Contaminated Lands

Accidents, spills, leaks, and improper disposal and handling of hazardous materials and wastes have resulted in tens of thousands of contaminated sites across the United States. The nature of the contaminants and the hazards they present vary greatly from site to site. These contaminants include industrial solvents, petroleum products, metals, residuals from manufacturing processes, pesticides, and radiological materials, as well as certain naturally occurring substances such as asbestos. Contaminated lands can threaten human health and the environment, in addition to hampering economic growth and the vitality of local communities.

The presence of contaminated soils in a particular location may or may not have health consequences. Soils, unlike air and water, are not intentionally inhaled, absorbed, or ingested. Contaminants diffuse more slowly through soil than through air or water, so contaminants are rarely distributed uniformly across a contaminated site. Soils are a concern if children are playing, attending school, or residing on or near to contaminated land. People and pets may track contaminated soils and dusts into homes where infants and toddlers are playing. Some contaminants may harm or penetrate the skin, and by touching or playing in soil children may come into direct contact with them. Children may ingest soils through hand-to-mouth play or by eating without first washing their hands after having touched contaminated soil. Soil dust may be carried on the wind and inhaled into the lungs, where it can be very damaging. The optimal approach to minimizing risks to children from contaminated soils is to prevent these exposures.

In addition, contaminated land may contribute to pollution of ground water, surface water, ambient air, and foods, creating additional potential human exposure routes. For example, consumption of fish caught at or near a contaminated site may increase risk of exposure to contaminants from the site. The same is true of drinking water from contaminated ground- or surface water sources. When drinking water sources are affected at EPA-tracked contaminated sites, an alternate water supply may need to be provided, in some cases permanently.

Cleanup of contaminated lands may be conducted by EPA, other federal agencies, states, tribes, municipalities, or the party responsible for the contamination. As of September 2011, EPA's programs for assessing and cleaning up contaminated lands track roughly 22 million acres of land across the United States, or nearly 1% of the entire U.S. land mass.[1] EPA and its partners conduct work on contaminated lands through federally mandated programs such as the Superfund and Corrective Action programs. The Superfund program, implemented under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), aims to clean up some of the most hazardous and highly polluted inactive commercial, industrial, and residential properties in the country. The Corrective Action program, implemented under the Resource Conservation and Recovery Act (RCRA), aims to control and clean up releases at operating hazardous waste treatment, storage, and disposal facilities. EPA is also responsible for other programs that focus on management of contaminated lands, including Brownfields, underground storage tanks, and RCRA waste management and minimization programs.

EPA prioritizes sites for cleanup using information from initial investigations regarding possible threats to human health or the environment. EPA's primary concern is to protect people from the most contaminated lands and to clean up these sites to a standard that is protective, and that state, local, or tribal governments and communities deem appropriate based on the future uses of the individual site. EPA and partner agencies work to contain possible routes for exposure as soon as possible.[2,3]

When a potential pathway for exposure is identified, a process is normally initiated for the pathway to be minimized or eliminated. For Superfund sites and for hazardous waste facilities requiring Corrective Action, EPA or authorized state regulators assess contaminated media, exposure pathways, risks from complete pathways, and the significance of any risks. If no significant human health risks are identified, a determination is made that the site has all human health protective measures in place. If significant human health risks are or may be present, regulators choose site-specific controls (e.g., fencing, caps, containment walls) and cleanup activities (e.g., excavation, groundwater treatment) necessary to reduce the risks.

If additional contamination or previously unrecognized pathways of exposure are identified, a site that is designated as having all human health protective measures in place may lose that designation until pathways of exposure are controlled.

When a site is designated as having all human health protective measures in place, known pathways of exposure have been controlled, although additional cleanup work may remain. These sites pose a reduced risk to children compared with most sites that have not yet been designated as having all human health protective measures in place. However, there can be a number of reasons why a site has not yet achieved that designation. For example, some sites have not yet been adequately assessed, and it is thus unknown whether these sites pose significant risk to human health.

