

## Landfills and Health Effects

### Annotated Resources

Though it may seem obvious, to community members that their health problems are associated with living near a landfill, few formal studies have supported this link. Most research has focused on studies of people living near hazardous waste sites, rather than municipal landfills. We have included some of these studies, recognizing that many MSW landfills contain a percentage of hazardous waste.

Though these can serve as helpful tools in supporting your argument, there are always errors and uncertainties within experimental study designs which can lead to skewed results. There is no way to be one hundred percent certain of the materials in a landfill, just as there is no way to definitively “prove” that health problems are a result of landfill proximity. We encourage you to use these studies as a tool in your fight. However, it is ultimately your organizing and advocacy that will make the most impact, rather than any health study.

1. **Wanderley, Vivianni Palmeria, et al. Socio-Environmental and Hematological Profile of Landfill Residents (São Jorge Landfill–Sao Paulo, Brazil).** *International Journal of Environmental Research and Public Health* (2016) 64(14).

This study assessed the correlation between certain social, economic, and environmental factors and disease markers from hematological tests on people living in the vicinity of a landfill in Santo André, Brazil. Study participants consisted of a group of people living near the landfill (experimental group) and a group of people living in a central city (control group). Landfill residents were found more likely to have sewage, live in brick houses, and have a low household income, while the control group was characterized by having masonry houses, sanitation, and a higher household income. This demonstrates that residents living near landfills are more likely to be of lower class, exhibiting a common pattern of environmental classism. Moreover, the study found landfill residents to be 3.33 times more likely to have hematological abnormalities when compared to the control group. The hematological disorders common to landfill residents were leukocytosis, anemia, lymphocytosis and neutropenia.

2. **Mataloni, Francesca et al. Morbidity and mortality of people who live close to municipal waste landfills: a multisite cohort study.** *International Journal of Epidemiology* (2016) 45(3): 806–815.

This was a cohort study of 242,209 residents between 1996 and 2008 living within 5km of nine different landfills across the Lazio region in central Italy. With dispersion modeling, researchers were able to estimate each resident’s exposure to landfill contaminants, using concentrations of Hydrogen Sulfide as a surrogate for total emitted pollutants. The researchers found a solid correlation between resident’s distance from the landfill and modeled Hydrogen Sulfide concentrations. Hydrogen Sulfide exposure was associated with mortality for lung cancer and respiratory diseases, as well as hospitalization for respiratory diseases, especially among children. These results were adjusted for confounding variables such as gender, age, socioeconomic status, ambient PM<sub>10</sub> concentration, and distance from main roads or highways and industries. These

results exhibit that living near landfills can lead to respiratory system damage. The adjustment for other confounding environmental conditions strengthens the credibility of the study's conclusions.

3. **Shibata, T., Wilson J.L., Watson, L.M. Shibata, T., Wilson, J. L., Watson, L. M., Nikitin, I. V., A., Ane, R. L., & Maidin, A. (2015). Life in a landfill slum, children's health, and the Millennium Development Goals. *Science of The Total Environment*, 536, 408- 418.**

This study, conducted in Indonesia, evaluated the living and working conditions of those living in landfill slum. Through face-to-face interviews with the population, researchers analyzed the demographic and population characteristics, as well as ambient air and MSW contamination. Results of this study concluded that children from the landfill slum were more likely to suffer from diarrhea and acute respiratory infections.

4. **Mattiello, A., Chiodini, P., Bianco, E., Forgiione, N., Flammia, I., Gallo, C., Panico, S. (2013). Health effects associated with the disposal of solid waste in landfills and incinerators in populations living in surrounding areas: A systematic review. *International Journal of Public Health Int J Public Health*, 58(5), 725-735.**

This report compiles the results of 60 relevant papers within literature that describe health problems related to landfills and incinerators. Researchers found that through their review, the most consistent result was found to be the occurrence of congenital anomalies, as well as increased rates of hospitalization, due to residency near waste landfills.

5. **Cabral, M. et al. Low-level environmental exposure to lead and renal adverse effects: A cross-sectional study in the population of children bordering the Mbeubeuss landfill near Dakar, Senegal. *Human Experimental Toxicology* (2012) 31:1280-1291.**

This article examines the effect of lead exposure on children living near a landfill in Senegal. Soil and air samples collected near the landfill indicated metal contamination. The authors designed a study that examined multiple factors that indicated lead contamination in humans. The study concluded that the landfill poses a significant health risk for children. The biomarkers used to indicate the presence of lead showed high levels of lead absorption. An excess production of reactive oxygen species in specific organs may be involved in lead-induced renal injury. The authors suggest that these environmental problems be considered as part of future development programs in poor countries.

