.[68] Because of their typically large size,

65. National Environmental Policy Act, 42 U.S.C. §§ 4321-4370c (1993).

66. For a general discussion of state versions of NEPA, see Gail Kamaras, *Cumulative Impact Assessment: A Comparison of Federal and State Environmental Review Provisions*, 57 ALB. L. REV. 113 (1993).

67. Zimmerman, *supra* note 5, at 653.

68. CORNELIA B. FLORA ET AL., RURAL COMMUNITIES: LEGACY & CHANGE 14-15 (1992).

political jurisdictions should be seen as complementing other geographic areas in defining a sense of community, such as Census data units[69] or easily defined service areas.[70]

1. Choosing Among Jurisdictions

There are a number of alternatives to assigning a single political jurisdiction to the location of a hazardous waste site. The selection depends not only upon the location of the site within the jurisdiction and relative to neighboring jurisdictions, but also on which level of jurisdiction reflects an "appropriate" political community, e.g., a borough, town, metropolitan area, or county. The choice can make a considerable difference in the characterization of the socioeconomic setting.

The case of Lipari Landfill in New Jersey illustrates some of the issues posed by defining the characteristics of communities using the boundaries of official political jurisdictions. Lipari Landfill has the highest score of any inactive hazardous waste site on the National Priorities List ("NPL").[71] The NPL contains waste sites designated for cleanup. Scores are assigned as a means of listing a site on the NPL, and a score of 28.5 or higher qualifies the site for the list. The average for sites on the NPL at any given time is about 40, and Lipari Landfill's score exceeds 70.[72] Although the magnitude of the score, *per se*, is not supposed to have any relationship to the magnitude of risk, risk may relate to the components of the score. Thus, the extremely high score of the Lipari Landfill is noteworthy.

Figure 1 shows the location of the landfill with respect to the closest political jurisdictions. The landfill is located in Gloucester County, New Jersey. Early Superfund documents designated the borough of Pitman as the location of the site.[73] The map shows that

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69. *See supra* text accompanying note 63.

70. Service areas for hazardous waste sites are particularly difficult to define since they are typically regional facilities. Customers can be drawn from many different geographic areas, not having common borders or even being near one another.

71. Under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), the EPA is instructed to compile an NPL identifying the top priorities among the nation's hazardous sites pursuant to a Hazardous Ranking System, which derives a score for determining the environmental risk posed by a site. 42 U.S.C. § 9605 (1988).

72. U.S. ENVTL. PROTECTION AGENCY, NATIONAL PRIORITIES LIST, FINAL AND PROPOSED SITES (May 1993).

73. *See* U.S. Envtl. Protection Agency, R. of Decision, Lipari Landfill, N.J., Aug. 3, 1982. For later records of decision, see U.S. Envtl. Protection Agency, R. of Decision, Lipari Landfill, N.J., July 11, 1988; U.S. Envtl. Protection Agency, R. of Decision, Lipari Landfill, N.J., Sept. 30, 1985.

Figure 1

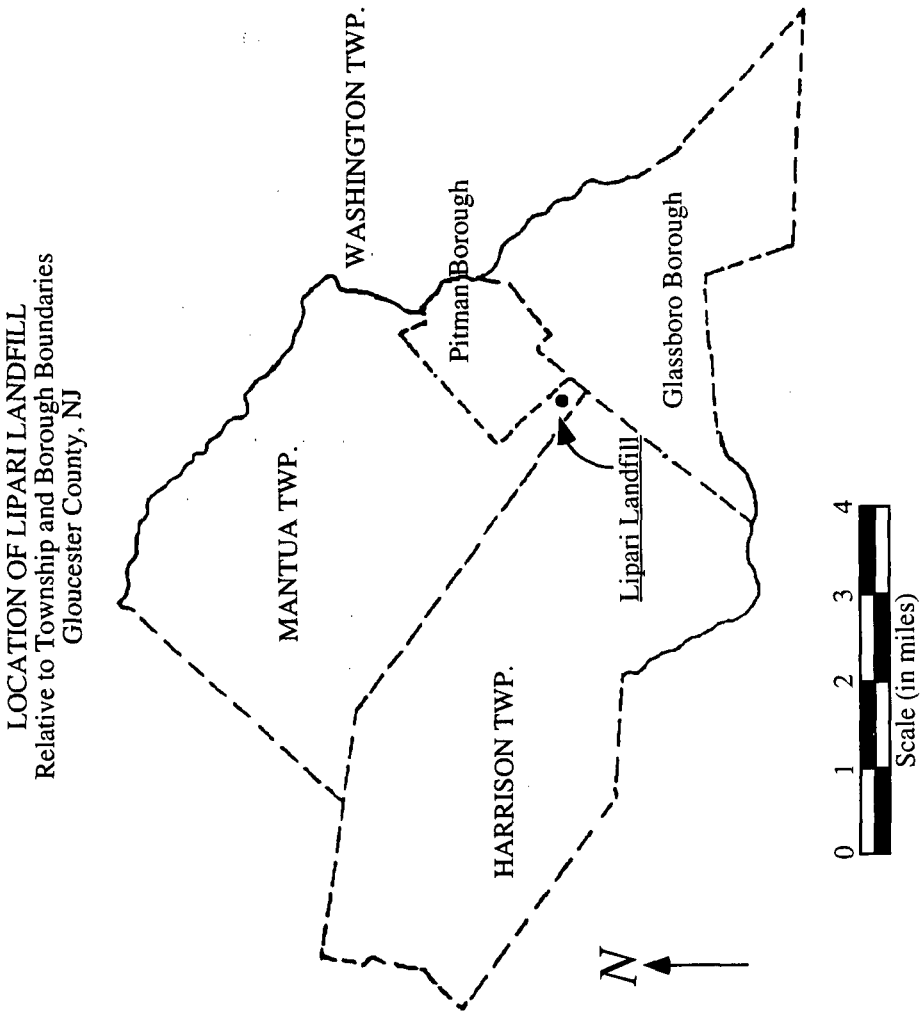
LOCATION OF LIPARI LANDFILL
Relative to Township and Borough Boundaries
Gloucester County, NJ
WASHINGTON TWP.
Pitman Borough
Glassboro Borough
MANTUA TWP.
Lipari Landfill
HARRISON TWP.
N
0 1 2 3 4
Scale (in miles)