This approach to managing potential exposures is based on identified presence of contaminants and potential exposure pathways because there is often an absence of information identifying actual children's exposures; however, there are notable exceptions where EPA and other federal and state agencies have addressed documented exposures.[4-10]

Children who have been exposed to contaminants do not all experience the same health outcomes. The magnitude and duration of an exposure, the pathway of exposure (ingestion, inhalation, dermal), the stage of development at which a child is exposed, and differences in genetic susceptibility all influence the variation in outcome from exposure. Even after exposure characteristics and genetic factors have been taken into consideration, variation remains in risks experienced by different individuals and different communities as a consequence of exposures to contaminants. This variation may in part be explained through socio–cultural and socioeconomic factors that have been associated with physical and psychological health, including family income, unemployment, nutrition, education, housing and infrastructure, race, gender, class, access to health services, social cohesion, participation in local decision-making, exercise, and health-related behaviors (e.g., smoking, drug abuse).[11-22]

Of the many sociological determinants of health, the relationships between race/ethnicity and health status and between lower levels of income and less optimal health are among the most documented.[23-26] Because these factors are related to many of the other sociological determinants, they are frequently used as proxies for a larger set of factors. For these reasons, the following indicators of children living in proximity to contaminated lands focus on differences by race/ethnicity and family income level.

Indicator E10: Percentage of children ages 0-17 years living within one mile of Superfund and Corrective Action sites that may not have all human health protective measures in place, 2009

Indicator E11: Distribution by race/ethnicity and family income of children living near selected contaminated lands in 2009, compared with the distribution by race/ethnicity and income of children in the general U.S. population

About the Indicators: Indicators E10 and E11 present information about children living within one mile of Superfund sites or RCRA Corrective Action sites that may not have had all human health protective measures in place as of October 1, 2009. Site boundaries were estimated and a computer mapping tool was used to identify all land areas within one mile of each of these sites. Data from the 2000 U.S. Census were then used to estimate the population of children living within these areas. Indicator E10 provides information about U.S. children living within one mile of these selected sites, including the percentage of children in proximity by race, ethnicity, and family income. Indicator E11 compares the race/ethnicity profile of children living within one mile of these selected sites with the profile for all children living in the United States.

Corrective Action and Superfund Sites

EPA's Office of Solid Waste and Emergency Response manages the RCRA Corrective Action Program and the Superfund Program, and maintains inventories of sites in each program. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database provides information on Superfund sites, and the Resource Conservation and Recovery Act Information (RCRAInfo) database provides information on RCRA Corrective Action sites. As of October 1, 2009 there were 1,653 Corrective Action and Superfund sites, totaling more than 10 million acres, that may not have had all human health protective measures in place.[3] Of the 3,746 Corrective Action sites at that time, 1,297 fell into this category. Of the 1,727 Superfund sites (which includes both sites that are on the National Priorities List and sites that are not on the NPL but for which the Superfund program has some responsibilities), a total of 356 fell into this category. The location and extent of each site are characterized by the latitude and longitude of a single point within that site, and the area (total acres) of the site, obtained from the official documentation for each site.[i] A map displaying the distribution of these sites across the country and their prevalence in urbanized areas is available in the Methods document for this topic (available at www.epa.gov/ace).

Some of the largest sites that EPA oversees are federal facilities. Among the sites that may not have had all human health protective measures in place in 2009, 47 Corrective Action sites and 62 Superfund sites are federal facilities.

[i] Actual boundaries of the sites are available in digital form for only a few sites.

Estimating Site Areas and Children's Proximity

For purposes of indicator calculation, the actual land area within each site was approximated using the latitude/longitude and acreage information. A circle whose area equaled the site's acreage was drawn around each site's latitude/longitude identification point. It is important to note that these areas are not the actual site boundaries, and are not expected to reflect the actual area of contamination. Contamination will likely be determined by factors such as the release of waste, the contours of the land, and groundwater flow. Sites also have hotspots (areas with high levels of contamination) and areas that have been remediated or were never contaminated. The site boundaries are therefore likely to overestimate the area of a site that is contaminated. Nonetheless, approximating the area of a site with a circle is a reasonable assumption that provides the best available information for this analysis.

To identify land areas in proximity to the selected contaminated lands, a one-mile buffer was drawn around the circle representing each site. Data on total child population, and population by race and ethnicity, were collected from the 2000 Census for children living in Census blocks whose center point was within the one-mile buffer boundary. Information on family income levels (percentage above and below poverty level, by race and ethnicity) was extrapolated for these blocks from Census block group data. Data from the 2000 census were used in order to obtain necessary population race/ethnicity and income statistics at the local level; this information is not available in the 2009 census estimates.[ii]

Data Presented in the Indicators

Each indicator presents a characterization of the population of children living within one mile of Superfund or RCRA Corrective Action sites that may not have had all human health protective measures in place as of October 1, 2009. Indicator E10 shows the percentage of children living within one mile of a site, by race/ethnicity and family income. Indicator E11 shows the proportion of children of each race and ethnicity among those living in proximity to the selected sites, compared with the race/ethnicity proportions among all children in the United States. This comparison is also made for children living in homes with incomes below poverty level. Tables of values for these indicators at the state level are available in the Appendix to this document.

