HAZARDOUS WASTES, HAZARDOUS MATERIALS AND ENVIRONMENTAL HEALTH INEQUITY

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This paper reviews issues associated with the equity of locating hazardous waste sites and hazardous materials. Reports and case studies indicate that hazardous waste sites and the locations of hazardous materials are disproportionately situated near minority communities, especially African-American communities. This inequitable placement of hazardous waste sites is of concern, since exposure to toxic waste can adversely affect human health.

Proximity to these sites may place these minority communities at higher risk of developing cancers and respiratory, cardiovascular, and neurological diseases, and of incurring increased levels of individual and family stress. The health of persons in minority communities near hazardous waste sites is further compromised by their lack of access to adequate health care.

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3. Key Words: environmental equity, hazardous materials, hazardous wastes.

4. Abbreviations: CERCLA, Comprehensive Environmental Response, Compensation and Liability Act of 1980; EPA, U.S. Environmental Protection Agency; GAO, General Accounting Office; PCB, polychlorinated biphenyl; NPL, National Priorities List.

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The potential health risks borne by racial and ethnic minorities and by low income communities as a consequence of exposure to toxic waste constitutes environmental inequity. In order to decrease the burden of these risks, we recommend developing environmental policies that address environmental inequity; conducting detailed demographic and health studies that assess the impact of exposure to toxic waste on minority populations; and devising educational programs to sensitize professional service providers and prevent exposure by community residents. This paper identifies research needs and opportunities.

INTRODUCTION

In response to the requirements set forth in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (P.L. 96-510), also known as the "Superfund Law," EPA has identified over 1200 hazardous waste sites that pose a significant threat to the environment or to public health, and ranked them in a National Priorities List (NPL) (EPA, 1984). The distribution of the NPL sites varies considerably across major regions of the United States (EPA, 1991b, 1992) (see Figure 1).

The disposal of toxic waste creates a major pollution problem (Clark et al., 1982) and may increase risks to human health (Hoover and Fraumeni, 1975; Neutra, 1983). The problems of communities contaminated with hazardous wastes are increasingly being researched and identified (Edelstein, 1988; Griffith et al., 1989; Unger et al., 1992). Even where legal hazardous waste facilities exist, leakage and consequent health risks to surrounding communities are frequently reported (Hallman and Wandersman, 1989).

Pollution problems and increased health risks are not limited to hazardous waste sites but are also associated with generating, transporting, and disposing of toxic substances. For example, deposition of lead in the soil in many inner city communities may be sufficient to cause permanent health impairment to children who live there (Mielke, 1991).

The potential health risks borne by racial and ethnic minorities and by low income communities as a consequence of proximity to toxic waste and materials constitutes environmental inequity. The purpose of this paper is to review the issue of inequities of location with respect to hazardous waste sites in particular, and selected examples of hazardous materials in general, and to propose steps to clarify and resolve the situation.

ENVIRONMENTAL INEQUITY: HAZARDOUS WASTES IN MINORITY AND LOW INCOME COMMUNITIES

In 1971, the annual report of the Council on Environmental Quality described inequities in the distribution of environmental hazards in the United States (Mohai and Bryant, 1992). More

