

Running the Numbers

*A Periodic Feature to Inform North Carolina Health Care Professionals
About Current Topics in Health Statistics*

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Demographic Characteristics of Individuals Residing Near Hazardous Waste Sites in North Carolina

Concerns over the potential adverse health effects posed by hazardous waste sites date back several decades, and events such as those as Times Beach, Missouri, and Love Canal, New York, propelled the issue to national importance. These concerns led to the enactment of several major pieces of legislation in the 1970s and 1980s. In 1976, the Resource Conservation and Recovery Act was passed to regulate the generation, management and disposal of hazardous waste. In 1980, Congress passed the Comprehensive Environmental Response Compensation and Liability Act to begin clean up of the most dangerous of these sites, many of which had been abandoned. The Superfund Amendments and Reauthorization Act was passed in 1986, providing additional funds for site remediation and increasing the involvement of local and state partners in prioritization and clean-up efforts. Through this legislation, the Environmental Protection Agency is required to create an inventory of all hazardous waste sites and to develop and maintain a list of abandoned sites—known as National Priority List (NPL) or “Superfund” sites—believed to be most hazardous to human health. There are approximately 1,290 NPL sites in the United States, 36 of which are in North Carolina [1].

The possible health effects of hazardous waste sites have been widely studied. Although some evidence suggests they may pose a potential threat to public health, the findings are equivocal [2]. Hazardous waste sites have been linked, although not consistently, to a wide variety of adverse health outcomes, including cancer [3], congenital malformations [4-6], respiratory disease [7], and diabetes [8]. One of the chief limitations of the research to date concerns the lack of adequate characterization of human exposure, including limited knowledge of specific toxins at a given site, uncertainty about the route and intensity of exposure, and poor understanding of the toxicologic mechanisms of action. Although advanced methods such as pollutant dispersion modeling are promising, the bulk of the research focus has been, and continues to be, on simple methods based on distance, such as residential proximity to waste sites. This has led to considerable interest, concern, and controversy about the demographic characteristics of populations residing near hazardous waste sites [9, 10]. Presented here is a description of the population characteristics of communities located near hazardous waste sites in North Carolina.

By use of a geographic information system, NPL sites in North Carolina were located, and buffers of 1 and 4 miles were created around them. The buffers were then overlaid with census block group information. From this overlay, the percentage of the area in each block group was obtained, and the demographic variables were adjusted proportionally. The results are an area-weighted estimate of the population’s characteristics (Figure 1, available only in the online edition of the NCMJ). This method assumes that the population is evenly distributed throughout a block group. The 2010 Census Public Law File was used for the population estimates.

FIGURE 1.
National Priority List (NPL) Sites in North Carolina, May 2011

This figure is available in its entirety in the
online edition of the NCMJ.

Note: Data are from [11, 12] and the Environmental Protection Agency (unpublished).

TABLE 1.
Race/Ethnicity and Age of North Carolina Residents Living Within 1 and 4 Miles
of a National Priority List Site

Characteristic	Overall	≤1 mile	≤4 miles
Race/ethnicity			
1 race			
Any	9,329,284 (100)	79,423 (0.85)	953,766 (10.2)
White	6,528,950 (100)	51,029 (0.78)	643,273 (9.85)
African American	2,048,628 (100)	20,528 (1.00)	230,728 (11.3)
Native American	122,110 (100)	558 (0.46)	5,992 (4.91)
Asian	208,962 (100)	2,765 (1.32)	35,710 (17.1)
Pacific Islander	6,604 (100)	105 (1.59)	1,226 (18.6)
Other	414,030 (100)	4,385 (1.06)	36,778 (8.88)
Hispanic/Latino ^a	800,120 (100)	9,230 (1.15)	82,740 (10.3)
Age			
<18 years	2,281,635 (100)	20,764 (0.91)	228,763 (10.0)
≥18 years	7,253,848 (100)	61,212 (0.84)	752,450 (10.4)
Total	9,535,483 (100)	81,976 (0.86)	981,213 (10.3)

Note. Data are from [11] and indicate no. (%) of individuals living within the specified distance.