Data for seven race/ethnicity groups are presented in the indicators: White, Black, Asian, American Indian or Alaska Native (AIAN), Native Hawaiian or Other Pacific Islander (NHOPI), All Other Races, and Hispanic. The "All Other Races" category includes all other races not specified, together with those individuals who report more than one race. Children of Hispanic ethnicity may be of any race. Data presented by race do not include any designation of ethnicity; for example, the indicator value labeled "Black" includes both Hispanic and non-Hispanic Black children, and children who are Black and Hispanic are included in the indicator values for both

[ii] A greater percentage of children were living in poverty in 2009 than in 2000; therefore, these calculations will understate the proportion of children below poverty living in proximity to the selected contaminated lands in 2009.

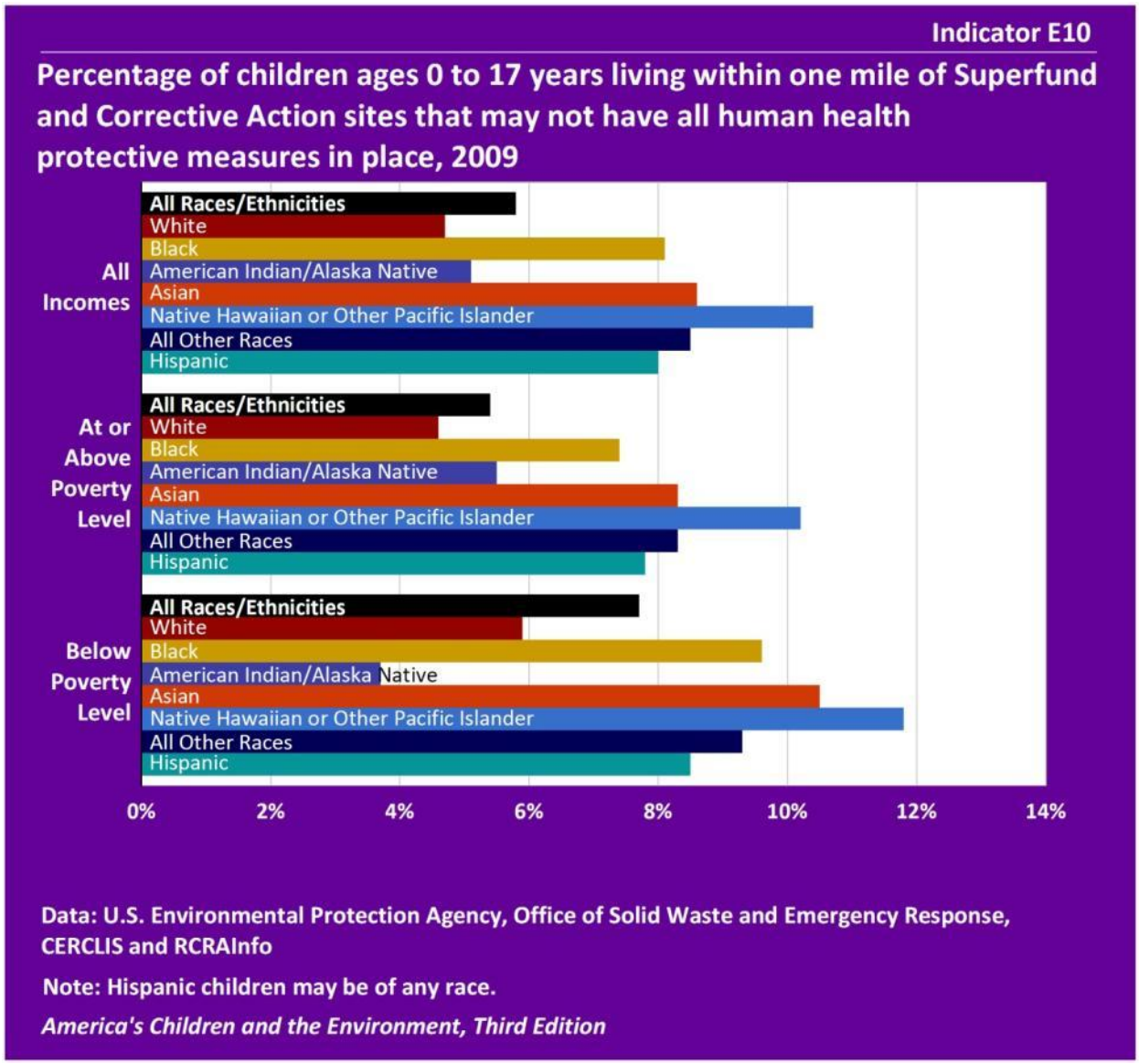
"Black" and "Hispanic" children. Three family income categories are presented in the indicators: all incomes, below the poverty level, and greater than or equal to the poverty level.