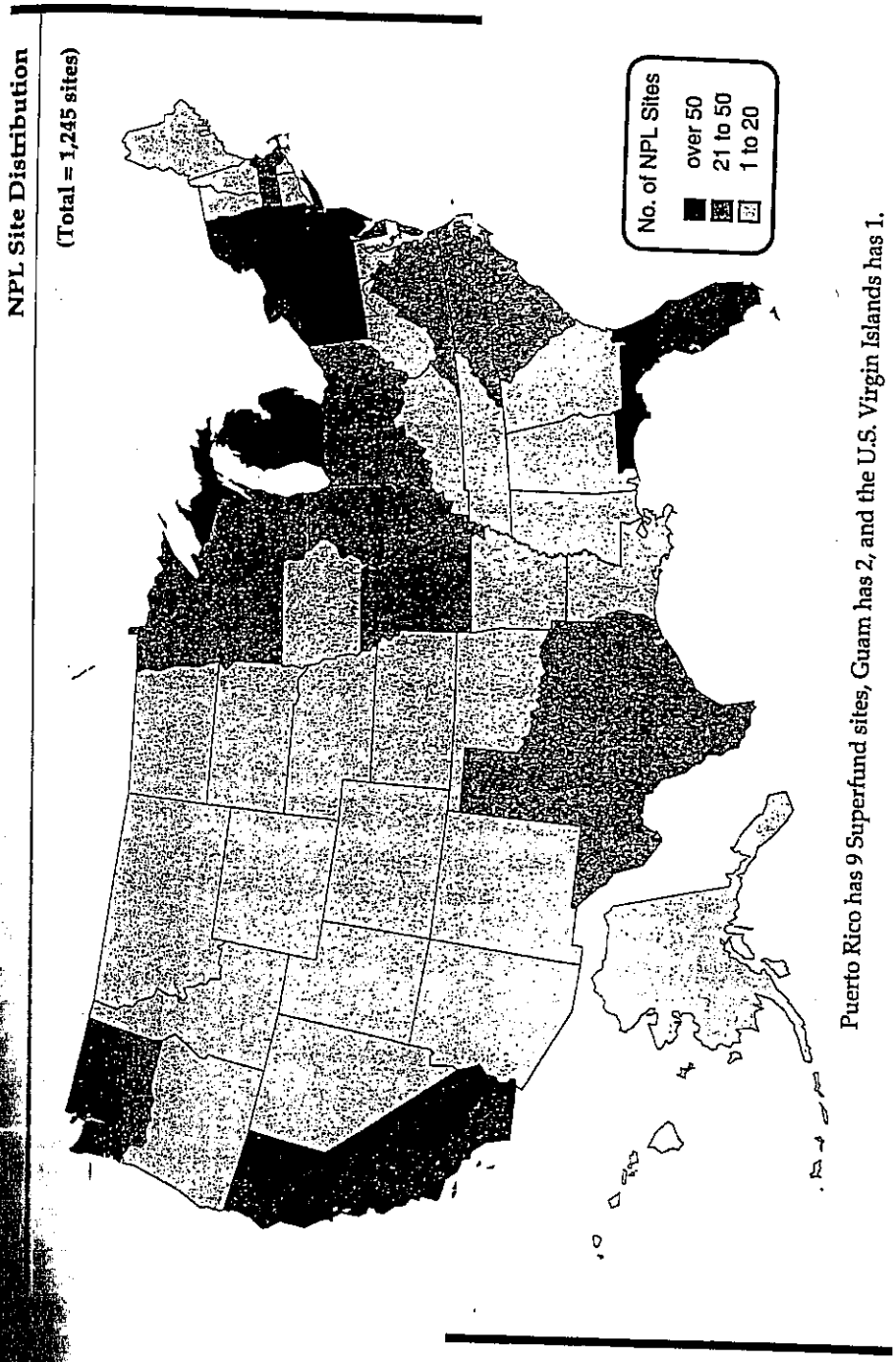

FIGURE 1. Distribution of NPL Sites Across the United States (1992). Source: Superfund Progress—Aficianado's Version.

recently, researchers have documented that hazardous waste sites are disproportionately located near African-American communities and other minorities including Hispanics and Native Americans (Bullard and Wright, 1986, 1987). Several examples are given in the following paragraphs.

The General Accounting Office (GAO) investigated the socioeconomic and racial composition of communities surrounding four hazardous waste landfills in the South. These sites included Chemical Waste Management (Sumter County, Alabama), Industrial Chemical Company (Chester County, South Carolina), SCA Services (Sumter County, South Carolina), and the Warren County PCB Landfill (Warren County, North Carolina). The GAO report found that three of the four landfills were located in communities that were predominantly African-American (U.S. General Accounting Office, 1983).

The United Church of Christ determined that the distribution of commercial hazardous waste facilities in communities in other parts of the United States displayed a pattern similar to that found in the South by GAO (Lee, 1987). Lee found that communities with a commercial hazardous waste facility have, on average, twice as many minority residents as communities without such facilities. In communities where two or more facilities are located, the proportion of minorities is more than triple than that of communities having no hazardous waste facility. In addition, Lee found that race is the single best predictor of where commercial hazardous waste facilities are located, even when other socioeconomic characteristics, such as average household income and average value of homes, are taken into account.

