# THE DIRT ON ENVIRONMENTAL DISCRIMINATION

***A Study Comparing Heavy Metal Concentrations in Soils Between High and Low-Income Neighborhoods in New Haven, CT***

**by**

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**&**
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**Introduction**

The topic of environmental justice has been a growing concern in recent years. Considerable research over the past decade has documented the relationship between exposure to environmental risks and race and poverty.[1] A 1987 study by the United Church of Christ's Commission on Racial Justice found that the mean percentage of minority populations in areas with toxic waste sites were four to five times greater than those of areas without toxic waste sites. 24% of all minorities have at least one hazardous waste facility in their community while they make up only 12% of the population.[2] Another study of New Jersey communities found that the greatest number of hazardous waste sites there tend to be found in neighborhoods with more poor, elderly, young, and African American residents.[3] In 1992, then senator Al Gore and US rep. John Lewis (D-Ga) introduced the Environmental Justice Act bill to, "ensure that the significant adverse health impacts that may be associated with environmental pollution in the United States are not distributed inequitably."[4] In spite of the flurry of activity over the issue, critics say these studies are incomplete, and claim that concerns are premature.[5]

Environmental hazards – including radioactive waste, asbestos, synthetic organic chemicals, and heavy metals – tend to be concentrated in urban and industrial areas .[6] Incontrovertible evidence shows that low-income and minority communities are disproportionately located in or near urban industrial areas containing waste treatment sites, freeways, and polluting manufacturing plants. Bob Knox, deputy director of the

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[1] Reich, P. L. 1992. *Greening the Ghetto: A Theory of Environmental Race Discrimination*. Kansas Law Review, 41, 271-297.

[2] United Church of Christ, Commission on Racial Justice, *Toxic waste and Race in the United States*. 1987

[3] Been, V. 1993. What's *Fairness Got to do With it? Environmental Justice and the Siting of Locally Undesirable Land Uses*. Cornell Law Review. 6 Cornell L. Rev. 1001

[4] Ibid.

[5] Begley, R. and Hunter, D. 1993. *Environmental Justice: Staying Ahead*. Chemical Week, September 15, 1993.

[6] Council on Scientific Affairs. 1985. *Effects of Toxic Chemicals on the Reproductive System*. Journal of the American Medical Association. June 21, 1985

Environmental Protection Agency, said, "The agency has acknowledged some communities bear a disproportionate risk because they have a lot of these facilities [toxic]."[7] Yet, in its twenty year history it has never conducted a national study examining the differences between levels of toxic contaminants in low and high-income neighborhoods. Research shows elevated blood lead levels among families in densely populated urban areas and in families with annual incomes under $15,000. Furthermore, they show a wide disparity in elevated blood lead levels between African American children (12%) and white children (2.0%).[8] A common source of lead in humans, especially children, is through ingestion or inhalation of dirt and dust containing these and other trace metals. This group of pollutants needs to be investigated more thoroughly. Often they accumulate in soil which is a "primary recipient, intended or otherwise, of many of the waste products and chemicals used in modern society. Once these materials enter the soil they become part of a cycle that affects all forms of life."[9]

Metals have existed in the earth from its inception. They are present in most rocks in the earth's crust and are concentrated in ores in some regions, coming to the surface in cycles of erosion, volcanic activity, and sedimentation. Lead, zinc, and copper are "trace metals" currently being referred to as "toxic metals". They are present in the environment in low concentrations and, in certain conditions, are considered hazardous to humans and other animals.[10] The human species through the use of technology has immensely altered the cycling of metals by increasing their mobilization through air, soil, water, and biotic life.

Over the course of this century, people have released lead into the environment in unhealthy concentrations. The burning of oil and gas, coal

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[7]Miller, Ken. 1993. *Civil Rights Report Validates 'Environmental Injustice" Claims.* Gannett News Service. September 17, 1993.

[8]Committee on Environmental Hazards, 1984-1986, Philip J. Landrigan, MD, Chairman. *Statement on Childhood Lead Poisoning.* American Academy of Pediatrics, March 1987.

[9]Brady, N. C. 1990. *The Nature and Property of Soils.* New York: MacMillan Publishing Company.

[10]Harte, J (Ed.). 1991. Toxics A to Z: A guide to Everyday Pollution Hazards. Berkeley: University of California Press.

combustion, storage batteries, iron and steel production, plumbing pipes, paint additive, and solid waste incineration are all activities that discharge lead into the atmosphere. The discovery of tetraethyl lead (TEL) as an antiknock additive for gasoline was made in 1921 and its use was perpetuated throughout most of the century.[11] Lead deposited from the air is immobilized by organic components in the soil and retained in the top 2-5 cm of undisturbed soil.[12] Fortunately, strict regulations limiting the lead content of gasoline since the 1970s have greatly reduced its emission. However, background concentrations of lead continue to be significantly higher than they were prior to industrialization, and human blood lead level concentrations in exposed populations have increased concomitantly[13] (Harte at al., 1991). A study released in 1988 noted that:

> "Since Lead does not dissipate, biodegrade, or decay, the lead deposited into dust and soil becomes a long-term source of lead exposure...although lead emissions from gasoline have largely been eliminated, an estimated 4-5 million tons of lead used in gasoline remain in dust and soil."[14]

Lead can cause tremendous health problems even at low concentrations in the human body. Entering through the blood stream into soft and hard body tissues, such as the brain, kidneys, bone, and teeth , it tends to have a cumulative effect.[15] Repeated small doses can have neurotoxic effects, such as decreased intelligence, short-term memory loss, visual-motor and perceptual impairment, and delayed reaction time. These symptoms are most damaging to the rapidly developing neurologic systems of children and fetuses.[16] One study evaluated the IQ scores and overall functioning of

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[11]Ibid.

[12]Center for Disease Control. 1991. *Preventing Lead Poisoning in Young Children.* Atlanta: U.S. Department of Health and Human Services.

[13]Harte et. al. 1991

[14]Agency for Toxic Substances and Disease Registry (ATSDR). 1988. *The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress.* Atlanta: ATSDR.

[15]Rabinovitz, M. B. e. a. 1976. *Kinetic Analysis of Lead Metabolism in Healthy Humans.* Journal of Clinical Investigation, 58, 260 - 270.