^aMay include individuals in the categories above

Table 1 shows the race/ethnicity and age characteristics of individuals living within 1 mile and 4 miles of NPL sites in North Carolina. Less than 1% of North Carolina residents live within 1 mile of an NPL site, and approximately 10% live within 4 miles. Asian and Pacific Islanders composed the ethnic groups with the largest percentage of individuals living near NPL sites, whereas Native Americans composed the group with the smallest percentage. There was little difference among whites, African American, and Hispanics with respect to the percentage living near NPL sites. There was little difference in the age distribution of persons living near NPL sites; the percentages of persons younger than 18 years and 18 years or older who were living within 1 mile and 4 miles of an NPL were similar to those of the total population. Table 2 shows the proportion of North Carolina census block groups, stratified by income level, within 1 and 4 miles of an NPL site. There was no consistent trend in the relationship between income level and proximity to NPL sites.

Approximately 10% of North Carolina residents reside within 4 miles of a hazardous waste site listed on the NPL. Despite previous concerns that a disproportionate percentage of minorities and socioeconomically disadvantaged populations live near such sites, these findings suggest that residential proximity to NPL sites does not vary substantially by race/ethnicity or income level. The potential adverse health effects among persons residing near hazardous waste sites remains unclear, and effective evaluation of such risks presents a complex and expensive challenge. Given the current scarcity of resources, priorities might be better placed on site containment and remediation, rather than on continued health risk assessments of these potential public health hazards. NCMJ

TABLE 2.
US Census Block Groups (CBGs) Within 1 and 4 Miles of a National Priority List
Site, by CBG Income Level

Income	Overall	≤1 mile	≤4 miles
\$0-\$19,500	2,294 (100)	79 (3.44)	282 (12.3)
\$19,501-\$30,000	2,030 (100)	65 (3.20)	314 (15.5)
\$30,001-\$55,000	823 (100)	29/823 (3.52)	166 (20.2)
>\$55,000	119 (100)	0	17 (14.3)

Note. Data are from [12] and indicate no. (%) of CBGs within the specified distance.

References

1. Superfund. Environmental Protection Agency Web site. <http://www.epa.gov/superfund/index.htm>. Accessed May 6, 2011
2. Johnson BL, DeRosa C. The toxicological hazard of superfund hazardous waste sites. *Rev Environ Health*. 1997;12(4):235-251.
3. Russi MB, Borak JB, Cullen MR. An examination of cancer epidemiology studies among populations living close to toxic waste sites. *Environ Health*. 2008;7:32.
4. Brender JD, Zhan FB, Suarez L, Longlois PH, Moody K. Maternal residential proximity to waste sites and industrial facilities and oral clefts in offspring. *J Occup Environ Med*. 2006;48(6):565-572.
5. Suarez L, et al. Maternal exposures to hazardous waste sites and industrial facilities and risk of neural tube defects in offspring. *Ann Epidemiol*. 2007;17(10):772-777.
6. Langlois PH, et al. Maternal residential proximity to waste sites and industrial facilities and conotruncal heart defects in offspring. *Paediatr Perinat Epidemiol*. 2009;23(4):321-331.
7. Ma J, Kouznetsova M, Lessner L, Carpenter DO. Asthma and infectious respiratory diseases in children—correlation to residence near hazardous waste sites. *Paediatr Respir Rev*. 2007;8(4):292-298.
8. Kouznetsova M, Huang X, Ma J, Lessner L, Carpenter DO. Increased rate of hospitalization for diabetes and residential proximity of hazardous waste sites. *Environ Health Perspect*. 2007;115(1):75-79.
9. Brown P. Race, class, and environmental health: a review and systematization of the literature. *Environ Res*. 1995;69:15-30.
10. Anderson DL, Oakes JM, Egan KL. Environmental equity in Superfund: demographics of the discovery and prioritization of abandoned toxic sites. *Eval Rev*. 1997;21:3-26.
11. US Census Bureau. 2010 Census Redistricting Data (Public Law 94-171) Summary File—North Carolina [machine-readable files]. Washington, DC: US Census Bureau; 2011.
12. US Census Bureau. 2010 Census American Community Survey (2005-2009 ACS SF) Summary File—North Carolina [machine-readable files]. Washington, DC: US Census Bureau; 2011.

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