6. **De Felice, B. et al. Telomere shortening in women residents close to waste landfill sites. *Gene* (2012) 500:101- 106.**

This study examines the effect of environmental pollution from illegal landfills on pregnant women in Campania, Italy. Specifically, the study looks at the effect on telomere length which has implications for early onset of age-related diseases. The authors determined that the pollution caused by illegal dumping has resulted in higher oxidative stress, shorter telomere length and lower telomerase activity, which are known determinants of cell senescence and aging-related meiotic dysfunction in women.

7. **Heaney, C. D., Wing, S., Campbell, R. L., Caldwell, D., Hopkins, B., Richardson, D., & Yeatts, K. (2011). Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill. *Environmental Research*, 111(6), 847-852.**

This study looked at the health and quality of life of a community of North Carolina residents affected by exposure to numerous waste facilities. For ten months in 2009, participants of this study used methods of self-reporting to keep track of irritant and physical symptoms they experienced due to exposure from living near a landfill. Results found that experience of malodor was common to those who live near waste sites, and that it negatively impacts the well-being of those populations.

8. **Mari, M., Nadal, M., Schuhmacher, M., & Domingo, J. L. (2009). Exposure to heavy metals and PCDD/Fs by the population living in the vicinity of a hazardous waste landfill in Catalonia, Spain: Health risk assessment. *Environment International*, 35(7), 1034-1039.**

This study examines a population in Catalonia, Spain which is exposed to heavy metals from a hazardous waste landfill. Researchers specifically looked at the health effects associated with air inhalation, soil and dust ingestion, as well as dermal absorption. With their results, they concluded that concentrations of metals found within the area were relatively higher in the nearest village to the landfill indicating closer proximity to a landfill equals higher exposure to the pollutants released by said landfill.

**9. Porta, D. et al. Systemic Review of Epidemiological Studies on Health Effects Associated with Management of Solid Waste. *Environmental Health* (2009) 8:60-73.**

This paper provides an overview of the studies in the published literature that evaluated the adverse health effects associated with different waste management methods including landfills. The authors also scored the reported effects in order to derive useable excess risk estimates for health impact assessment. The study design and potential biases in effect estimates were evaluated for each study included in the review. The authors found that for populations living within 2 kilometers of landfills, there was limited evidence of congenital anomalies and low birth weight with an excess risk of 2 percent and 6 percent, respectively. The excess risk tended to be higher when sites handled toxic waste. Many of the studies suffered from various limitations that are described in the review. Despite this, the authors concluded with a moderate degree of confidence that “we have derived some effect estimates that could be used for health impact assessment.”

**10. Kouznetsova, M., et al. Increased Rate of Hospitalization for Diabetes and Residential Proximity of Hazardous Waste Sites. *Environmental Health Perspectives* (2007) 115(1): 75-79.**

This study investigated whether residence near persistent organic pollutants (POPs)-contaminated hazardous waste sites increased rates of hospitalization for diabetes. The authors examined adult diabetes patients 25-74 years of age in New York State from 1993-2000. After controlling for major potential confounders, the study found a statistically significant increase in the rate of hospitalization for diabetes among patients residing in ZIP codes containing POPs-contaminated waste sites versus patients in “clean” sites. These results do not prove a cause and effect relationship; however, this study provides further support for the association between diabetes and exposure to environmental contaminants.

**11. Kuehn, C.M., et al. Risk of Malformations Associated with Residential Proximity to Hazardous Waste Sites in Washington State. *Environmental Research* (2007) 103: 405-412.**

This study examines the relationship between malformations occurring in infants and maternal residential proximity to hazardous waste sites in Washington State. Maternal residence of infants born with malformations from 1987-2001 was compared to maternal residence of infants who were randomly selected and who were born without malformations during this same time period. The authors found that infants born within 5 miles of a hazardous waste site had an increased risk of malformations compared to infants born more than 5 miles away from a hazardous waste site.