[16]Center for Disease Control. 1985. Preventing Lead Poisoning in Children No. Department of Health and Human Services.

children with lower level lead accumulation in their teeth (considered long term storage sites of lead) to those with higher levels of lead accumulation in their teeth who had not experienced lead poisoning. The children with higher lead levels were correlated with lower IQ scores, attention spans, and overall functioning.[17]

Zinc has been utilized in "galvanized iron and steel, metal alloys, brass, batteries, and rubber manufacturing."[18] It combines easily with other metals, such as iron and steel, to form alloys. In the form of zinc oxide, it is used in vulcanizing rubber, photocopying, and medical treatment. Concentrations of zinc are highest near mines, smelters, iron and steel foundries, and city streets (due to tire wear). It follows that industry workers are the group exposed at the highest rate. Zinc is required for human health, but can be toxic if inhaled or consumed in large quantities. Overconsumption can lead to stomach disorders and inhalation can lead to lung damage or death in severe cases. Though not stored in the body, long term exposure in high quantities may increase the risk of heart disease and immune disorders.[19]

Like the other metals, copper is commonly distributed among minerals and soils.[20] The main sources of copper from human use have been "mine tailings, fly ash, fertilizers, and windblown copper containing dust."[21] Copper has a high toxicity of free-dissolved ions but this is mitigated by a tendency to organically complex itself. Copper is less abundant in highly organic soils.[22]

Zinc and copper are lower in toxicity and are necessary micronutrients in life, although they can be harmful at elevated levels. Lead, on the other hand, has no biotic use and can be very harmful to the health of humans and

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[17]Environmental Defense Fund (EDF). 1990. *Legacy of Lead: America's Continuing Epidemic of Childhood Lead Poisoning. A Report and Proposal for Legislative Action.* Washington. D.C. EDF. See section by Needleman, 1988.
[18]Moore, J.W. and S. Ramamoorthy. 1984. *Heavy Metals in Natural Waters.* New York: Springer-Verlag.
[19]Harte et. al. 1991.
[20]Hesse, P.R. 1971. A textbook of Soil Chemical Analysis. New York: Chemical Publishing Co., Inc.
[21]Moore, J.W. and Ramamoorthy. 1984.
[22]Hess, P. R. 1971. *A Textbook of Soil Chemical Analysis.* New York: Chemical Publishing Co., Inc.

other biota. Lead, with a density five times greater than water, is the only true "heavy metal" of the three.[23] Because of its high toxicity it has been of most concern to researchers.

Each of the three metals is concentrated in greater abundance at the sources of distribution. Because of its abundant use in automobile fuel, lead has been globally distributed through the atmosphere, and therefore does not necessarily have a point-source. However, the typical range of lead concentrations in the air near urban freeways exceeds the range in other areas, and ranges of lead concentration in urban and smelting areas exceeds the range in rural areas.[24]

This study was designed as a preliminary effort to address the current void in environmental research in low-income communities. It compares the concentration of toxic metals in the surface soil of low income neighborhoods to those in high income neighborhoods.

## Materials & Methods

Median family incomes were used as an indicator of low and high economic status, and study areas were chosen based on census tract information provided by 1990 U.S. census data. Census tracts with the two lowest (tracts 1402 and 1406) and two highest (tracts 1410 and 1411) median family incomes in New Haven, were selected (see appendix A).

Two sampling sites were randomly chosen within each of the four tracts: one multiple-use/recreation area and one residential area. Six soil samples, for a total of 48 samples, were collected at each of these locations as follows: three samples 200 cm from the road at 420 cm intervals and three samples 560 cm from the road at 420 cm intervals. The top 5 cm of mineral soil was removed from each sample site using a 2 cm diameter soil corer. Pavement constraints on Davenport St., in census tract 1402, required the

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[23]Harte et. al. 1991.
[24]Ibid.

three samples closer to the street to be taken at a 110 cm distance from the road rather than the designated 200 cm distance.

Soil samples were oven dried at 80°F. Once dry, samples were strained through a 2 mm sieve to separate out course fragments. Both fine (<2 mm) and corse (>2 mm) fragments of each sample were weighed. Corse fragments were then discarded. 2.00 gram samples were measured from the fine fragments and placed in ceramic crucibles.

Samples were ashed in a furnace at 500°F for fifteen hours. Ashed samples were first cooled in the furnace for approximately two hours and were then removed. The samples were weighed with crucibles and weights were recorded. 8 ml. of nitric acid were added to the ash which was then heated and filtered through a No. 41 Whatman filter into a 50 ml volumetric flask. The flask was filled to 50 ml with distilled water. Samples were poured into plastic storage bottles and labeled with batch and sample numbers. Each sample was tested for lead, zinc, and copper content by using a Perkins & Elmer Atomic Absorption Spectrometer (AA).

Some samples contained very high concentrations of elements and could not be read by the AA machine. Therefore, 4 samples were diluted to 3 ml of solution to 10 ml distilled water, and 12 samples were re-ashed with .20 grams of soil and resuspended in a 50 ml solution of nitric acid and distilled water.

## Results

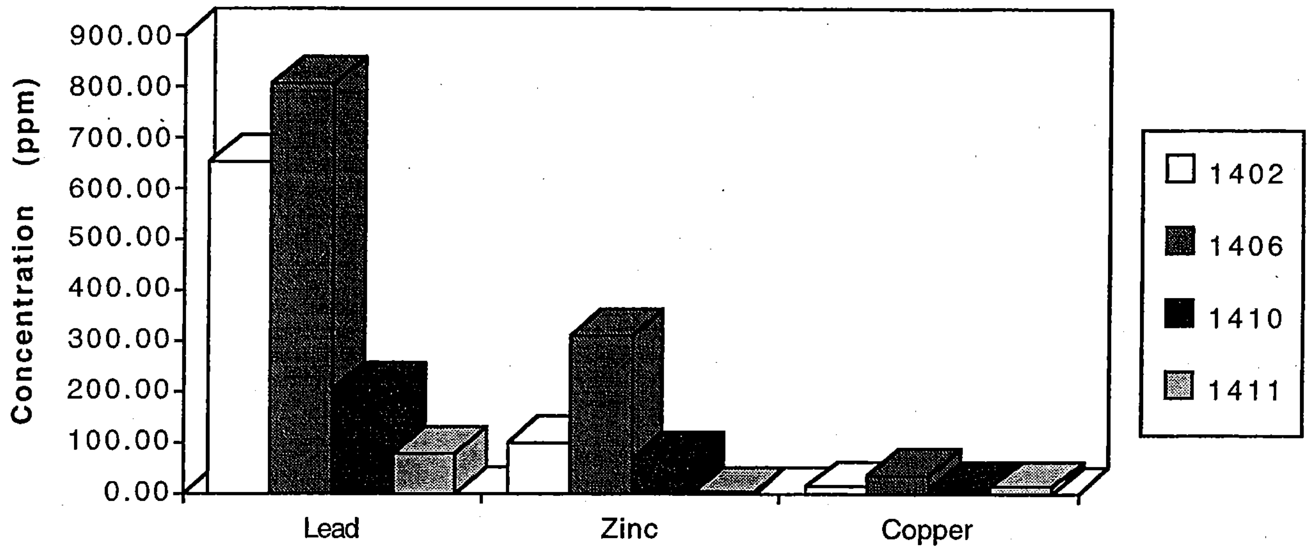
The μg/g (ppm) and g/m2 of lead (Pb), zinc (Zn), and copper (Cu), as well as the percentage loss on ignition of organic matter (LOI) and the bulk density (g/cm3), were determined for each soil sample. The means in each census tract were computed and the results are presented in table 1.