Table 1. Selected Population and Housing Characteristics of Political Jurisdiction in Proximity to Lipari Landfill, NJ, 1980-1990

A. 1980, 1985 Census

	Pitman Borough	Glassboro Borough	Mantua Twp.	Harrison Twp.	Washington Twp.	Gloucester County
Population (1980)	9,744	14,564	9,193	3,585	27,878	199,917
Population (1986)	9,580	14,420	9,540	3,890	32,910	211,500
% Population Change (1980-1985)	-1.6%	-1.0%	+3.8%	+8.5%	+18.1%	+5.8%
Population Density (1986)	4,165	1,567	600	205	1,524	647
% Black (1980)	0.4%	16.1%	0.7%	4.8%	2.7%	8.4%
% Hispanic (1980)	0.5%	1.4%	1.2%	0.7%	1.0%	1.1%
% 65 yrs.+ (1980)	14.5%	7.9%	7.3%	10.5%	4.5%	8.9%
% Owner Occupied (1980)	71.9%	53.3%	88.7%	69.8%	87.4%	76.5%
Median House Value (1980)	44,200	41,100	41,400	55,300	60,100	44,200
Per Capita Income (1979)	7,486	5,744	7,015	7,510	7,616	6,939
(1985)	11,484	8,737	10,972	12,043	11,874	10,828
Household Income (1979)	18,517	14,732	21,209	18,056	24,814	21,882
% Below Poverty (1980)	6.7%	23.8%	4.8%	9.2%	3.9%	17.0%
% HS Graduates (1980)	74.3%	66.6%	64.9%	70.2%	80.7%	66.2%

B. 1990 Census

	Pitman Borough	Glassboro Borough	Mantua Twp.	Harrison Twp.	Washington Twp.	Gloucester County
Population (1990)	9,365	15,614	10,074	4,715	41,960	230,082
Population (1980)	9,744	14,564	9,193	3,585	21,878	199,917
Population Change (1980 - 1990)	-3.9%	+7.2%	+9.6%	+31.5%	+91.8%	+15.1%
Population Density (1990)	4,072	1,697	634	246	1,961	708
% Black (1990)	0.5%	18.5%	1.3%	3.1%	3.7%	8.7%
% Hispanic (1990)	0.6%	2.9%	1.1%	1.7%	1.4%	1.8%
% 65 yrs.+ (1990)	16.1%	10.4%	10.5%	10.7%	6.3%	10.8%
% Owner-occupied (1990)	73.2%	59.3%	90.2%	77.1%	86.6%	78.3%
Median House Value (1990)	97,100	97,600	97,300	138,400	126,600	99,300
Median Contract Rent (1990)	444	428	422	334	579	437
Per Capita Income (1990)	16,167	12,684	17,316	17,931	17,478	15,207
Household Income (1990)	40,136	34,218	42,841	45,429	51,503	39,387

SOURCES:

U.S. Bureau of the Census, *County and City Data Book*, 1983 and 1988 (Washington, D.C.: U.S. GPO, 1983 and 1988).

U.S. Bureau of the Census, *1990 Census of Population and Housing. Summary Population and Housing Characteristics.* New Jersey (1990-CPH-1-32) (Washington, D.C.: U.S. GPO, August 1991).

Rae Zimmerman, Public Knowledge and Perceptions of Risk Assessment: The Legitimation of Risk Assessment Through Knowledge of its Process, Final Report to the New Jersey Institute of Technology Hazardous Substance Management Research Center, Newark, NJ, September 1990, Table 13 (on file with Author). Supplemented with U.S. Bureau of the Census data for 1990.

it is actually located just outside of Pitman, on the outskirts of the Township of Mantua. It also practically borders another township, Harrison, and another borough, Glassboro. The map illustrates the difficulty of assigning a political jurisdiction that most appropri-

ately characterizes the landfill's location. Further, this assignment raises the question of whether the choice makes a difference in the characterization of the community. Another issue is, disregarding the proximity of the landfill to several political jurisdictions, what level of jurisdiction (in this case, borough, township or county) should be used in characterizing the impacted area.

In the case of the Lipari Landfill, there were generally no substantial differences in selected socioeconomic population characteristics of the various jurisdictions, with one exception. The Black population of the neighboring Glassboro was considerably larger than that of other jurisdictions. In 1980, the Black population of Pitman and Mantua was under five percent while in Glassboro it was sixteen percent, above the 1980 State percentage. Household income was also lower in Glassboro than in the neighboring jurisdictions. This disparity increased in 1990, the proportion of Glassboro's Black population increasing to eighteen percent, still above the New Jersey 1990 statewide percentage of 13.4%. The impact area considered by local residents did not extend into Glassboro, as it focused primarily on a lake and tributaries in the opposite direction.[74]

2. *Border and Boundary Issues*

Border issues are related to the selection of a level or size of jurisdiction. Many waste disposal facilities are sited at the outer boundaries of political jurisdictions such as a municipality, county, or state. An analysis of NPL sites in two northeastern states showed that a number of sites were within a few miles of counties other than the one ascribed to the site location.[75] Some sites in that group were also within a few miles of other states. This implies that adjacent jurisdictions could be more impacted than the one in which a hazardous waste site is located. Thus, confining an analysis to the boundaries of a political jurisdiction may miss the significance of what happens just over a border.

The Lipari Landfill case also illustrates the boundary problem. The landfill is well within a mile of the four jurisdictional areas discussed above, and is actually within several miles of another one as well—Washington Township—though it does not border it. As

74. It is unclear whether the Black population participated in recreational or other activities involving the lake or water bodies hydrologically contiguous with it.

