PROXIMITY OF PUBLIC SCHOOLS TO TOXIC WASTE SITES

A VULNERABILITY INDEX

Introduction

Many chemicals, especially persistent organic pollutants, are ubiquitous in the environment and have been found globally throughout the ecosystem. Many of these chemicals are also routinely detected in humans. Starting even from infancy, babies in America are now born with an average of 287 chemicals in their blood.[1]

There have been many spatial analysis studies researching a subset of the population's proximity to toxic chemical exposure and population/census tract data. Typically, connections to socio-economic status or race are analyzed. However, there does not seem to be much literature on children's proximity to chemical waste and exposure. Schools were chosen because children are particularly vulnerable to toxic insult. Children with their developing systems and smaller size means they have a greater body burden per contaminant dose. Also, children are developing rapidly and are at increased sensitivity during specific growth-related time windows.

Due to a long history of military activity and industry, Massachusetts has numerous toxic waste sites. In order to approach a complete toxic profile a variety of hazardous waste sites taken from both federal data and state level data will be compiled. One of the defining features of this project is the focus on land pollution versus air pollution which is more commonly researched.

Toxic waste sites and the ensuing environmental contamination could theoretically amplify the chemical exposure to children attending schools in close proximity.

Methodology

First the most risky sites in terms of likely environmental contamination were chosen. Then a density map based on the location of toxic waste sites was created. All the sites were weighted equal except for Superfund sites which were more heavily weighted (x3) where red shows the highest likely risk of environmental contaminants.

All public schools in Massachusetts were analyzed for being within 250 meters of what I determined to be the most hazardous of sites: Superfund sites, EPA Toxic Release Inventory sites, and certain brownfields according MassDEP classifications.
Of these schools, the elementary schools are highlighted given younger children's higher vulnerability.

Results

- **7194** total hazardous waste sites
- **196** schools within 250 meters of a toxic waste site
- **70** schools within of 3 or more toxic waste sites
- **56** are elementary schools