Tract 1406 had the highest mean concentration (ppm) of all three elements and tract 1402 had the next highest mean concentration of both lead and zinc. The mean concentrations of lead and zinc were significantly lower in census tracts 1410 and 1411, with tract 1406 having almost ten times the concentration of lead as tract 1411. The highest mean percent of organic matter was lost from samples in tracts 1410 and 1411. The mean concentration of copper was fairly uniform in all tracts except 1406 (see table 1, figure 2 and apendices B-E).

*Table 1: Mean Experimental Results*

| Tract | μg/g(ppm) | | | g/m2 | | | % LOI | Bulk Density $g/cm^3$ |
|---|---|---|---|---|---|---|---|---|
| | Pb | Zn | Cu | Pb | Zn | Cu | | |
| 1402 | 653.77 | 99.77 | 12.59 | 33.78 | 5.27 | 0.63 | 1.79 | 1.10 |
| 1406 | 805.44 | 311.19 | 36.44 | 35.32 | 13.59 | 1.56 | 4.04 | 0.89 |
| 1410 | 205.33 | 66.38 | 10.85 | 8.32 | 2.75 | 0.43 | 7.42 | 0.88 |
| 1411 | 79.73 | 2.05 | 12.84 | 2.97 | 2.05 | 0.47 | 7.54 | 0.77 |

Mean Concentrations of Metals in New Haven Soils




## Discussion

These results suggest a disturbing relationship in the concentration of lead, zinc, and copper and the socioeconomic status of neighborhoods. Soil samples from census tracts 1402 and 1406, with median annual family incomes below $13,000 had substantially higher mean concentrations of both lead and zinc than did tracts 1410 and 1411, with median family incomes above $47,000. In addition, the two high income tracts had greater organic matter content, indicated by a higher loss on ignition.

Unfortunately, no studies have been done to determine the level at which concentration of heavy metals in soils can have toxic effects in humans. It has been determined however, that for every 100 ppm rise over 500 ppm, blood lead levels increase 1-2 μ/dL. The data from our study, in conjunction with that collected by the Department of Health in the city of New Haven, CT, suggest that there is a high correlation between blood lead levels and soil lead content. The city study determined that, on average, the number of people with elevated blood lead levels is greater in census tracts with a higher percentage of low/moderate incomes.[25] Furthermore, the study determined that census tract 1406 (the tract with highest soil lead concentration in our study), ranked first in the number of confirmed cases of lead poisoning, while tracts 1410 and 1411 ranked 26th and 27th respectively (out of 28 total tracts)[26] (see appendix F). This information is particularly remarkable considering that healthcare services are less accessible to lower income families (and therefore, the cases of confirmed lead poisonings are under-reported).

Although our study examined the difference in soil metal concentrations between high and low-income neighborhoods, census data indicates that the same correlation exists between soil quality and race. Information from the 1990 U.S. Census show that people of color make up 69% and 86% of the population in census tracts 1402 and 1406 respectively. Tracts 1410 and 1411 show almost the opposite demographics with whites making up 93% and 80% of the populations there.

Theories about why these correlation's exist are hotly debated. Most government officials and industry professionals stop short of attributing the problem to intentional racism. They argue that economic imperatives prompt operators of manufacturing plants, waste treatment facilities, and other sources of pollution to choose sites where property values are low. They also make the corollary contention that low-income households are more likely to move to inexpensive areas like those typically occupied these polluters.

Scholars and civil rights activists, on the other hand, are more likely to blame institutionalized discrimination. They argue that personal choices are not enough to explain the phenomenon. Government officials contribute by

[25]ATSDR. 1988.
[26]Tract 1402 ranked relatively low on the list (21st), but that is largely attributable to the low total population.

zoning to allow these industries to locate in poor neighborhoods, rather than in a wider distribution of neighborhoods. Furthermore, researchers have shown, and courts have accepted, that public housing, which serves primarily low-income minority households, is disproportionately located in polluted neighborhoods.[27]

Private industry exacerbates these conditions in various ways. In some instances, businesses offer to invest much needed funds in the communities to which they move, enticing financially strapped local politicians to overlook the potential health risks. The perception that citizens in poor communities do not wield political clout can further impact private policy. For instance, Cerrell Associates, a consulting firm, advised the state of California that in looking for waste treatment sites, "communities that conform to some kind of economic need criteria should be given high priority," as should "lower socio-economic neighborhoods."[28]

Although these results do not explain a reason for the correlation, the unsettling implication of our study is that environmental hazards do disproportionately effect low-income and minority people. Limitations in our resources have prevented us from taking a sample large enough to produce definitive results. However, the preliminary findings highlight the need for further research in several areas. A larger-scale study of this nature, as well as a careful examination of the connection between the metal concentration in soil and that in the blood of those exposed to it are urgently needed.