The relationships among race, class, and environmental quality were further explored by Bullard (1990). Bullard's analysis focuses on five African-American communities that are struggling with environmental problems: Houston and Dallas, Texas; Institute, West Virginia; Alsen, Louisiana; and Emelle, Alabama.

In Houston, the black neighborhoods have had to contend with a disproportionately large share of the city's garbage dumps, landfills, incinerators, salvage yards, and a host of other unwanted land uses (Bullard, 1990). Locating solid waste sites in black neighborhoods has heightened animosities between Houston's black community and the white-controlled city government. The black communities of Houston have become the dumping ground for the city's household garbage (Bullard, 1983). From the 1920s to the early 1970s, Houston operated five landfills to dispose of its garbage; all five were located in black neighborhoods. Houston also operated eight garbage incinerators during the same period; six were located in black neighborhoods (Bullard, 1990).

Bullard (1990) also found that hazardous waste landfills and incinerators in South Louisiana's "Cancer Alley" and Alabama's "Blackbelt" are found disproportionately in African-American communities. Further, the nation's largest commercial hazardous waste landfill, which receives wastes for Superfund sites and from all 48 contiguous states, is located in Emelle, Alabama,

where African-Americans make up 90% of the population. In EPA's Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee), where in 1992 African-Americans constituted one-fifth of the population, the Region's two operating commercial hazardous waste landfills were located in areas where African-Americans constituted the majority of the population, as identified by zip codes (Bullard, 1992).

Proximity to hazardous waste sites is not limited to African-American communities. In California, the areas in east Los Angeles and Kettleman City that are primarily inhabited by Latinos have become targets for companies trying to establish hazardous waste incinerators. Kettleman City, a rural community of farm workers, 95% of whose 1,500 residents are Latino, already has a hazardous waste landfill (Bullard, 1992).

Native American lands have also become prime candidates for waste disposal sites because of their unique legal status. More than 36 reservations have been suggested as sites for landfills and incinerators (Bullard, 1992, 1993). The overwhelming poverty of Native Americans and their lack of economic alternatives may be factors involved in selecting these lands for siting hazardous waste facilities (Bullard, 1992, 1993).

Noxious Facilities

Nieves (1992) indicated that minority populations are likely to be exposed to the hazards of noxious facilities. These noxious facilities include chemical manufacturing plants, petroleum production and refining facilities, smelters, incinerators, and hazardous waste disposal sites. In a second study, Nieves and Nieves (1992) examined the relationship between the density of minority populations and the density of hazardous waste facilities for the following three categories of noxious facilities: production, energy, and disposal facilities. County-level data were used in a correlation analysis for populations of African-Americans, Hispanics, and Asians in the four major regions of the United States (West, North Central, Northeast, and South). Even when income and housing value were controlled, and when the data set was limited to urban areas, consistent patterns of moderate to strong association of facility densities with percentages of minority populations were found. In all but two cases, the percentage of minority population in counties with noxious facilities was significantly higher than that in counties without these facilities.

Nieves and Nieves (1992) used regression analysis to examine the association between minority population concentrations and the density of environmental hazards, holding economic factors constant. Economic indicators (e.g., percentage of families below the poverty line, median household income, and median value of owner occupied housing) were used to control for factors besides racial/ethnic characteristics that might vary with the density of environmental hazards. These regressions were calculated for each facility type for the United States and for urban areas as a whole, and for each of the four regions. The relationships between minority concentration and facility density were found to vary considerably by facility type and region, but the percentage of African-Americans was directly

and significantly related to total facility density in all regions but the South (Nieves and Nieves, 1992).

Community Drinking Water

Ground water provides 50% of the drinking water in the United States and is reported to be the primary source of human exposure to chemical pollutants (Maugh, 1982). EPA has reported that 40% of NPL sites have released hazardous substances to surface water (EPA, 1991b) and that 74% of these hazardous waste sites have contaminated ground water with heavy metals and organic solvents (EPA, 1984, 1991b).