75. Data collected in connection with RAE ZIMMERMAN, REGION II, U.S. ENVTL. PROTECTION AGENCY, NPL SITES AT STATE BOUNDARIES WITHIN FOUR MILES OF ANOTHER STATE (June 1993)(on file with author).

noted above, one of the adjacent jurisdictions, Glassboro, has somewhat different characteristics from the others. Glassboro extends from under one mile from the landfill, at its nearest point, to four miles from the landfill, at its farthest point. This poses a major decision as to community selection. The location of the landfill on a U.S. Geological Survey (U.S.G.S.) topographic map gives a much closer view of the landfill, showing housing developments in Pitman that are practically adjacent to the landfill. Housing units within Glassboro are not immediately apparent near the site. Other surrounding land uses indicated on the U.S.G.S. maps and other similar site maps are orchards.

Sensitivity to these boundary and border issues will often require the use of data collection methods different from those currently used under the programs that regulate inactive hazardous waste sites, such as Superfund and its state analogues. At the present time, for example, jurisdictional boundaries are not carefully identified on Superfund area maps, though portions of the boundaries may appear on the most detailed maps. Usually sites are located on a U.S.G.S. topographic map, which does not indicate political jurisdictions and neighboring areas completely. At a minimum, all jurisdictional boundaries should be identified on site maps.

3. *Results of Equity Studies Using Jurisdictional Boundaries*

Several studies have used counties, municipalities, or other jurisdictions as bases for analyzing equity associated with the location and cleanup of hazardous waste sites. A study of NPL Superfund sites found that, as a group, communities with sites typically had a greater percentage of Blacks, when the municipalities were weighted by population size, than the percentage of Blacks nationally.[76] This was also true for Hispanic populations, though the relationship was less pronounced. Two variables, income and percentage of the population below a Census-defined poverty line, did not assume prominence at this geographic level of analysis.[77]

One measure of progress toward site cleanup is the existence of a Record of Decision (an "ROD"), which is a cleanup plan. The Zimmerman study found that the higher the Black population of a community with an NPL site was, the less likely the community's NPL site was to have a ROD, although this was also a function of

76. Zimmerman, *supra* note 5.

77. *Id.* at 657.

when the site was placed on the NPL. Sites that had been on the NPL longer were more likely to have RODs.[78]

Similar studies have been conducted at county and zip code levels by others.[79] Most of the findings show that inactive waste sites on the NPL[80] were, on average, located in areas that had higher Black populations relative to geographic units within which the analyzed jurisdictions were located.

B. Census Data Units: Tracts, Block Groups, and Blocks

The use of continuous data bases, i.e. radial distances, can theoretically overcome the problems posed by jurisdictional boundaries. The argument for using this approach is that a sense of community and the incidence of impact know no political boundaries.

Numerous environmental equity studies are being conducted that use Census data units smaller than or at least encompassing political jurisdictions.[81] These data units are as close to a continuous data base as possible, short of doing new surveys aimed at individuals. Census data are collected at several levels below the level of a municipality: blocks, block groups, and tracts.[82]

Blocks are the smallest unit of data provided by the Census, and are "bounded on all sides by visible features such as streets, roads, streams, and railroad tracks, and by invisible boundaries such as city, town, township, and county limits, property lines, and short, imaginary extensions of streets and roads."[83] Block Groups are clusters of Blocks, and "generally contain between 250 and 550 housing units, with the ideal size being 400 housing units."[84] Tracts are subdivisions of a county that "usually have between 2,400 and 8,000 persons and, when first delineated, are designed to be homogeneous with respect to population characteristics, economic status, and living conditions."[85] Even though the Block Group is larger than the Block, the practical advantage of this level of aggre-

78. *Id.* at 660.

79. *See* UCC REPORT, *supra* note 4; John A. Hird, *Environmental Policy and Equity: The Case of Superfund*, 12 J. OF POL'Y ANALYSIS & MANAGEMENT 323 (1993).

80. These facilities were often sited decades ago prior to the Superfund program.

81. *See generally*, Zimmerman, *supra* note 5; Hird, *supra* note 79.

82. UCC REPORT, *supra* note 4. Zip code data are also available from the Census, and prior to the availability of smaller more homogeneous units, they had often been used in equity studies. *Id.*

83. U.S. BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION AND HOUSING, AREA CLASSIFICATIONS app. A, A-3 to A-6 (1991).

84. *Id.*

85. *Id.*

gation is that a much larger selection of social and economic characteristics is available. Within each data category the physical area of the units would be expected to vary widely from place to place depending upon population density. This is an outcome of Census methods. For example, the Census tries to adhere to a roughly constant number and/or homogeneous composition of housing units or population for Block Groups and Tracts respectively, and adheres to various natural boundaries in the case of Blocks.

There are several ways to obtain socioeconomic data for these smaller areas as a function of distance from a given site. Assume, for example, that one is interested in the social and economic characteristics of an area within a two mile radius of a hazardous waste site. One approach is to aggregate Census data units within the distance of interest, i.e., two miles, taking the boundaries of the aggregated area as the boundaries of the outermost Census data units (in order to avoid subdividing the data units). Identifying the locations of these units within a precise distance is usually accomplished with reference to the centers of each of the units. With this method, even though a two mile distance is used to obtain the census data units, the ultimate area obtained will not correspond to the area of a circle circumscribed by a two mile radius. The actual area can still be calculated since areas are given in the Census for each data unit. The two mile distance in this example only pertains to the distance at which the Block centers are located and not the perimeter of the area for which data are actually obtained.

A second approach is to use Geographic Information Systems (GIS) which can carve out the exact circle circumscribed by the two mile radius. While this method may have the advantage of showing the precise distance for which the circle is circumscribed, i.e., the area of a circle within a two mile radius, the disadvantage is that census data units may have to be intersected to obtain a circle or some other area with a desired shape. The intersection of these units requires that assumptions be made about where the population is within the intersected unit. The assumption usually made is that population is homogeneously distributed within the intersected units. Although this assumption might work with total population figures, it is not likely to work well with subpopulations, which tend to cluster geographically, and are not typically distributed homogeneously.