**12. Gilbreath, S and Philip Kass. Adverse Birth Outcomes associated with open dumpsites in Alaska Native Villages. *American Journal of Epidemiology* (2006) 164(4): 518-528.**

This study evaluates adverse birth outcomes in infants whose birth records indicate that the mothers lived in villages with dumpsites that were potentially hazardous to public health. The authors found that mothers who lived in villages with intermediate and high hazard dumpsite has a higher proportion of low birth weight infants than did mothers in the control group. More infants born to mothers who lived in the intermediate and high hazard villages suffered from intrauterine growth retardation.

**13. Palmer, S. et al. Risk of congenital anomalies after the opening of landfill sites. *Environmental Health Perspectives* (2005) 113(10): 1362-1365.**

This study was conducted to investigate whether there was an increased risk of births with congenital malformations for mothers living near 24 landfill sites in Wales that opened between 1983 and 1997. Expected rates of congenital anomalies were compared to those of mothers living

within 2 km of the sites, before and after opening of the landfills. Results showed risk of congenital anomalies for mothers living near the landfills increased when the sites were opened. However, the data could not establish a causal link between the landfills and the malformations because of a variety of biases that may have confounded the relationship. Nonetheless, the increase in risk associated with the opening of sites requires continued surveillance.

- 14. Morgan, O., Vrijheid, M., Dolk, H. Risk of low birth weight near EUROHAZCON hazardous waste landfill sites in England. *Archives of Environmental Health* (2004) 59(3): 149-151.**

This study evaluated risk of low birth weight near 10 English hazardous waste sites used in a previous study of congenital anomalies (see below). The authors found a small but not statistically significant increase in risk of low birth weight within 3 km of sites. The findings of this study suggests that previously reported results for congenital anomalies should not be extrapolated to a wider range of reproductive effects but instead evaluated separately for each outcome.

- 15. Dummer, T., Dickinson, H., Parker, L. Adverse pregnancy outcomes near landfill sites in Cumbria, northwest England, 1950-1993. *Archives of Environmental Health* (2003) 58(11): 692-697.**

This study evaluated the risks of stillbirth or neonatal death for mothers living near landfills. All stillbirths, neonatal deaths, and lethal congenital anomalies occurring among 287,993 births to mothers in Cumbria, northwest England during the period 1950-1993 were studied. For the period 1970-1993, a small but significant increase in risk of "other congenital anomalies of the nervous system" was found in mothers living near domestic waste landfill sites. This finding was consistent with other researchers, but a casual effect could not be inferred and the possibility that the results occurred by chance could not be ruled out.

- 16. Vrijheid et al. Chromosomal congenial anomalies and residence near hazardous waste landfill sites. *Lancet* (2002) 359: 320-322.**

This study revealed that there is an increased risk of chromosomal anomalies in people who live close to hazardous waste landfills. Adjustments were made for maternal age and socioeconomic status. The results of this study suggest that an increase in the risk of chromosomal anomalies is similar to that found for non-chromosomal anomalies.

- 17. Elliot, P. et al. Risk of adverse birth outcomes in populations living near landfill sites. *British Medical Journal* (2001) 323: 363-368.**

Between 1982 and 1997, a study was conducted to investigate the risk of adverse birth outcomes associated with residence near landfill sites. Individuals living 2 km from one of 9565 landfill sites throughout Great Britain were sampled. This has been the largest study of associations between residence near landfill and adverse birth outcomes thus far. It was concluded that residents near landfill sites are at risk of having children with congenital anomalies and low birth weight, however, further studies are needed to explain these findings.

- 18. McNamee, R., Dolk, H. Editorial: Does exposure to landfill waste harm the fetus? *British Medical Journal* (2001) 323: 351-352.**

This editorial addresses issues concerning the article entitled "Risk of adverse birth outcomes in populations living near landfill sites" by Elliot et al. in the August 2001 edition of the British Medical Journal.

- 19. Pukkala, E and Antti Ponka. Increased incidence of cancer and asthma in houses built on a former dump area. *Environmental Health Perspectives* (2001) 109(11): 1121-1125.**

This study evaluated the health of people who moved into twelve blockhouses in Helsinki, Finland that were built on a former dumpsite. Cancer and other chronic diseases were evaluated. The authors found a statistically significant increase in cancer for both sexes. The relative risk increased slightly with the number of years lived in the area. They also found increases in asthma

and chronic pancreatitis. The authors concluded that the “possibility of a causal association between the dump exposure and incidence of cancer and asthma cannot be fully excluded.” Nonetheless, the city council decided to demolish all houses in the dump area.