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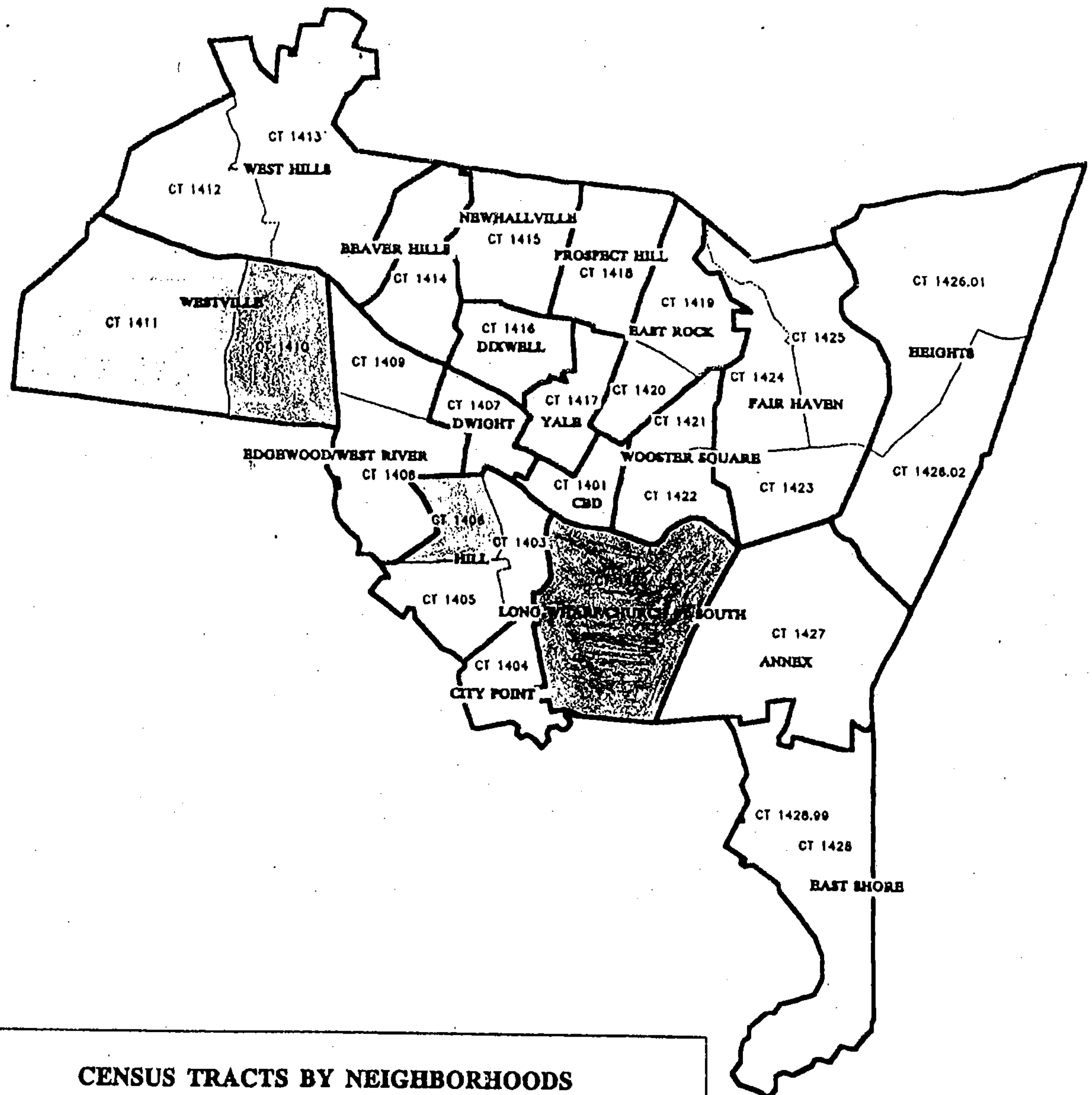
[27]See Dubin, J. C. 1992. *From Junkyards to Gentrification: Explicating a Right to Protective Zoning in Low-Income Communities.* Minnesota Law Review, 77, 739.
[28]Been. 1993.

APPENDIX A




**CENSUS TRACTS BY NEIGHBORHOODS**

**CITY OF NEW HAVEN, CONNECTICUT**

**LEGEND**

Census Tract

Neighborhood

Census Tract 1402 MFI= $7,856
Site A: Brewery St./Post Office
Site B: Spring St./Cedar St.

Census Tract 1406 MFI= $12,281
Site A: Davenport St.
Site B: Legion St./Vine St.

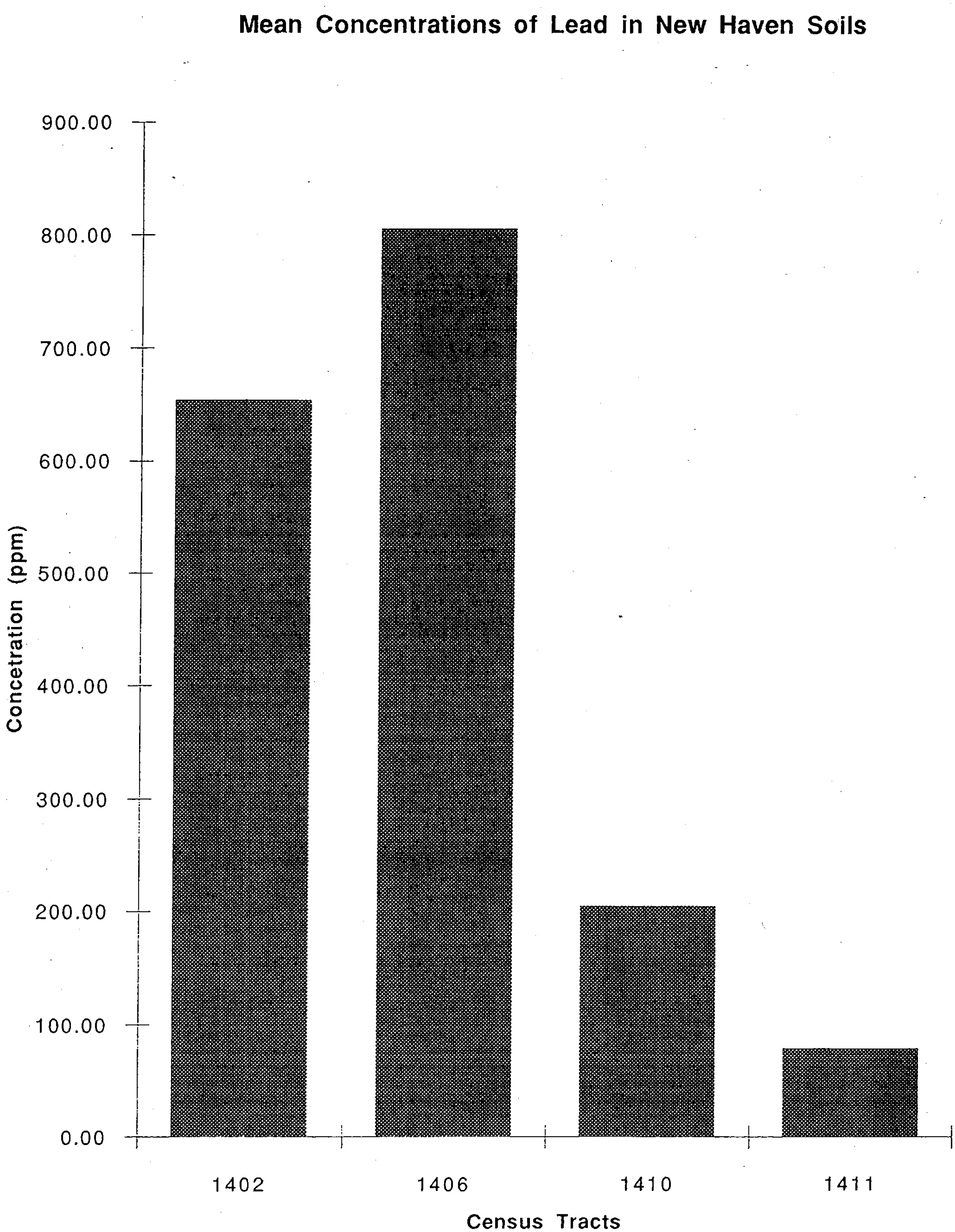
Census Tract 1410 MFI= $46, 964
Site A: Edgewood Park
Site B: 2028 Chapel St.