1. Comparisons for Sets of Hazardous Waste Sites

The area of the aggregated Census Block units (the smallest level of data aggregation available from the Census) using the first approach was compared with the area of various circles, using two hundred hazardous waste sites in the northeastern United States. The data shown in Table 2 illustrate the effect of both distance and level of data aggregation on the data characteristics.[86]

a. Distance

Regardless of the data unit (Block or Block Group), at small distances from the hazardous waste sites (i.e., under one mile) the mean area circumscribed using the location of the Block centers often differs substantially from the mean area of a circle for the set of two hundred sites. Once one moves over a mile away, however, the differences for these sites stabilize, showing an average difference between the Block-centers method and the mean area of the circle of usually not more than twenty percent.

Table 2. Comparison of Areas Circumscribed by Using Block vs. Block Group Census Data Units for Selected NPL Sites in the Northeastern United States

	Mean Areas (in square miles)		
Distance* (miles)	Circles	Blocks	Block Groups
0.25	0.196	0.182	0.374
0.5	0.785	0.634	1.597
0.75	1.767	1.536	2.593
1.0	3.142	2.587	3.333
2.0	12.566	10.447	10.455
3.0	28.274	23.241	22.057
4.0	50.265	40.669	41.022

* This distance refers to the radial distance from the site within which the centers of Census Block and Block Group data units were drawn. If a center of a Block or Block Group lies outside of the specified distance, it is not included within that distance even though portions of the area might be within that distance.

86. Data compiled in connection with RAE ZIMMERMAN, REGION II, U.S. ENVTL. PROTECTION AGENCY, AN ENVIRONMENTAL EQUITY STUDY FOR INACTIVE HAZARDOUS WASTE SITES (Feb. 1994)(on file with author).

b. Level of Aggregation

The differences between the area circumscribed and that of a circle increase as larger data units are used, as one would expect. This can be seen clearly by comparing, once again, the results of aggregating data for Census Blocks and Block Groups, using the example of some hazardous waste sites in the northeastern United States. There are considerable differences in the area circumscribed by Blocks vs. Block Groups at selected distances from these sites. A major difference in using Block vs. Block Group data aggregates occurs at distances very close to a site. The mean areas of the Block Group aggregates at one-quarter and one-half mile radii are almost double the mean areas obtained at the same distance for Block aggregates. The difference between the areas circumscribed using Blocks vs. Block Groups is very small beyond one mile, however, and the absolute difference is usually only about one square mile. These differences occur because the Block aggregates allow one to get more detailed data close to a site. The centers of many Block Groups may not even exist within small distances (under one mile) from a selected point. In fact, the number of sites for which data become available increases with distance. The larger the unit of data analysis, the more pronounced this change is. As one moves out further, however, the differences between the mean areas of the Block Group and Block aggregates practically disappear. To some extent this dampening effect on the differences is produced by the cumulation of the numbers, that is, data for each successive distance contains all of the data at closer distances.

2. Comparisons for Single Examples of Hazardous Waste Sites—Lipari Landfill

Obtaining data for Lipari Landfill using the first approach described above (pulling census Blocks within prescribed distances) for various distances within a four mile radius of the site, illustrates for a particular site whether differences arise by altering the distance and level of aggregation used to analyze a site.

a. Distance

Within various distances under one mile, regardless of data unit used, the percentage of the population that is Black remains similar to the Black population of Pitman and Mantua. Farther out, the percentage rises, becoming similar to that of the County. Asian and Hispanic populations stay the same regardless of distance.

b. Level of Aggregation

An examination of Lipari Landfill illustrates how an alteration in the scale of the Census unit affects socioeconomic data, in particular, the racial composition and population density. Altering the data unit has little impact on the percentage of the Black population but a substantial impact with respect to population density. Although the percentage of the Black population changes from about one percent close to the site to seven to nine percent farther out, regardless of whether Blocks or Block Groups are used, population density is about four times larger for Block Group aggregates than for the Block aggregates within one mile. As one would expect, the further the distance, the less pronounced the differences are between the results produced using Block aggregates versus Block Group aggregates. Even the difference between population density farther out becomes less than fifty percent for the Block and Block Group aggregates rather than the four-fold difference at smaller distances.

3. Analysis of Findings

The set of multiple hazardous waste sites and single site examples above illustrate how random differences in socioeconomic characteristics can appear in aggregated data. These differences depend on the level of aggregation chosen (e.g., Census Block level, Tract, or municipality), the area perimeters used for a particular site, and the shape of an area circumscribed (e.g., a circle, collection of Blocks, etc.). Differences may also appear for some variables but not others, and for some sites, but not others. Further, the larger the unit of analysis, the more likely it is that the characteristics of a large geographic area will be assumed to be the same as those of a smaller sub-area within it. This bias can occur when a given characteristic of the populations located in two different areas is compared, and generalizations are made about the distribution of that characteristic with respect to a second characteristic in each area. This potential bias argues for working with smaller geographic units.

The issue of distance is a more difficult one. Without additional information about the physical extent of impacted interests, it is impossible to determine appropriate distances for analyzing equity. From an analytical perspective, the differences between the values for a given socioeconomic characteristic become less significant as the distance becomes greater within a few miles from the site.

C. Alternative Criteria for Spatially Defining Potentially Impacted Communities

The previous discussion based the location of potential impact areas or communities on the location of a proximate, residential population. Alternatively, community boundaries can be circumscribed on the basis of (1) activities other than one's home residence or (2) interests or environmental issues that are of concern in connection with the particular environmental condition, such as a hazardous waste site.

Activities other than residential activity can produce different boundaries for affected communities. These alternative locations include place of work, recreation, shopping, and school. These alternatives produce different geographic pictures of the size and location of the community. Activities can be a significant basis for defining communities, since they can bring individuals into proximity to a hazardous waste site.