**20. Berger, S., Jones P., White, M. Exploratory analysis of respiratory illness among persons living near a landfill. *Journal of Environmental Health* (2000) 62.6: 19.**

Due to concern expressed by residents in two Staten Island, NY communities, the authors of this study evaluated the severity and frequency of respiratory symptoms occurring over a 12-month period among self-identified residents with asthma, severe breathing, or other respiratory conditions. Responses indicated that residents who lived adjacent to the landfill and those from the north-shore (seven miles from the landfill) had differing health problems, with landfill residents reporting higher rates of certain odors and eye, nose and throat irritation. The authors concluded that further investigation of respiratory illnesses should be conducted, as the study showed high rates of respiratory-related symptoms and conditions.

**21. Vrijheid et al. Health effects of residence near hazardous waste landfill sites: a review of epidemiologic literature. *Environmental Health Perspectives* (2000) 108: (Suppl. 1) 101-112.**

This review is an evaluation of current literature on the adverse health effects due to residence near landfill sites. It is difficult to make a conclusion about direct causes for adverse health effects and risks of landfills in general are hard to quantify. Of the studies reviewed, all proved to have insufficient exposure information. This article suggests that research of exposure to landfill sites needs to take a more interdisciplinary approach. Furthermore, epidemiologic and toxicologic studies need to be conducted for individual chemicals and chemical mixtures in order to understand what their effects may be on a population living near a landfill.

**22. Knox, EG. Childhood cancers, birthplaces, incinerators and landfill sites. *International Journal of Epidemiology* (2000) 29: 391-397.**

A study conducted in Great Britain between 1974 and 1987 found that children living near incinerators, both municipal and medical, were at more risk of getting cancer than those children living near landfill sites. This study targeted the sensitivity of children to carcinogenic emissions, but it failed to take into account the association of additional toxic sources in the vicinity. This study also did not account for the migration of families from areas of high toxicity to areas of low toxicity before, during, or after a child's birth.

**23. State of New York Department of Health, Center for Environmental Health. Investigation of cancer incidence near 38 landfills with soil gas migration conditions: New York state, 1980-1989, 1998. Available from: New York State DOH, 2 University Place, Albany, NY 12203-3399. Phone: 1-800-458-1158.**

Thirty-eight landfills throughout the state of New York were selected for a study to find out if people living near certain landfills had an increased risk of cancer compared to people living elsewhere. This study evaluated cancer incidence among people living around these 38 landfills between 1980 and 1989. All cases of leukemia, non-Hodgkin's lymphoma, liver, lung, kidney, bladder and brain cancer were identified and located on a map. Although this study had many limitations, it still found that women living near the landfills had a higher incidence of bladder cancer and leukemia. In comparison, men did not show an increased risk of any type of cancer despite their proximity to a landfill.

**24. Dolk, H. et al. Risk of congenital anomalies near hazardous-waste landfill sites in Europe: the EUROHAZCON study. *Lancet* (1998) 352: 423-427.**

This study examined seven regional registers of congenital anomalies in five different countries in Europe to determine if exposure from hazardous chemicals at landfills increased the risk of birth defects. Twenty-one sites were examined overall and among those sites mothers within a 3 km radius showed a significantly raised risk of having children with congenital anomalies. The results of this study were adjusted for maternal age and socioeconomic status. However, this study's findings are limited by a lack of information on exposures.

- 25. Berry, M., and Bove, F. Birth weight reduction associated with residence near a hazardous waste landfill. *Environmental Health Perspectives* (1997) 105(8): 856-861.**

Twenty-five years of birth certificate information (1961-1985) was collected in order to examine the relationship between birth weight and mother's residence near the Lipari Landfill located in New Jersey. The results indicated that there was a significant impact to infants born to residents who lived near the landfill during the time they would have been at greatest risk of exposure to hazardous chemicals. Many factors, including maternal health, cigarette and alcohol consumption during pregnancy, and socioeconomic status were not available for this study.

- 26. Goldberg, M. et al. Incidence of cancer among persons living near a municipal solid waste landfill site in Montreal, Quebec. *Archives of Environmental Health* (1995) 50(6): 416-424.**

In a Canadian study, researchers from the Public Health Department in Montreal evaluated cancer incidence rates in people living around the Miron Quarry municipal landfill. Thirty-five volatile organic chemicals were identified in the landfill gases sampled, including known human carcinogens. When evaluating cancer incidence rates among persons living near the landfill, it was concluded that there might have been increased risks for certain cancers, such as stomach, liver, lung, prostate, and cervix uteri. The researchers also concluded that there were too many unknown factors to make any conclusions as to whether cancer incidence and proximity to the landfill were directly related.