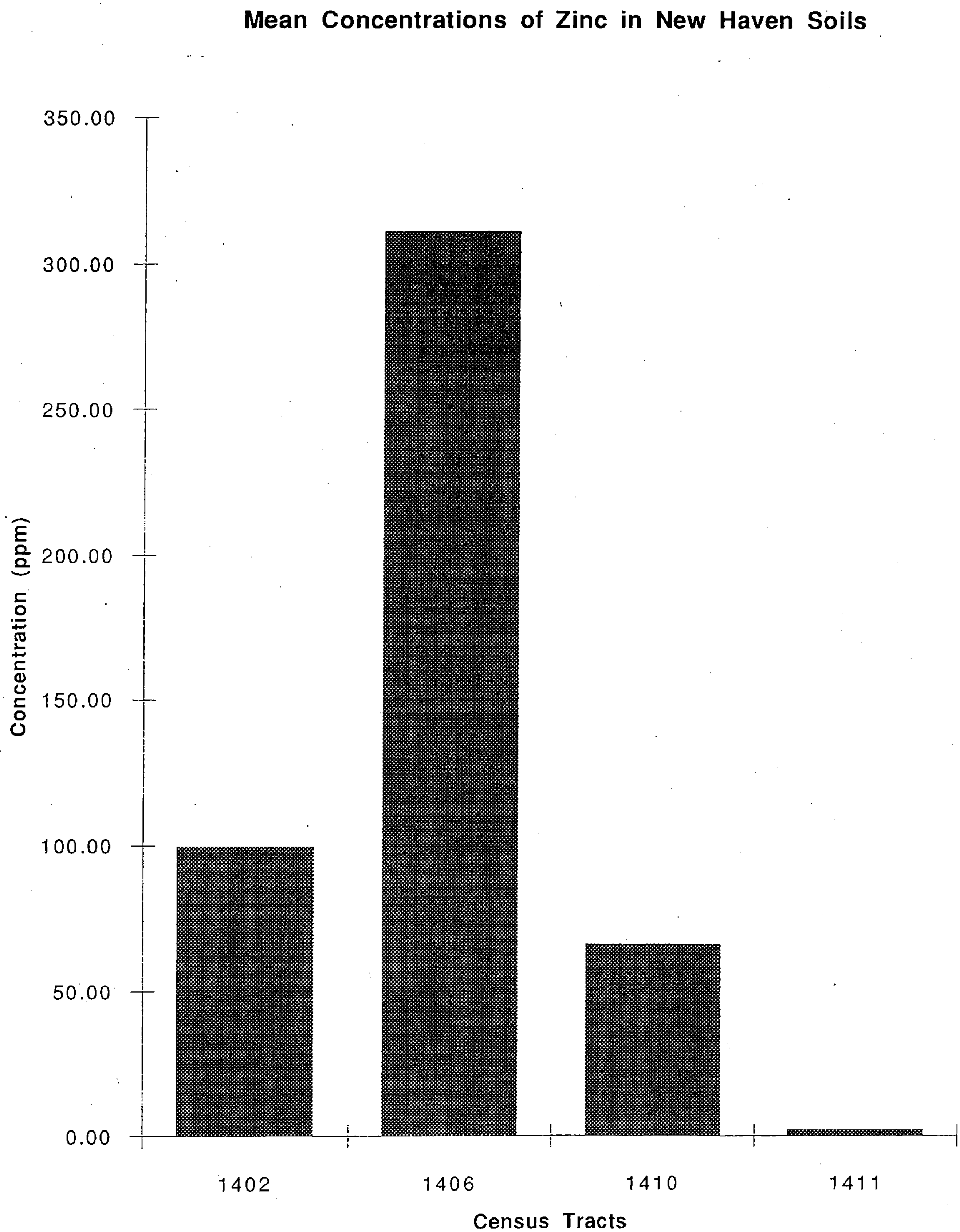
Census Tract 1411 MFI= $54,069
Site A: Yale Golf Course Road
Site B: 75 Laurel St.

MFI = Median Family Income

**Miles**

0 1 2


Mean Concentrations of Lead in New Haven Soils
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Concetration (ppm)
1402
1406
1410
1411
Census Tracts


Mean Concentrations of Zinc in New Haven Soils
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Concentration (ppm)
1402
1406
1410
1411
Census Tracts