Cartographer: Elisa Jazan

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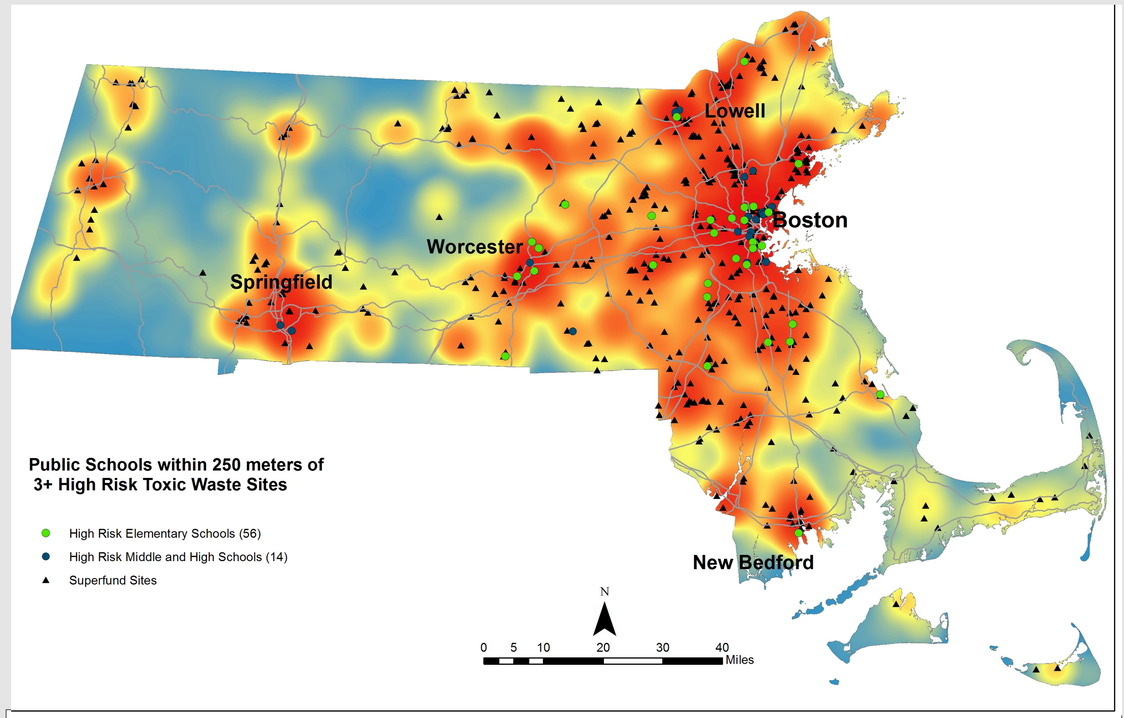
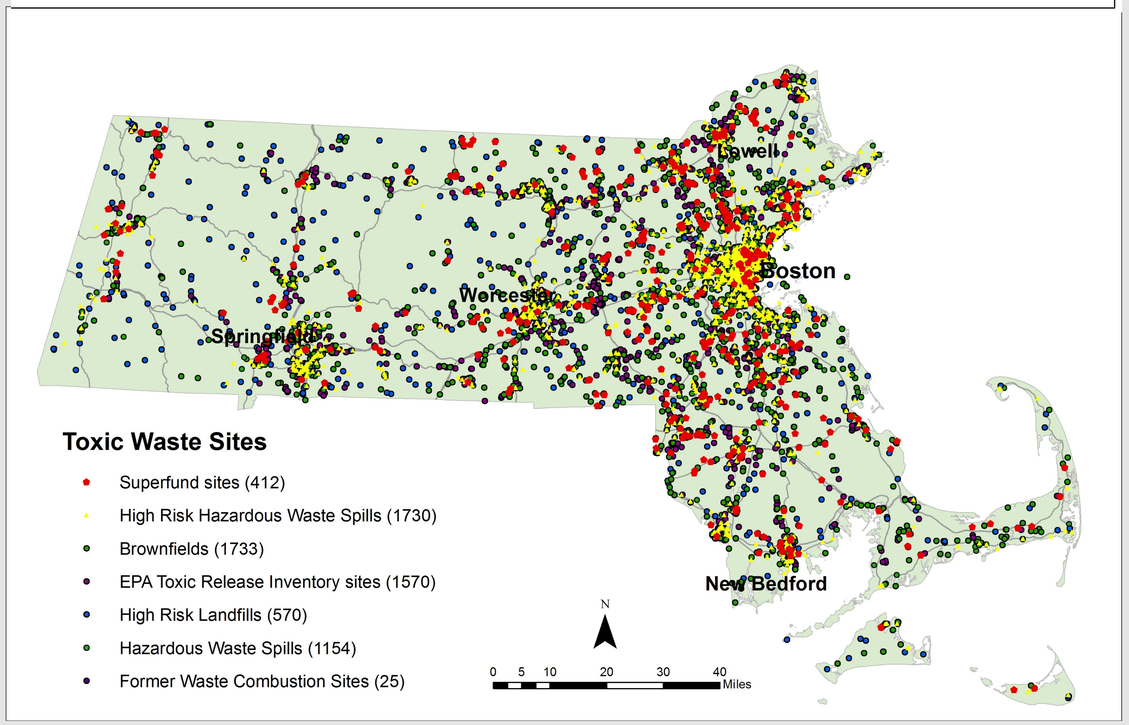
Data Sources: EPA, MassGIS

Projection: NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001





Superfund site: defined by the EPA as the "nation's worst hazardous waste sites" and "significant environmental emergencies".

Hazardous Waste Spill: The MassDEP Oil or Hazardous Materials Sites with Activity and Use Limitation (AUL) datalayer is a statewide point dataset containing the approximate location of oil or hazardous material release/disposal sites where an AUL has been filed.