- 27. Shaw, G. et al. Congenital malformations and birth weight in areas with potential environmental contamination. *Archives of Environmental Health* (March/April 1992) 47: 147-154.**

Due to the public's increasing concern about reproductive damage as a result of exposure to environmental contamination, a study was conducted to determine if mothers living near contaminated sites were at a greater risk of having children with congenital malformations. This study did not reveal lower birth weight or increased risks for most malformations among women who lived in contaminated areas. It did, however, show an elevated risk for infants with malformations of the heart and circulatory system.

- 28. Upton, A. et al. Public health aspects of toxic chemical disposal sites. *Annual Review of Public Health* (1989) 10:1-22.**

This article provides a summary and overview of past health studies conducted around toxic waste disposal sites. The results of 16 published epidemiological studies of residential exposures to toxic waste sites are summarized in this report, many of which are landfills operated by local, state or federal agencies. Although many weaknesses were identified in this review, several adverse health impacts were also identified. These included decreased weight at birth, increase in the frequency of congenital malformations, increase in the occurrence of certain forms of cancer, decrease in the growth and maturation of children, and increased prevalence of central nervous system symptoms. Overall, this article provides evidence that health problems associated with exposure to toxic waste disposal sites are underestimated and poorly studied.

- 29. Hertzman, C. et al. Upper Ottawa Street landfill site health study. *Environmental Health Perspectives* (1987) 75:173-195.**

As of 1987, there were few health studies conducted that found health problems in communities living around landfills that were published in the medical or scientific literature. To this day, there is still a lack of conclusive studies giving evidence that adverse health effects are caused by landfills alone. In a study conducted by Clyde Hertzman et al. a number of health problems in workers and residents living near the Upper Ottawa Street Landfill in Hamilton, Ontario were identified. A few of the problems found with the highest credibility included clusters of respiratory, skin, narcotic, and mood disorders. Evidence is presented in their study that supports the hypothesis that vapors, fumes or particulate matter emanating from the landfill site, as well as direct skin exposure, may have lead to the health problems found in excess in this particular area.

- 30. Paigen, B. et al. Growth of children living near the hazardous waste site, Love Canal. *Human Biology* (June 1987) 59(3): 489-508.**

This is the third of a series of three studies that were conducted on children living near the Love Canal landfill. This study examined whether living near a hazardous waste site had an adverse impact on the growth patterns of children. Children are especially vulnerable to environmental contamination and it was hypothesized that exposed children would be smaller in comparison to control groups of children within a similar socioeconomic status. In earlier studies it was found that there was a significant effect between health problems and the closeness of homes near Love Canal, but in this study the difference in stature associated with birth and residence near Love Canal was not statistically significant. These findings suggest that length of exposure to chemicals may be more important to study rather than point of exposure.

- 31. Goldman, L., and Paigen, B. Low birth weight, prematurity and birth defects in children living near the hazardous waste site, Love Canal. *Hazardous Waste & Hazardous Materials* (1985) 2(2):209-223.**

This is the second of a series of three studies that were conducted on children living near the Love Canal landfill. This study assessed birth weight, prematurity, gestational age, and birth defects in 239 children who were living in the Love Canal neighborhood before and shortly after birth. Overall the results showed no significant difference in prematurity, but there was an increase in low birth rate and birth defects. The outcomes of this study suggest that low birth weight is a good indicator of adverse health effects caused by exposure to low levels of chemicals.

- 32. Paigen, B., and Goldman, L. Prevalence of health problems in children living near Love Canal. *Hazardous Waste & Hazardous Materials* (1985) 2(1):23-43.**

This is the first of a series of three health studies that were conducted on children living near the Love Canal landfill. This particular study looked at the overall health of children. The parents of 523 Love Canal and 440 control children were given questionnaires. It was found that children that lived near Love Canal had an increased prevalence of seven major health problems including, seizures, learning problems, hyperactivity, eye irritation, skin rashes, abdominal pain, and incontinence. This paper addresses many of the difficulties involved with conducting community health studies and recognizes the limitations of science when there are so many variables to contend with.

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