## Mean Concentrations of Copper in New Haven Soils

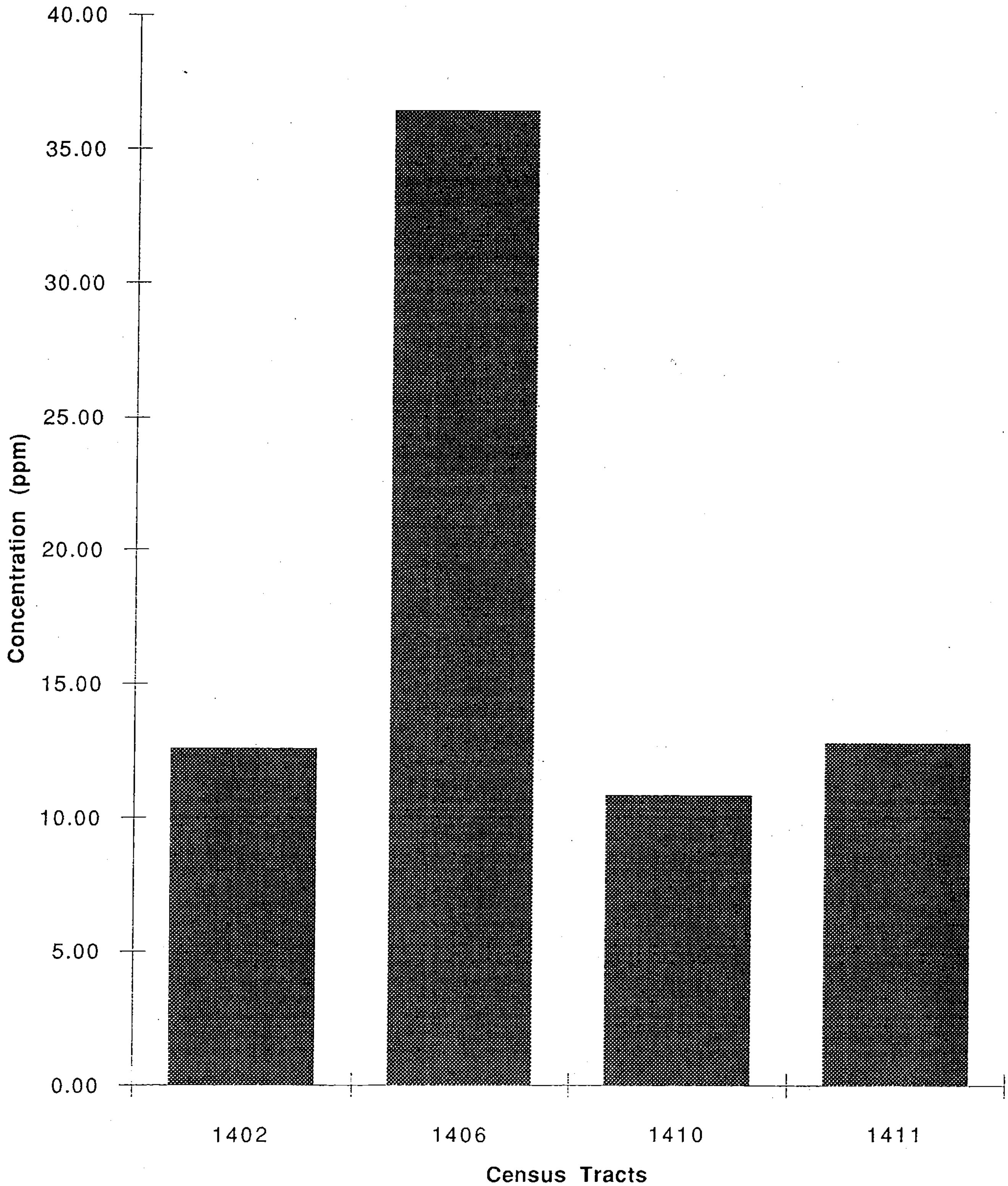


Table of Results - New Haven Soil Study

| Code # | Census Tract | Address | Weight Coarse fragments (g) | Weight. 2 mm (g) | Crucible Weight (g) | Crucible & sample wt. (g) | Crucible & ash wt. (g) | Sample size (g) | %LOI | Bulk Density g/cm3 | Kg soil m2 | Lead ppm | Lead g/m2 | Zinc ppm | Zinc g/m2 | Copper ppm | Copper g/m2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D14 | 1402 | Brewery/ P.O. | 1.79 | 44.18 | 9.54 | 11.54 | 11.52 | 2.00 | 1.00 | 0.95 | 46.90 | 5.00 | 0.23 | 14.50 | 0.68 | 5.00 | 0.23 |
| D19 | 1402 | Brewery/ P.O. | 2.56 | 51.94 | 8.58 | 10.58 | 10.56 | 2.00 | 1.00 | 1.13 | 55.14 | 4.75 | 0.26 | 8.75 | 0.48 | 4.50 | 0.25 |
| D24 | 1402 | Spring & Cedar | 4.53 | 32.92 | 10.74 | 12.74 | 12.66 | 2.00 | 4.00 | 0.73 | 34.95 | 742.50 | 25.95 | 221.67 | 7.75 | 27.25 | 0.95 |
| D30 | 1402 | Brewery/ P.O. | 4.43 | 54.06 | 7.18 | 9.18 | 9.15 | 2.00 | 1.50 | 1.19 | 57.39 | 4.00 | 0.23 | 11.75 | 0.67 | 4.00 | 0.23 |
| D31 | 1402 | Spring & Cedar | 3.11 | 45.58 | 6.89 | 7.09 | 7.08 | 0.20 | 5.00 | 0.99 | 48.39 | 1602.50 | 77.54 | 140.00 | 6.77 | 37.00 | 1.79 |
| D32 | 1402 | Brewery/ P.O. | 2.16 | 67.23 | 10.29 | 12.29 | 12.29 | 2.00 | 0.00 | 1.45 | 71.37 | 1.25 | 0.09 | 6.00 | 0.43 | 3.50 | 0.25 |
| D33 | 1402 | Spring & Cedar | 5.31 | 54.68 | 7.75 | 7.95 | 7.95 | 0.20 | 0.00 | 1.21 | 58.05 | 547.50 | 31.78 | 210.00 | 12.19 | 19.75 | 1.15 |
| D34 | 1402 | Spring & Cedar | 2.28 | 56.05 | 7.78 | 7.98 | 7.98 | 0.20 | 0.00 | 1.21 | 59.50 | 4415.00 | 262.70 | 532.50 | 31.68 | 29.25 | 1.74 |
| D36 | 1402 | Brewery/ P.O. | 3.7 | 57.65 | 9.86 | 11.86 | 11.83 | 2.00 | 1.50 | 1.26 | 61.20 | 17.75 | 1.09 | 8.00 | 0.49 | 6.25 | 0.38 |
| D37 | 1402 | Spring & Cedar | 1.36 | 58.27 | 9.02 | 11.02 | 10.97 | 2.00 | 2.50 | 1.25 | 61.86 | 132.75 | 8.21 | 39.25 | 2.43 | 14.75 | 0.91 |
| D40 | 1402 | Spring & Cedar | 3.77 | 27.33 | 6.96 | 7.16 | 7.15 | 0.20 | 5.00 | 0.60 | 29.01 | 367.50 | 10.66 | 115.00 | 3.34 | 19.25 | 0.56 |
| D50 | 1402 | Brewery/ P.O. | 4.38 | 57.24 | 9.95 | 11.95 | 11.95 | 2.00 | 0.00 | 1.26 | 60.76 | 4.75 | 0.29 | 11.75 | 0.71 | 5.00 | 0.30 |
| D18 | 1406 | Legion & Vine | 4.91 | 41.8 | 9.73 | 11.73 | 11.68 | 2.00 | 2.50 | 0.92 | 44.37 | 36.75 | 1.63 | 26.25 | 1.16 | 7.25 | 0.32 |
| D21 | 1406 | Legion & Vine | 5.95 | 41.18 | 9.62 | 11.62 | 11.59 | 2.00 | 1.50 | 0.92 | 43.72 | 20.75 | 0.91 | 24.00 | 1.05 | 11.75 | 0.51 |
| D27 | 1406 | Legion & Vine | 8.11 | 45.12 | 10.53 | 12.53 | 12.49 | 2.00 | 2.00 | 1.02 | 47.90 | 26.25 | 1.26 | 30.75 | 1.47 | 12.00 | 0.57 |
| D29 | 1406 | Legion & Vine | 4.25 | 38.27 | 10.1 | 12.1 | 12.05 | 2.00 | 2.50 | 0.84 | 40.63 | 62.25 | 2.53 | 35.25 | 1.43 | 9.00 | 0.37 |
| D3 | 1406 | Davenport | 1.51 | 38.35 | 6.76 | 6.96 | 6.95 | 0.20 | 5.00 | 0.82 | 40.71 | 1345.00 | 54.76 | 580.00 | 23.61 | 91.25 | 3.71 |
| D35 | 1406 | Legion & Vine | 6.13 | 34.13 | 7.23 | 9.23 | 9.18 | 2.00 | 2.50 | 0.76 | 36.23 | 38.50 | 1.39 | 26.00 | 0.94 | 9.00 | 0.33 |
| D38 | 1406 | Legion & Vine | 8.9 | 44.78 | 10.12 | 12.12 | 12.07 | 2.00 | 2.50 | 1.02 | 47.54 | 23.25 | 1.11 | 22.00 | 1.05 | 7.25 | 0.34 |
| D4 | 1406 | Davenport | 0.8 | 51.61 | 7.33 | 7.53 | 7.52 | 0.20 | 5.00 | 1.10 | 54.79 | 2395.00 | 131.22 | 770.00 | 42.19 | 49.50 | 2.71 |
| D47 | 1406 | Davenport | 1.22 | 37.27 | 7.3 | 7.5 | 7.49 | 0.20 | 5.00 | 0.80 | 39.56 | 790.00 | 31.26 | 380.00 | 15.03 | 51.75 | 2.05 |
| D5 | 1406 | Davenport | 2.47 | 34.08 | 10.14 | 10.34 | 10.33 | 0.20 | 5.00 | 0.74 | 36.18 | 2065.00 | 74.71 | 607.50 | 21.98 | 47.75 | 1.73 |