Designation of sites that may not have all human health protective measures in place were made for the first time in 2009; trend data are not reported because these designations were not analyzed for purposes of this report in earlier years.[iii]

For purposes of these indicators, proximity to a site is used as a surrogate for potential exposure to contaminants found at these sites. The indicators do not imply any specific relationship between childhood illness and a child's proximity to a Superfund or Corrective Action site. Information on amounts of environmental contamination, which would be a source of exposure to children, is generally available for these sites, but information on the extent to which children are actually exposed is not generally available. Because of the ways in which children can be exposed to land contaminants and the potential for certain contaminants to move into groundwater or to vaporize through soil, the proximity to contaminated sites may increase the potential for exposure and the possible health consequences, but proximity to a site does not mean that there will always be exposure. Nor does proximity to a site represent risks of adverse health effects. The risk of exposure posed to children varies significantly across all the different types of contaminated sites and the different activities of children on or near the sites. Many sites do not pose risks outside of property boundaries.

These indicators present a high-end approximation of children at risk from the Corrective Action and Superfund sites that may not have all human health protective measures in place, but do not include children near the much larger universe of Brownfield sites, leaking underground storage tanks, and sites addressed solely by state, tribal, and local authorities or private companies. While the indicators include those RCRA Corrective Action sites assumed to have the most potential for contamination, these sites represent only a subset of waste treatment, storage, or disposal facilities currently regulated by EPA. The indicators also do not capture the proportion of children living near contaminated sites that are yet to be identified. Access to uncontrolled contamination remains the greatest risk of potential exposure, and risks are most likely to have been greatest prior to intervention by EPA and partner agencies. The ultimate cleanup of these sites best assures reduced health risks for children by eliminating the possibility of exposure and promotes the health of their communities since cleanup opens the way for sustainable redevelopment and revitalization opportunities.

[iii] These data cannot be compared to Indicator E9 from previous editions of *America's Children and the Environment*. Previous versions considered only Superfund sites; represented each site as a single point, rather than an area; and did not consider the status of human health protective measures put in place at the sites.



Data characterization

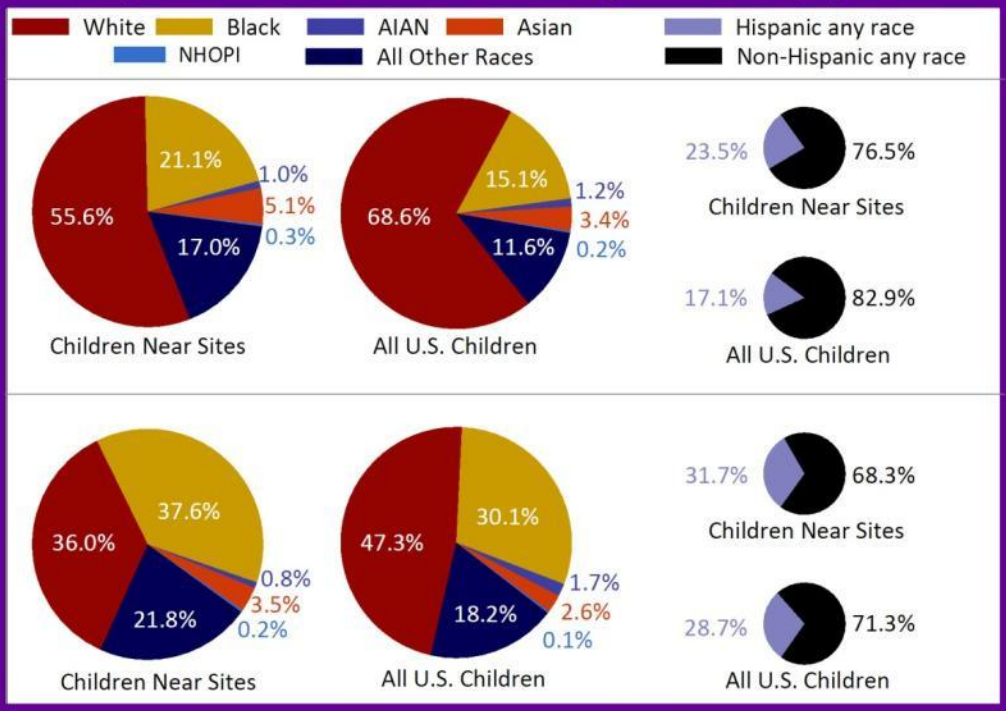
- Data on Superfund and RCRA Corrective Action sites are reported by EPA regional offices and states, and compiled in EPA's databases of information on contaminated sites.
- Information for each site includes the site name, state in which the site is located, latitude, longitude, estimated acreage, and site status.
- Areas of known or suspected contamination may be less than the total acreage at each site.