There are examples of chemical wastes leaching from disposal sites into community water supplies or contributing to air pollution. Private water supplies were contaminated by trichloroethylene from a hazardous waste site in Londonderry Township, Pennsylvania (Logue et al., 1985). In Hardeman County, Tennessee, organic solvents, including carbon tetrachloride, benzene, chloroform, and toluene, migrated from the hazardous waste site via ground water to nearby private drinking water wells (Clark et al., 1982; Harris et al., 1984). An environmental health survey of the area was conducted to determine whether any adverse health effects were associated with the consumption of water from these contaminated wells (Clark et al., 1982; Harris et al., 1984). The survey consisted of a health questionnaire, a clinical examination, and biochemical screening. The results revealed elevated concentrations of serum enzymes, alkaline phosphatase, serum glutamic oxaloacetic transaminase, and slight hepatomegaly. All these symptoms are indicative of subclinical and transitory liver injury.

Lead Dust Contaminated Communities

Many products contain hazardous materials and when these products are used or deteriorate, they release the hazardous materials into the environment. No element is better documented than lead. The use of lead in paint and gasoline has caused major problems in urban environments. In a case study of the pattern of lead dust concentrations in urban soils, Mielke (1993) describes and compares the results of soil lead surveys conducted in five cities of Minnesota and six cities of Louisiana. The results of the studies were stratified by city. The results show a major peak of lead concentration in inner city soils (the highest lead dust concentrations were found in Minneapolis, St. Paul and New Orleans), with an exponential decline toward the outskirts of each city. The fact that urban soils have high concentrations of lead dust may be the underlying explanation for the high prevalence of elevated blood lead levels found in inner city African-American children (Mielke and Adams, 1989; Mielke et al., 1989; Mielke, 1993). The prevalence of excessive exposure within inner cities are probably higher than previously estimated (Blumenthal et al., 1991).

One of the largest difficulties for most hazardous materials is measuring exposure and determining health outcomes as a result of low levels of exposure. However, in the case of lead there is a well established biomarker. Unequivocal evidence links lead with health effects (Sexton, 1992). All groups of children suffer from excessive lead exposure, but black children

are disproportionately exposed. Before they enter the first grade, more than half of poor black children in the United States have blood lead levels recognized to be in the range which cause neurotoxic effects (Blumenthal et al., 1991; Needleman, 1991). Children with elevated blood lead levels have lower IQ scores and are more distracted, disorganized, and hyperactive than children with low blood levels (Needleman and Gatsonis, 1990). Lead mining and use has been so common that many communities are at risk. Lead in soil was sufficiently high in a predominantly Hispanic community in Colorado, that it resulted in a public health advisory by the Agency for Toxic Substance and Disease Registry (Harris and Williams, 1992).

HEALTH STATUS AND ENVIRONMENTAL HEALTH EFFECTS IN MINORITY AND LOW INCOME COMMUNITIES

Recent reports document substantial disparities in the health of blacks compared to that of other Americans (Byrd, 1990). African-Americans continue to experience poorer health outcomes than any other racial or ethnic group in the United States (U.S. Department of Health and Human Services, 1985a,b, 1989).

Poor health status and lack of access to adequate health care may contribute significantly to the impact of environmental contamination on minority communities. By using a comprehensive environmental health database derived from an extensive literature search, Harris and Williams (1992) confirmed the paucity of information that specifically links preexisting health factors with increased risk to environmental contamination. Preexisting health factors include respiratory diseases such as asthma, cardiovascular diseases such as hypertension, as well as sickle cell anemia.

Cancer

Racial differences in cancer incidences between black and white populations have been investigated in a number of studies (Swanson and Young, 1983; Swanson et al., 1985). Satariano and Swanson (1988) reported that racial differences in age-specific incidence rates for many forms of cancer are more pronounced, especially for males, when cancer occurs in early adulthood (ages 20 to 44) and in middle age (ages 45 to 54) than when cancer occurs in persons aged 65 and over. This finding suggests that blacks and whites who develop cancer in their senior years have more similar exposure or host susceptibility than blacks and whites for whom cancer occurs in early adulthood or middle age (Satariano and Swanson, 1988).