| D6 | 1406 | Davenport | 3.9 | 41.15 | 7.4 | 7.6 | 7.58 | 0.20 | 10.00 | 0.90 | 43.68 | 1657.50 | 72.41 | 802.50 | 35.06 | 81.00 | 3.54 |
| D7 | 1406 | Davenport | 4.12 | 39.6 | 7.63 | 7.83 | 7.82 | 0.20 | 5.00 | 0.87 | 42.04 | 1205.00 | 50.66 | 430.00 | 18.08 | 59.75 | 2.51 |
| D1 | 1410 | Edgewood pk | 0 | 44.41 | 10.61 | 12.61 | 12.46 | 2.00 | 7.50 | 0.94 | 47.14 | 87.50 | 4.13 | 44.00 | 2.07 | 9.50 | 0.45 |
| D15 | 1410 | Edgewood pk | 0.38 | 48.42 | 10.13 | 12.13 | 12.01 | 2.00 | 6.00 | 1.03 | 51.40 | 232.50 | 11.95 | 46.00 | 2.36 | 10.00 | 0.51 |
| D16 | 1410 | Edgewood pk | 1.77 | 55.53 | 10.63 | 12.63 | 12.55 | 2.00 | 4.00 | 1.20 | 58.95 | 273.75 | 16.14 | 40.75 | 2.40 | 11.00 | 0.65 |
| D2 | 1410 | 2028 Chapel | 0.6 | 37.07 | 7.09 | 9.09 | 8.95 | 2.00 | 7.00 | 0.79 | 39.35 | 234.25 | 9.22 | 88.33 | 3.48 | 12.50 | 0.49 |
| D22 | 1410 | Edgewood pk | 0.22 | 47.03 | 6.62 | 8.62 | 8.46 | 2.00 | 8.00 | 1.00 | 49.93 | 148.75 | 7.43 | 39.25 | 1.96 | 8.50 | 0.42 |
| D23 | 1410 | 2028 Chapel | 1.71 | 34.98 | 9.59 | 11.59 | 11.44 | 2.00 | 7.50 | 0.75 | 37.13 | 156.75 | 5.82 | 89.50 | 3.32 | 12.75 | 0.47 |
| D26 | 1410 | 2028 chapel | 1.01 | 27.76 | 9.08 | 11.08 | 10.86 | 2.00 | 11.00 | 0.59 | 29.47 | 171.75 | 5.06 | 71.25 | 2.10 | 10.00 | 0.29 |
| D39 | 1410 | Edgewood Pk. | 0.15 | 47.35 | 9.73 | 11.73 | 11.56 | 2.00 | 8.50 | 1.01 | 50.27 | 108.75 | 5.47 | 52.50 | 2.64 | 10.25 | 0.52 |
| D41 | 1410 | 2028 Chapel | 0.23 | 37.58 | 8.63 | 8.83 | 8.81 | 0.20 | 10.00 | 0.80 | 39.89 | 232.50 | 9.28 | 117.50 | 4.69 | 13.00 | 0.52 |
| D52 | 1410 | 2028 Chapel | 0.32 | 32.27 | 9.6 | 11.6 | 11.44 | 2.00 | 8.00 | 0.69 | 34.26 | 175.75 | 6.02 | 56.25 | 1.93 | 8.00 | 0.27 |
| D8 | 1410 | Edgewood Pk | 1.72 | 47.23 | 7.79 | 9.79 | 9.66 | 2.00 | 6.50 | 1.02 | 50.14 | 381.67 | 19.14 | 47.00 | 2.36 | 14.00 | 0.70 |
| D9 | 1410 | 2028 Chapel | 1.87 | 34 | 10.01 | 10.21 | 10.2 | 0.20 | 5.00 | 0.73 | 36.09 | 260.00 | 9.38 | 110.00 | 3.97 | 10.75 | 0.39 |
| 10 | 1411 | 75 LAUREL ST. | 1.81 | 33.76 | 10.68 | 12.68 | 12.55 | 2.00 | 6.50 | 0.73 | 35.84 | 102.25 | 3.66 | 53.50 | 1.92 | 16.50 | 0.59 |
| D10 | 1411 | YALE GOLF COR | 3.18 | 17.77 | 9.67 | 11.67 | 11.39 | 2.00 | 14.00 | 0.39 | 18.86 | 61.50 | 1.16 | 35.00 | 0.66 | 8.75 | 0.17 |
| D13 | 1411 | YALE GOLF COR | 3.75 | 46.24 | 10.43 | 12.43 | 12.32 | 2.00 | 5.50 | 1.01 | 49.09 | 76.50 | 3.76 | 46.75 | 2.29 | 9.25 | 0.45 |
| D17 | 1411 | YALE GOLF COR | 3.02 | 25.67 | 10.01 | 12.01 | 11.8 | 2.00 | 10.50 | 0.56 | 27.25 | 59.75 | 1.63 | 34.50 | 0.94 | 16.25 | 0.44 |
| D20 | 1411 | YALE GOLF COR | 3.91 | 39.08 | 10.31 | 12.31 | 12.19 | 2.00 | 6.00 | 0.86 | 41.49 | 41.75 | 1.73 | 14.25 | 0.59 | 2.75 | 0.11 |
| D25 | 1411 | YALE GOLF COR | 4.29 | 43.51 | 7.17 | 9.17 | 9.07 | 2.00 | 5.00 | 0.96 | 46.19 | 87.00 | 4.02 | 40.00 | 1.85 | 11.00 | 0.51 |
| D45 | 1411 | YALE GOLF COR | 3.39 | 24.31 | 10.64 | 12.64 | 12.4 | 2.00 | 12.00 | 0.53 | 25.81 | 53.00 | 1.37 | 34.00 | 0.88 | 8.00 | 0.21 |
| D48 | 1411 | 75 LAUREL ST. | 0.98 | 32.67 | 10.69 | 12.69 | 12.56 | 2.00 | 6.50 | 0.70 | 34.68 | 98.50 | 3.42 | 57.75 | 2.00 | 10.00 | 0.35 |
| D51 | 1411 | 75 LAUREL ST. | 12.44 | 27.99 | 10.14 | 12.14 | 12 | 2.00 | 7.00 | 0.66 | 29.71 | 107.50 | 3.19 | 54.00 | 1.60 | 23.50 | 0.70 |
| E4 | 1411 | 75 LAUREL ST. | 1.18 | 42.73 | 9.64 | 11.64 | 11.55 | 2.00 | 4.50 | 0.92 | 45.36 | 89.50 | 4.06 | 55.00 | 2.49 | 13.25 | 0.60 |
| E5 | 1411 | 75 LAUREL ST. | 1.76 | 48.24 | 10.43 | 12.43 | 12.33 | 2.00 | 5.00 | 1.04 | 51.21 | 95.50 | 4.89 | 79.17 | 4.05 | 12.00 | 0.61 |
| E8 | 1411 | 75 LAUREL ST. | 0.12 | 39.65 | 10.29 | 12.29 | 12.13 | 2.00 | 8.00 | 0.84 | 42.09 | 91.25 | 3.84 | 120.83 | 5.09 | 21.00 | 0.88 |