A second basis for delineating communities is common interests and environmental concerns which are not necessarily linked to residential location. This approach often requires a knowledge of the location of the concerned population as well as the geographic extent of a particular condition. Furthermore, exposed populations, whether located near the sites or not, often consider themselves part of the affected community. Communities defined in terms of common interests constantly change over time as an issue evolves.[87] With respect to hazardous waste sites on the NPL, interest groups and individuals may change at different points in the cleanup process—from site discovery to final cleanup. Key points for public involvement and awareness around which communities can coalesce are (1) the preparation of the Remedial Investigation/Feasibility Study (RI/FS),[88] (2) the health risk assessment conducted in connection with the RI/FS, and (3) the Record of Decision (ROD) describing the site cleanup plan and its alternatives, since a public hearing is held on the ROD.

In the case of the Lipari Landfill, the active communities were drawn primarily from Pitman. For example, the Pitman-Alceon Lake-Lipari Landfill Community Association consisted of Pitman

87. *See generally* MICHAEL R. EDELSTEIN, CONTAMINATED COMMUNITIES: THE SOCIAL AND PSYCHOLOGICAL IMPACTS OF RESIDENTIAL TOXIC EXPOSURE (1987) (case study of Jackson Township, New Jersey).

88. During the remedial investigation, data on the site is collected and the site is characterized. During the feasibility study, a detailed analysis of the remedial alternatives for the site is conducted. 40 C.F.R. § 300.430(a)(2) (1993).

residents. Another active organization was the Pitman Environmental Commission, also primarily based within the Pitman political jurisdiction.[89] Using community activism as a criterion to circumscribe impact areas would argue, in the case of the Lipari Landfill, for the designation of the political jurisdiction of Pitman in spite of the proximity of the landfill to other jurisdictions.

The exposure-assessment component of a risk assessment also illustrates how the boundary of an impacted community can vary depending on how exposure is defined. Cultural bias has occasionally been ascribed to exposure measurement and data collection. Fish consumption, for example, can be a major route into the human body for certain contaminants, such as heavy metals, pesticides, and certain toxic organics.[90] In exposure assessments, fish consumption is usually portrayed as an average, and usually reflects the amount of trimmed fillets consumed.[91] These average fish consumption figures, it has been argued, may not take into account that minority populations have different dietary habits with respect to fish consumption. Certain minority populations typically eat parts that concentrate pollutants, but that are not counted as part of fish consumption.[92] Minorities tend to consume more fish than non-minority populations. For example, studies have found that Blacks and Native Americans have much higher levels of fish consumption than do whites.[93] Earlier studies found that Asians have still higher consumption levels.[94] In addition, minorities may obtain their fish in areas more likely to be contaminated. Finally, the preparation of fish and shellfish may also release contaminants contained within them. The considerable dispersion and variation of fish consumption patterns present obvious problems for the spatial definition of a community on the basis of exposure.

Another example of these difficulties occurred in New York State during the 1970s. A State health advisory was issued in 1981

89. Rae Zimmerman, Public Knowledge and Perceptions of Risk Assessment, Final Report to the New Jersey Institute of Technology Hazardous Substance Management Research Center (Newark, N.J. Sept. 1990). The prominence of the Pitman organizations in this case is also discussed in Carl E. Van Horn & Yvonne Chilik, *How Clean is Clean? A Case Study of the Nation's No. 1 Superfund Toxic Dump*, 8 ENVTL. IMPACT ASSESSMENT REV. 133 (1988).

90. *See* 1 U.S. ENVTL. PROTECTION AGENCY, *supra* note 3, at 15.

91. *Id.* at 16.

92. *Id.*

93. Patrick C. West, et al., *Minority Anglers and Toxic Fish Consumption: Evidence from a Statewide Survey of Michigan*, *in* RACE AND THE INCIDENCE OF ENVIRONMENTAL HAZARDS (Bunyon Bryant & Paul Mohai eds., 1992).

94. 1 U.S. ENVTL. PROTECTION AGENCY, *supra* note 3, at 15.

to stop the consumption of Hudson River's blue crabs and the liquids in which they were cooked, because of cadmium contamination leaking from a Superfund site on the Hudson River at Cold Spring, New York.[95] Even though the cadmium would have probably been contained within certain organs and possibly within the crab's shell, when the crab were prepared using certain liquids, the cadmium was leached out.[96] Thus, those consuming contaminated food, rather than those living near the source, were the affected communities. The inference from this example is that community is defined radically differently if one takes into account exposure information than it would be from simply measuring the proximity to contaminant sources.

D. Selection of a Standard of Comparison

Equity by definition implies some standard or criterion by which one evaluates population distribution patterns relative to the alleged source of environmental harm. Once a geographic area is selected, a unit of comparison must also be chosen. This issue arises regardless of the geographic unit chosen—jurisdiction, Census data unit, or other spatial area. Many alternatives have been tried. For example, the magnitude and distribution of a minority population in an area of interest is usually compared with similar patterns at the statewide, countywide, and municipal geographic levels. Alternatively, comparisons have been made among different subpopulations within the same geographic area. Selecting a comparison population is not a unique concern to environmental issues. In fact, it has historically surfaced in the development and application of location and population quotients in urban economics. The choice of standards of comparison continues to be one of the more subjective, discretionary areas of environmental equity research.

IV. Geography and the Courts

Several court cases are noteworthy for their focus on the geography of race in resolving environmental equity issues.[97] The delinea-

95. New York State Dep't of Health, Sport Fish Consumption Advisory, Press Release, June 10, 1981.

96. *Id.*

97. *See* R.I.S.E., Inc. v. Kay, 768 F. Supp. 1141 (E.D. Va. 1991), *aff'd*, 977 F.2d 573 (4th Cir. 1992); East Bibb Twiggs Neighborhood Ass'n v. Macon-Bibb County Planning & Zoning Comm'n, 706 F. Supp. 880 (M.D. GA.), *aff'd*, 896 F.2d 1264 (11th Cir. 1989); Bean v. Southwestern Waste Management Corp., 482 F. Supp. 673 (S.D. Tex. 1979), *aff'd*, 782 F.2d 1038 (5th Cir. 1986). For a general discussion of *R.I.S.E.* and

tion of boundaries around waste sites has been a critical step in identifying the social and economic characteristics of residents adjacent to waste sites. These cases provide insight into what courts have accepted or rejected with respect to the delineation of geographic boundaries around various kinds of waste sites.