High Risk Hazardous Waste Spill: An AUL site that is one of the following MassDEP classifications: RAO A-3: A permanent solution has been achieved. Contamination has not been reduced to background and an Activity and use Limitation (AUL) has been implemented

Tier 1- (a) there is evidence of groundwater contamination with oil and/or hazardous material at concentrations equal to or exceeding the applicable RCGW-1 Reportable Concentration set forth in 310 CMR 40.0360, and such groundwater is located within an Interim Wellhead Protection Area, Zone II, or within 500 feet of a Private Water Supply Well; (b) an Imminent Hazard is present; (c) one or more remedial actions are required as part of an Immediate Response Action pursuant to 310 CMR 40.0414(2); or (d) one or more response actions are required as part of an Immediate Response Action to eliminate or mitigate a Critical Exposure Pathway pursuant to 310 CMR 40.0414(3)

Brownfield: A property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Toxic Release Inventory program: The EPA tracks the management of certain toxic chemicals that may pose a threat to human health and the environment. U.S. facilities in different industry sectors must report annually how much of each chemical is released to the environment and/or managed through recycling, energy recovery and treatment. (A "release" of a chemical means that it is emitted to the air or water, or placed in some type of land disposal.)

Landfills: Only unlined landfills and those containing sludge and construction and demolition waste were included. The USEPA has concluded that all landfills eventually will leak into the environment (U.S. Environmental Protection Agency, 1988). Thus, the fate and transport of leachate in the environment, from both old and modern landfills, is a potentially serious environmental problem. Many toxins bind exceptionally well to sludge matrices. C&D waste can contain lead, asbestos and chemically treated wood.

Historic Waste Combustion Sites: Incomplete waste incineration is the primary cause of dioxin pollutants, including TCDD (2,3,7,8-Tetrachlorodibenzo-*p*-dioxin) the most toxic chemical known thus far.

Discussion

Unfortunately background chemical exposure is undeniable. The health effects are unclear but potentially widespread and could include any of the following consequences.

Exposure to **endocrine disruptors**, chemicals that can alter the normal functions of hormones, at critical times of development can have irreversible effects which are not necessarily immediately understood. According to the World Health Organization endocrine disrupting chemicals can cause developmental effects on the nervous system in children and attention deficit /hyperactivity in children. The European Society for Paediatric Endocrinology and Pediatric Endocrine Society (American) issued a joint Call to Action Statement since "it is well documented that fetuses and children may be very sensitive to exposure from exogenous hormones".[2]

It has been estimated that up to 19% of **cancer** worldwide is a result of exposure to environmental contaminants.[3] The increased risk of cancer due to environmental pollutants makes epidemiological studies "extraordinarily difficult and indecisive."[4]

Additional increasing prevalence of other disorders may also be associated with increased background levels of toxic exposure. Food **allergies** increased 18% in children in just 10 years between 1997 and 2007.[5] Allergies are an **immune disfunction**, as is **asthma** which is also steadily increasing in the population.[6] There are many hypotheses but it is yet to be clear what is causing these increases.

Girls, and boys now it seems, are experiencing **early puberty** with no clear cause.[7] Hormone alteration seems likely, which we've already shown can be caused by environmental contaminants. There also might be a connection with the rising rates of obesity. **Obesity** is yet another public health phenomena that does not have any definitive explanation. However, there is a new area of research into 'obesogens". Obesogens are environmental chemical exposures that have metabolic effects.[8]

The environmental contaminants from these various toxic waste sites are wide-ranging from heavy metals to persistent organic pollutants to polyaromatic hydrocarbons. It is difficult to measure the direct effects. If we have little control over our background exposures than more consideration should be taken to minimize our exposures to chemicals we can control such pesticide use, our choices for our personal care products and what we eat. Every decision, at an individual, an industry and governmental level that includes the risk of exposure to a synthetic chemical should be carefully considered especially where children are concerned.
Further research could include examining the socioeconomic status as well as the health status of the students in the schools found in close proximity of toxic waste sites. Aggregating additional pollution data, such as proximity to major roads and freeways could give a clearer picture of total environmental exposure body burden.

References

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