Satariano and Swanson also found that African-Americans are at elevated risk for cancer of the esophagus, stomach, and prostate. Although many etiologic factors may be responsible for the increased incidence of cancer of the esophagus and stomach in African-Americans, environmental pollutants may play an important role in the prevalence of these types of cancer (Griffith et al., 1989). Previous studies have linked cancers of the bladder, stomach, large intestine, and rectum to proximity to hazardous waste disposal sites (Budnick et al., 1984; Najem et al., 1985). Recently, Goldman (1991) reported that age-adjusted mortality rates for

specific lung and gastrointestinal cancers, which may be related to environmental exposures, were substantially higher for minorities, especially African-Americans.

Haan and associates (1987) suggested that socioeconomic status and poverty may explain black/white differences in total mortality and cancer mortality. However, Polednak (1990) reported that observed numbers of total and cancer deaths in a higher income black community in New York (Suffolk County) were still significantly greater than expected on the basis of death rates among American whites. On the basis of age-specific and gender-specific death rates for whites in the United States, the total death rates from all causes, as well as cancer death rates of black men and women in Suffolk County, were higher than expected. These higher than expected rates may be due to early life and occupational exposure to hazardous substances.

Respiratory Diseases

Respiratory diseases related to environmental contamination (such as asthma) are also more prevalent in African-Americans. Weitzman and associates (1990) analyzed data from the Child Health Supplement to the 1981 National Health Interview Survey to determine whether racial and socioeconomic differences influenced rates of childhood asthma. In this sample of 15,416 children, black children were almost twice as likely to have asthma as white children (4.4% versus 2.5%). Racial disparities in prevalence emerged between the ages of 1 and 3 years and were apparent in all age groups. The authors concluded that black and poor children in the United States have higher rates of asthma, that social and environmental factors exert substantial influences on rates of asthma, and that much of the disparity in prevalence can be accounted for by social and environmental characteristics.

Community Stress

Minority communities living near hazardous waste sites are not only at high risk of developing cancers and of manifesting respiratory, cardiovascular, and neurologic diseases, but are also subjected to individual and family stress (Unger et al., 1992). Individuals in these communities may experience feelings of depression, helplessness, a lack of control over their environment, more family quarrels, and worries about their health and the health of their children (Edelstein, 1988).

SUMMARY AND CONCLUSIONS

Hazardous waste sites and hazardous materials create a major pollution problem and potential for increased health risks to human beings. Soil, water, and air are the major routes of hazardous material exposure to all communities. Various reports and case studies have indicated that minority communities are disproportionately exposed to hazardous materials. In particular, hazardous waste sites are more likely to be located near African-American communities, as well as Hispanic, Asian, and Native American communities.

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RECOMMENDATIONS

In order to decrease the burden of environmental risks on racial minorities and low-income communities, we recommend that the following issues of environmental equity be addressed:

- Environmental policies need to be reviewed and analyzed to address issues of environmental equity. Procedures for issuing permits for pending hazardous materials production and waste facilities need to be evaluated to determine whether race and socioeconomic factors are being properly considered. Recommendations included in the EPA Environmental Equity report should be incorporated into all decisions for siting hazardous facilities and waste. A survey of the different EPA regions should be conducted in order to assess whether there are regional differences in locating hazardous facilities near minority communities.

- Extensive epidemiologic studies are needed to evaluate the full extent of the impact of hazardous materials on various minority communities. More studies are needed to assess the magnitude of any adverse health effects associated with hazardous materials, polluted air and ground water, and contaminated soil. These studies should be designed to ensure the collection and analysis of the data by income and race.

- There is a need to expand on research to develop biomarkers for early detection and screening. These biomarkers could then be used to screen minority populations living near sources of hazardous materials.

- Problem areas where minorities are disproportionately exposed to environmental hazards should be identified, and corrective remedial steps and mitigation procedures should be implemented.

- Steps should be taken to prevent low-income housing from being built near hazardous waste sites, industrial sites, or otherwise environmentally undesirable areas.

- An effective outreach program should be organized to assist in achieving environmental equity. This outreach program should provide a technical support system for data analyses of demographic and epidemiologic studies, link universities with environmental agencies, and establish environmental equity centers. The environmental equity centers should be located in minority communities living in proximity of hazardous waste sites or other sources of hazardous materials. The centers should include representatives from local and federal regulatory agencies (such as EPA), environmental health scientists as well as community leaders.

- Efforts should be made to increase the number of minority scientists involved in environmental research and to train minority health care providers in environmental health.

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