In each of these cases, boundaries were delineated in order to circumscribe an area for which social and economic characteristics of inhabitants potentially affected by the facility would be defined. The cases illustrate how the boundaries were used in the court arguments by both plaintiffs and defendants and how sensitive the findings of an equity analysis can be to the manner of defining boundaries. The cases also illustrate how the controversy often turns on not only which geographic unit is used but the unit's size.

A. *Bean v. Southwestern Waste Management Corp.*[98]

Plaintiffs charged the Texas Department of Health with discrimination in the issuance of a permit to operate a solid waste facility in East Houston. They filed a motion for a temporary restraining order and preliminary injunction. The District Court for the Southern District of Texas denied Plaintiffs' motion for preliminary relief, holding that they had failed to establish a substantial likelihood of success on the merits.[99] In particular, the court found that the plaintiffs had not shown a pattern or practice of discrimination sufficient to support a finding of intent.[100]

In *Bean*, the plaintiffs focused on a number of different geographic areas in their statistical analyses of the proximity of minority populations to the proposed solid waste facility. These areas ranged from the entire city of Houston, to two halves of the city (the eastern and western portions), specific tracts, smaller census units, and a target area.[101] The court's analysis of the data led it to conclude that there was no basis for a finding of discrimination. The court recognized, however, that in the plaintiffs' case for permanent relief, it would be necessary to consider the consistency of the racial composition of both census tracts and the broader neigh-

Bean, see Gerald Torres, *Environmental Burdens and Democratic Justice*, 21 FORDHAM URB. L. J. 431, 440-42 (1993).

98. 482 F. Supp. 673.

99. *Bean*, 482 F. Supp. at 677.

100. *Id.* at 677-78.

101. *Id.* at 678.

borhoods within which facilities were located, to determine if a pattern of discrimination existed.[102]

Seventeen permitted solid waste facilities were operating in Houston by 1978.[103] Of these, fourteen were located in census tracts with a fifty percent or less minority population.[104] Ten facilities were located in census tracts with a twenty-five percent or less minority population.[105] In the target area, the two approved sites for facilities had a seventy percent minority population.[106] The facility at issue was in a census tract with a minority population of approximately sixty percent. The court found, however, that this did not establish a pattern of discrimination since over half of all the facilities in the target area were located in census tracts with a minority population of less than twenty-five percent.[107]

In attempting to establish a pattern of discrimination, the plaintiffs forwarded several data bases for analysis, as summarized by Collin. The first data set forwarded the theory that the disparity arose because the target area contained 6.9% of Houston's total population, but 100% of Houston's type I municipal land fills.[108] There were two such facilities in the target area. The court rejected this set on two grounds. First, two sites composed too small of a sample to be representative.[109] Second, one of the sites was in a target area located in a census tract with only an 18.4% minority population.[110]

The plaintiffs' second data set focused on the "total number of solid waste sites in the... target area."[111] The plaintiffs' theory was that 6.9% of Houston's total population living in a target area containing 15% of Houston's solid waste sites was a disparity.[112] Since the target area population was seventy percent minority, the plaintiffs contended that this disparity constituted discrimina-

102. *Id.* at 680; *see also* Kelly M. Colquette & Elizabeth A.H. Robertson, *Environmental Racism: The Cases, Consequences, and Commendations*, 5 TUL. ENVTL. L.J. 153, 201-02 (1991); Robert Collin, *Environmental Equity: A Law and Planning Approach to Environmental Racism*, 11 VA. ENVTL. L.J. 495, 520-23 (1992) (setting forth the framework of a series of data sets used in the case).

103. *Bean*, 482 F. Supp. at 677.

104. *Id.*

105. *Id.*

106. *Id.*

107. *Id.*; Collin, *supra* note 102, at 521-22.

108. 482 F. Supp. at 678.

109. *Id.*

110. *Id.*

111. *Id.*; Collin, *supra* note 102 at 522.

112. 482 F. Supp. at 678.

tion.[113] The court found that since the other facility in the target area was in a census tract that was more than seventy percent white, this data set did not support the charge of discrimination.[114]

The plaintiffs' third data set divided Houston into quadrants. The eastern quadrants of Houston contained 61.6% of Houston's minority population, but 67.6% of the city's solid waste facilities.[115] The western quadrants, however, contained 73.4% of the city's white population, but only 32.4% of the city's solid waste facilities.[116] The plaintiffs alleged that the disparity between the 67.6% and the 32.4% figures constituted discrimination. The court, however, agreed with the defendant's position that the facilities were sited in the eastern half of the city because that was where Houston's industrial area was located.[117] Therefore, the process of siting was not discriminatory. The court also implicitly held that this quadrant method was not the appropriate mode of analysis and that the Census tract analysis above was more appropriate.[118]

Naikang Tsao notes the alleged difficulties in focusing on Census tracts:

> "the focus on the census tract as the geographical unit against which siting decisions are measured may be both too broad or too narrow. According to the court, if the plaintiffs had produced evidence showing that even the sites located in the predominantly white census tracts were actually located near black neighborhoods or towns, 'the outcome of this case would be quite different.' The court also suggested that if a proposed site [would] affect an area larger than a census tract, then 'a target area analysis becomes much more persuasive."[119]

B. *East Bibb Twiggs Neighborhood Association v. Macon-Bibb County Planning & Zoning Commission*[120]

Plaintiffs charged a county planning and zoning commission with discrimination in granting approval of a permit for a private landfill. The court ruled that plaintiffs had failed to show discrimina-

113. *Id.*
114. *Id.*
115. *Id.*
116. *Id.*
117. *Id.*
118. *Id.* at 678-79.
119. Naikang Tsao, *Ameliorating Environmental Racism: A Citizen's Guide to Combatting the Discriminatory Siting of Toxic Waste Dumps*, 67 N.Y.U. L. REV. 366, 410 (1992); *see Bean*, 482 F. Supp. at 680.
120. 706 F. Supp. 880 (M.D. Ga.) *aff'd* 896 F.2d 1264 (11th Cir. 1989).