12/17/93

City of New Haven Lead-Based Paint Risk Reduction Program
Abstract

## Risk of Exposure

| Census Tract | % of Housing Built before 19801[1] | % Children under 6 years living in poverty[2] | Confirmed Lead Poisoning Cases 1989-92[3] | Rank by Total Cases of Confirmed Lead Poisoning |
|---|---|---|---|---|
| 1401 | 96 | 0 | 0 | 28 |
| 1402 | 86 | 72 | 7 | 21 |
| 1403 | 94 | 51 | 58 | 5 |
| 1404 | 93 | 19 | 56 | 6 |
| 1405 | 79 | 53 | 69 | 3 |
| 1406 | 69 | 62 | 133 | 1 |
| 1407 | 95 | 45 | 24 | 12 |
| 1408 | 90 | 39 | 33 | 9 |
| 1409 | 97 | 15 | 27 | 10 |
| 1410 | 98 | 0 | 1 | 26 |
| 1411 | 88 | 7 | 0 | 27 |
| 1412 | 96 | 27 | 12 | 17 |
| 1413 | 87 | 54 | 19 | 14 |
| 1414 | 84 | 14 | 23 | 13 |
| 1415 | 88 | 50 | 60 | 4 |
| 1416 | 91 | 45 | 70 | 2 |
| 1417 | 97 | 88 | 1 | 25 |
| 1418 | 98 | 26 | 6 | 23 |
| 1419 | 99 | 14 | 14 | 15 |
| 1420 | 93 | 9 | 6 | 22 |
| 1421 | 98 | 21 | 13 | 16 |
| 1422 | 99 | 0 | 7 | 20 |
| 1423 | 74 | 41 | 52 | 7 |
| 1424 | 90 | 33 | 39 | 8 |
| 1425 | 96 | 36 | 11 | 11 |
| 1426 | 89 | 13 | 9 | 19 |
| 1427 | 80 | 24 | 9 | 18 |
| 1428 | 92 | 0 | 1 | 24 |
| Total | | | 774 | |

Please note that endnotes appear at the end of this section.

## *Bibliography*


Agency for Toxic Substances and Disease Registry (ATSDR). 1988. *The Nature and Extent of Lead Poisoning in Children in the United States: A Report to Congress.* Atlanta: ATSDR.

Been, V. 1993. *What's Fairness Got to do With it? Environmental Justice and the Siting of Locally Undesirable Land Uses.* Cornell Law Review, 6, 1001.

Begley, R. a. H., D. 1993. *Environmental Justice: Staying Ahead.* Chemical Week(September 15).

Brady, N. C. 1990. *The Nature and Property of Soils.* New York: MacMillan Publishing Company.

Committee on Environmental Hazards 1984-1986, P. J. L., MD, Chairman (1987). *Statement on Childhood Lead Poisoning* . American Academy of Pediatrics.

Center for Disease Control. 1985. *Preventing Lead Poisoning in Children* . U.S. Department of Health and Human Services.

Center for Disease Control. 1991. *Preventing Lead Poisoning in Young Children* . U.S. Department of Health and Human Services.

Commission on Racial Justice. 1987. *Toxic Waste and Race in the United States* . United Church of Christ.

Council on Scientific Affairs. 1985. *Effects of Toxic Chemicals on the Reproductive System.* Journal of the American Medical Association. June 21.

Department of Health. 1993. *Childhood Lead Poisoning Prevention Program Progress Report (Fourth Quarter & Year End Report.* City of New Haven, CT Department of Health.

Dubin, J. C. 1992. *From Junkyards to Gentrification: Explicating a Right to Protective Zoning in Low-Income Communities.* Minnasota Law Review, 77, 739.

Environmental Defense Fund (EDF). 1990. *Legacy of Lead: America's Continuing Epidemic of Childhood Lead Poisoning. A Report and Proposal for Legislative Action.* Washington, D.C.: EDF.

Environmental Protection Agency (EPA). (1986). *Air Quality Criteria for Lead* EPA/600/8-83-028aF). EPA, Office of Health and Environmental Assessment.

Grossman, K. 1992. *From Toxic Racism to Environmental Justice.* E Magazine. May/June 1992. p. 30-35.

Harte, J (Ed.). 1991. *Toxics A to Z: A guide to Everyday Pollution Hazards.* Berkeley: University of California Press.

Hess, P. R. 1971. *A Textbook of Soil Chemical Analysis*. New York: Chemical Publishing Co., Inc.

Miller, K. 1993. *Civil Rights Report Validates 'Environmental Injustice' Claims.* Gannett News Service(September 17).

Moore, J. W. and Ramamorthy, S. 1984. *Heavy Metals in Natural Waters*. New York: Springer-Verlag.

Needleman, H. L. 1988. *Why Should We Worry About Lead Poisoning.* Contemporary Pediatrics. March, 1988. 34-56.

Rabinovitz, M. B. e. a. 1976. *Kinetic Analysis of Lead Metabolism in Healthy Humans*. Journal of Clinical Investigation, 58, 260 - 270.

Reich, P. L. 1992. *Greening the Ghetto: A Theory of Environmental Race Discrimination*. Kansas Law Review, 41, 271-297.

Russell, D. 1989. *Environmental Racism*. The Amicus Journal. Spring 1989. 22-32.