- Approximately 6% of all children in the United States lived within one mile of a Corrective Action or Superfund site that may not have had all human health protective measures in place as of 2009.

- About 8% of Black children, 9% of Asian children, 9% of children of "All Other Races," and 10% of Native Hawaiian and Other Pacific Islander (NHOPI) children lived in proximity to the designated sites. About 8% of Hispanic children, who may be of any race, lived in proximity to the sites. In contrast, about 5% of White children and 5% of American Indian/Alaska Native children lived in proximity to the designated sites.
- About 8% of all children in the United States in families with incomes below the poverty level lived within one mile of the designated sites, compared with about 5% of children above the poverty level. The proportion of children below the poverty level in proximity to the designated sites was generally greater than the proportion for those above poverty level for each race and ethnicity; the only exception to this pattern was for American Indian and Alaskan Native (AIAN) children.

Indicator E11

Distribution by race/ethnicity and family income of children living near selected contaminated lands* in 2009, compared with the distribution by race/ethnicity and income of children in the general U.S. population



Data: U.S. EPA, Office of Solid Waste and Emergency Response, CERCLIS and RCRAInfo

Note: AIAN = American Indian/Alaska Native. NHOPI = Native Hawaiian or Other Pacific Islander. Hispanic children may be of any race.

* Within one mile of Superfund and Corrective Action sites that may not have all human health protective measures in place.

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Data characterization

- Data on Superfund and RCRA Corrective Action sites are reported by EPA regional offices and states, and compiled in EPA's databases of information on contaminated sites.
- Information for each site includes the site name, state in which the site is located, latitude, longitude, estimated acreage, and site status.
- Areas of known or suspected contamination may be less than the total acreage at each site.

- Approximately 21% of all children living within one mile of a Corrective Action or Superfund site that may not have had all human health protective measures in place were Black, while 15% of children in the United States as a whole are Black. Black children account for about 30% of all U.S. children in homes below poverty level; among children below poverty level living within one mile of a designated site, about 38% were Black.

- The percentages of Asian children, Hispanic children, and children of "All Other Races" among children living close to the designated sites were also greater than the percentages of these children in the entire U.S. population, considering all incomes and considering only those in homes with incomes below poverty level.

Environments and Contaminants

Contaminated Lands

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Contaminated Lands

Table E10: Percentage of children ages 0 to 17 years living within one mile of Superfund and Corrective Action sites that may not have all human health protective measures in place, 2009

Race / Ethnicity	All Incomes	< Poverty Level	≥ Poverty Level
All Races/Ethnicities	5.8	7.7	5.4
White	4.7	5.9	4.6
Black	8.1	9.6	7.4
American Indian/Alaska Native	5.1	3.7	5.5
Asian	8.6	10.5	8.3
Native Hawaiian or Other Pacific Islander	10.4	11.8	10.2
Hispanic	8.0	8.5	7.8
All Other Races†	8.5	9.3	8.3

DATA: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, CERCLIS, and RCRAInfo

NOTE: Race categories include children of Hispanic ethnicity. Hispanic children may be of any race.

† The "All Other Races" category includes all other races not specified, together with those individuals who report more than one race.

Table E11: Distribution by race/ethnicity and family income of children living near selected contaminated lands* in 2009, compared with the distribution by race/ethnicity and income of children in the general U.S. population

Race / Ethnicity	Population	All Incomes	< Poverty Level
White	Children living near selected sites	55.6	36.0
	All children	68.6	47.3
Black	Children living near selected sites	21.1	37.6
	All children	15.1	30.1
American Indian/ Alaska Native	Children living near selected sites	1.0	0.8
	All children	1.2	1.7
Asian	Children living near selected sites	5.1	3.5
	All children	3.4	2.6
Native Hawaiian or Other Pacific Islander	Children living near selected sites	0.3	0.2
	All children	0.2	0.1
All Other Races†	Children living near selected sites	17.0	21.8
	All children	11.6	18.1
Hispanic	Children living near selected sites	23.5	31.7
	All children	17.1	28.7

DATA: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, CERCLIS, and RCRAInfo

*Within one mile of Superfund and Corrective Action sites that may not have all human health protective measures in place.

NOTE: Race categories include children of Hispanic ethnicity. Hispanic children may be of any race.

† The "All Other Races" category includes all other races not specified, together with those individuals who report more than one race.