tory impact or intent.[121] Plaintiffs argued that the proposed facility was in a Census tract that was sixty percent African American and that both the existing and proposed facilities were located in a governmental district that was seventy percent African American.[122] The existing facility, however, was in a Census tract that was seventy-six percent white, which led the court to conclude that no pattern of racial discrimination existed.[123]

Collin observes that "[i]n *East Bibb Twiggs* the court relied on the artificial impact of census tracts"[124] and points out that an area defined by the actual physical impact of the facility would have been better.[125] Tsao points out that the court's use of a census tract to define the boundary around an existing waste disposal landfill, led it to rule that a predominantly white community surrounded the landfill.[126] Tsao further notes that the plaintiffs, in contrast, argued that an enlarged area encompassing both the existing site and a proposed waste site was predominantly Black.[127]

Alternative conceptualizations of equity were brought forth in terms of different boundary definitions. Ultimately, the plaintiffs lost because the court rejected their conceptualization of the affected community.

C. *R.I.S.E., Inc. v. Kay*[128]

In *R.I.S.E.*, plaintiff opposed a permit for a proposed landfill near an African American community. While the court found that the placement of landfills in the county had a disproportionate impact on the African American community, the plaintiff had not supplied sufficient evidence to prove that the placement was intentionally discriminatory.[129]

A demographic analysis of the proposed site and three other county landfill sites did not rely upon Census tracts, since African

121. *Id.* at 884; *see also* Collin, *supra* note 102, at 524-27 (discussing how different results can occur by drawing boundaries differently even though the data units are the same).

122. *East Bibb Twiggs*, 706 F. Supp. at 884.

123. *Id.* at 884-85.

124. Collin, *supra* note 102, at 526.

125. *Id.* at 526 n.237 (citing Rachel D. Godsil, *Remedying Environmental Racism*, 90 MICH. L. REV. 394, 413 (1991)).

126. Tsao, *supra* note 118, at 408.

127. *Id.*

128. 768 F. Supp. 1144 (E.D. Va. 1991).

129. *Id.* at 1149 ("official action will not be held unconstitutional solely because it results in a racially disparate impact. Such action violates the Fourteenth Amendment's Equal Protection Clause only if it is intentionally discriminatory.").

Americans were concentrated in much smaller areas around the sites examined.[130] Differences in the geographic areas were expressed as differences in the magnitude of African American populations at various distances from a particular facility, rather than in terms of a particular unit of analysis (i.e., a Census tract, zip code, etc.).[131] In some ways, spatial delineation issues were not as relevant here as in other cases because of the predominance of minority populations so close to the site.[132]

The county population was approximately fifty percent African American and fifty percent white.[133] Within a half-mile radius of the proposed landfill, sixty-four percent of the population was African American.[134] Further, along the 3.2 mile transportation route to the proposed facility, 21 families were African American and 5 were white.[135]

Of the three, then current, landfills in the county, the first one, Mascot landfill, was sited in 1969. When the site was developed, the population within one mile of the site was 100% African American. The site was two miles from an African American church.[136]

The second site, Dahlgren landfill, was sited in 1971. When the facility was built, ninety-five percent of the population within the immediate area was African American. At the time of the *R.I.S.E.* case, ninety to ninety-five percent of the population within a two mile area was African American.[137]

The third site, Owenton landfill, was sited in 1977. When the landfill was first developed, approximately all of the residents living within a half-mile radius of the facility were African American. The site was one mile from an African American church.[138]

A fourth landfill was opened and closed in 1986. The population surrounding this landfill was predominantly white. It was closed due to environmental violations and community opposition.[139]

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130. *See id.* at 1147-48.

131. *See id.*

132. *See id.* at 1142-43. For a general discussion of the background to the case, see Collin, *supra* note 102, at 527-31; Robert W. Collin & William Harris, Sr., *Race and Waste in Two Virginia Communities*, *in* CONFRONTING ENVIRONMENTAL RACISM: VOICES FROM THE GRASSROOTS 95-98 (Robert D. Bullard ed., 1993).

133. *R.I.S.E.*, 768 F. Supp. at 1147.

134. *Id.*; Collin, *supra* note 102, at 529-30.

135. 768 F. Supp. at 1147.

136. *Id.* at 1148.

137. *Id.*

138. *Id.*

139. *Id.*

In summary, the *Bean*, *East Bibb Twiggs*, and *R.I.S.E.* trilogy of cases represent an inconsistent use of boundaries. Considerable variability exists, even within a given case, in the number, location, or size of the units used.[140] Sometimes, as in *R.I.S.E.*, conventional geographic areas are not used because a heavy concentration of minorities in an area proximate to the disputed site argues for dropping boundaries defined by existing data sets. A number of the authors comment that boundaries should instead be defined in terms of risk.[141]

In spite of differences in the use of available data units to describe minority population characteristics, these cases are consistent in demonstrating the contrast between the results obtained using different areas as a basis for determining equity. The difference is usually defined as some percentage, but the extent of difference between the percentages considered as a threshold for what is equitable or inequitable is not specified.

V. Conclusions and Recommendations

A. Selection and Definition of Subpopulations

The way in which race and ethnicity are used to categorize health and environmental data needs to be seriously examined. Race and ethnic classifications are often used to simplify the reporting of data, but may, in fact, be inappropriate surrogates for more complex social attributes that either may not necessarily cluster according to currently used racial and ethnic categories or may hide underlying causative factors for those attributes. Some have argued that the focus of equity analyses should be "class, lifestyle, and socioeconomic status"[142] and their association with health characteristics, rather than, or in addition to, race or ethnicity *per se*. Underlying causative factors, such as discrimination, can then be examined as explanations for these attributes when they are explicitly identified rather than being subsumed under a broader categorization of the data. In the spirit of this argument, a recent workshop on the use of race and ethnicity in public health emphasized that certain categories of race and ethnicity should not be considered as risks in and of themselves, but rather as potential

140. *See, e.g.*, *Bean*, 482 F. Supp. at 677-79.

141. *See* Collin, *supra* note 102, at 526.

142. Osborne & Feit, *supra* note 9, at 276.

indicators of risk factors along with other factors, such as income.[143] The workshop report concluded that

> "race should be viewed within public health surveillance as a sociological phenomenon. Race and ethnicity are not risk factors—they are markers used to better understand risk factors. For instance, homicide disproportionately impacts African American communities; however, when income status is considered, the impact of homicide in African American communities is similar to that in white communities."[144]

A considerable amount of data already exists on health and environmental status categorized by race and ethnicity from which environmental policies are constantly being drawn. At the time data were collected, however, much of the data were not sensitive to potential classification errors. Even more basically, they often did not even identify the sources of the classification so that others could make such determinations. Since the method of assigning race and ethnicity was changed in 1989 for birth and death certificates, data prior to that time period must be scrutinized more carefully than later data.

Given the difficulty and lack of consensus on setting standards or standard procedures for the definition of race and ethnicity, consistency may be more important than the introduction and application of any particular standard. This at least ensures comparability and explicit knowledge of the limitations of what is being measured. If corrections in the assumptions need to be made, then they can be made systematically.

The magnitude of the classification problem must be more clearly assessed. For example, how sensitive are conclusions to the misclassification of racial and ethnic data? On the one hand, Hahn's 1992 data found that the most egregious classification decisions that he studied accounted only for well under one percent of the cases. On the other hand, the classification problems produced very large distortions in the infant mortality rates once inconsistent classifications throughout the system were taken into account. Other reviews have found the classification problem to be very extensive, and when applied to health statistics, the problem may become even more magnified. Now that the issue has surfaced in the

143. Centers for Disease Control and Prevention, U.S. Dep't of Health and Human Servs., *Use of Race and Ethnicity in Public Health Surveillance*, 42 MORBIDITY & MORTALITY WEEKLY REP. vii (June 25, 1993).

144. *Id.*

health literature, the direction has been defined for a more thorough examination of the problem.

B. Spatial Definition

There is no easy way to circumvent the need to spatially define communities in order to explore equity questions. The observations on spatially bounding equity issues, however, point to a number of workable recommendations.

With respect to the selection of a level of aggregation and distance from a potential adverse environmental condition for the analysis of socioeconomic data, the following is suggested:

- Try to analyze data at a number of geographic levels and distances simultaneously. Where benefits and costs are relatively confined geographically and cover the same area, the criteria for choice should include being consistent about the areas receiving the benefits and the costs.[145]
- Keep in mind that the robustness of a finding is a function of the number of times the same conclusion can be drawn at many different geographic levels and distances.
- For any particular situation, there is no substitute for an in-depth field examination of the structure of the community, including those members who may not be located in the area, but frequent it and regard it as their community. Of course, even such field surveys will not come up with a unique boundary for every individual's concept of community, especially if they rely solely on interviews.
- Understand the community issues that are controversial. Different issues often have different spatial delineations.
- Spatial analysis is one of several perspectives on equity issues. Others focus on procedural equity—issues of intent and the extent to which procedures have been followed. Issues of procedural equity rather than distributional equity may be a better focus for the equity debate, even though the two are obviously intertwined.

C. Some Alternative Strategies

The examination of social issues such as environmental equity in a population-based and geographically-based framework lends an important perspective to these issues. Some refinements are neces-

145. *See generally* Greenberg, *supra* note 63.

sary along with explicit recognition of limiting assumptions in order for these techniques to be stronger tools for public policy.

Given the inevitable conceptual difficulties presented above for both racial and ethnic classification and spatial boundary definition, it might be best to emphasize procedural equity, which may not demand the geographic and classification precision in these areas that distributional equity requires.[146] A number of cases that arose out of a concern for distributional equity, have now shifted their focus to procedural equity.

The Brooklyn Navy Yard incinerator, for example, first proposed in the early 1980s, is focusing more on a series of procedural hurdles, even though issues relating to racial and ethnic biases were an original focus of concern.[147] Procedures that have been brought into play in connection with the incinerator include (1) the appropriateness with which historical and archaeological preservation was addressed in the environmental impact statement, (2) compliance with air quality ambient standards, and most recently, (3) the ability of the proposed incinerator to meet new operational standards set by the Clean Air Act Amendments of 1990.

An incinerator proposed in Kettleman City by Waste Management, Inc. is another example of an equity issue that has been challenged on procedural grounds.[148] Farm workers took officials to court, and won on two issues relating to procedural propriety: (1) public notices were only written in English not Spanish, in spite of the fact that the community was largely Hispanic and (2) no environmental impact statement was performed to examine alternatives.[149]

The many faceted debate over what constitutes a minority population, what are the appropriate geographical ranges to consider, and what thresholds constitute an equity problem will unquestionably continue. These factors are often dynamic over time, which adds to the complexity and controversy. Environmental equity is entering a phase in which institutional and management issues are

146. Roger E. Kasperson & Kirstin M. Dow, *Developmental and Geographical Equity in Global Environmental Change. A Framework for Analysis*, 15 EVALUATION REV. 149, 149-71 (1991). Distributional equity applies to outcomes (e.g., waste distribution relative to subpopulations) and procedural equity applies to process (e.g., siting and cleanup).

147. *See In re* S.E.S. Brooklyn Co. L.P., 5th Interim Dec. (New York State Dep't of Envtl. Conservation Sept. 9, 1993).

148. *See* El Pueblo Para el Aire y Agua Limpio v. County of Kings, 22 Envtl. L. Rep. (Envtl. L. Inst.) 20,357 (Cal. App. Dep't Super. Ct. 1991).

149. *Id.*

beginning to evolve, as indicated by the federal executive order. The management process that emerges should incorporate the richness that alternative perspectives to defining equity lend to the environmental equity issue.