ENVIRONMENTAL LEAD RISK IN THE TWIN CITIES

by Howard W. Mielke and John L. Adams

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A publication of the Center for Urban and Regional Affairs, 330 Hubert H. Humphrey Center, 301 19th Avenue S., Minneapolis, Minnesota 55455.

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CONTENTS

PREFACE

The maps showing urban lead contents in this report are the first of their kind. Lead dust is very toxic and not detectable by the human senses. In order to detect lead one needs analytical equipment. The maps summarize what is known about the pattern of lead contents distributed within the Twin Cities. The maps indicate where exposure to lead causes the highest risk to the resident population. A major means of reducing exposure in order to prevent ill effects from lead would be through dust control in the affected urban communities.

The Urban Lead Mapping Project was started at Macalester College with the collection and analysis of soil samples beginning in the summer of 1984. Chemical analysis of the soils was completed in 1985. The Urban Lead Mapping Project was then continued at the Center for Urban and Regional Affairs (CURA) in the summer of 1986 and completed in June 1988. In addition to the soil-lead data collected by the Urban Lead Mapping Project (hereafter referred to as the CURA data set), data were obtained from the lead project conducted by the Minnesota Pollution Control Agency (MPCA). The two projects differed in scope. The CURA data set was intensive and focused on collection of about 2,000 soil samples within 52 census tracts in the metropolitan area. The MPCA data set was extensive and involved the collection of about 1,000 soil samples in 109 census tracts within the boundaries of the Twin Cities. In twenty-one census tracts soil samples were collected by both projects. The combined MPCA and CURA data were used to make the houseside and streetside lead maps. The midyard map was based on MPCA data alone because midyard samples were not collected as a part of the CURA data set. As part of the state program, the Minnesota Department of Health (MDH) tested the blood lead levels of children during the summers of 1986 and 1987. The blood lead testing was conducted at least seven months after the 91 percent phase-down of lead content in gasoline, which began January 1, 1986. The testing was usually done in the same census tracts that were sampled for soil-lead. The blood lead survey provides an indication of the relative degree to which children are exposed to lead as they reside in various communities.

Many people, including college students, colleagues, elected officials, health workers, and public agency staffs have contributed directly and indirectly to the production of the maps in this report. Major funding for the mapping project came from the Saint Paul Foundation, Incorporated along with matching grants from Macalester College, the City of St. Paul, and the Center for Urban and Regional Affairs. To the people and institutions who helped make this effort possible we express our sincere appreciation.

LEAD, THE SILENT EPIDEMIC

Environmental Lead Exposure

Excessive lead exposure is a major problem facing American society. It is important that everyone, regardless of who they are or where they live, learn about this environmental problem. Solutions will come only with an understanding of the problem.

Population exposure to lead occurs as a result of the extensive use of lead in many manufactured products. Besides lead dust, which was mapped in this project, there are many other sources of lead exposure. Foods stored in cans soldered with lead, for example, and drinking water that passes through lead pipes may contain unacceptable trace amounts of lead. Much progress has taken place in reducing exposure to these lead sources in recent years, but there is still more to be done to remedy the problem. Lead dust is a legacy from several sources including leaded gasoline emissions, industrial waste emissions, and leaded paint. Leaded paint is a major hazard when there is direct contact or it is deteriorating or removed from surfaces in a manner that generates dust.

How Does Someone Become Exposed to Lead Dust?

Part of the answer depends on where a person lives. In rural agricultural lands the background lead levels in soils are between 5 and 10 parts per million (ppm). Urban residential soil contains at least 10 to 100 times more lead than rural soil. The maps printed here show the distribution of lead particles that have accumulated in the Twin Cities. Exposure is determined by the condition of the environment and personal habits of the individual. For example, where there are large expanses of uncovered dirt it is very likely that during winds, dust and the pollutants contained in that dust will become airborne. However the amount of lead in the air is not usually sufficient to cause a problem. A more important form of lead exposure is through ingestion of lead contaminated dust and soil. Lead contaminated dust may coat food preparation surfaces and settle on food and eating utensils. When adults ingest lead dust, they absorb and retain about 8 percent of the total lead ingested. Adult exposure to lead dust is generally low, although even low exposure can cause problems. Children are the most sensitive population of society and even low lead exposures for pregnant women and nursing mothers may adversely affect the health of their children.

Who is at Greatest Risk of Exposure to Lead Dust?

Next to fetuses, children between the ages of nine months and six years are most at risk from lead exposure. There are fundamental reasons why this is the case. First, during early development, children place their hands and objects into their mouths. This hand-to-mouth activity is an essential part of normal development and all children undertake this activity. When children play outside, a portion of them (about 5 to 10 percent) consume about 5 grams or more of soil-dust per day. A second reason children are at greatest risk has to do with their rate of absorption and retention of the lead they ingest. Children absorb and retain about 50 percent of the lead they ingest, or at least six times more than adults. Given the long winters, it would be expected that Minnesota children have a seasonal variation in lead exposure. In fact, the risk of lead exposure varies with the season. The risk of exposure is lowest during winter, when children are indoors and the ground is frozen, and highest during summer when children play outdoors and the dirt is exposed.

Some groups of children are at greater risk of exposure than others. For example, boys are at higher risk of exposure than girls, probably because boys' play tends to expose them more to dirt. Children from poor families are at greater risk than children from wealthy families. Black and Indian children are at greater risk than white children. Many factors enter into the increased risk of lead exposure for various groups of children. The lead maps will assist us in understanding these factors.

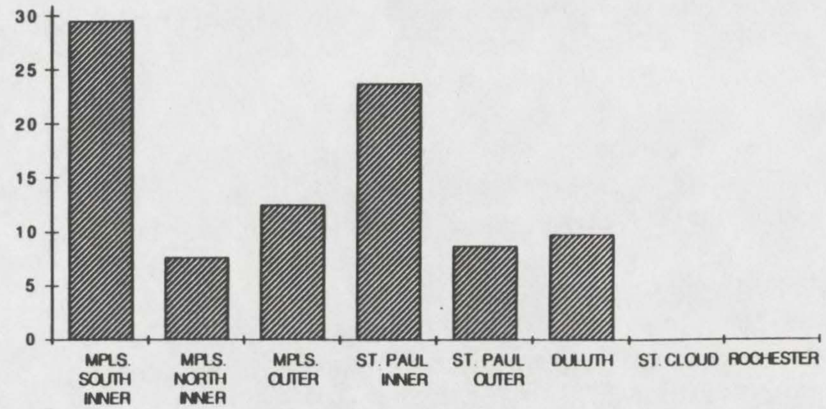
The maps show that the pattern of potential risk to lead exposure varies from one place to another. Communities where children of lower socio-economic groups live within the Twin Cities tend to have the highest lead contents. These same communities tend to be the most rundown areas and have yards that are poorly maintained. When dirt is devoid of vegetative cover, the lead it contains is more accessible to children. It is likely that the area of bare soil surface in a community influences the amount of dust and hence lead exposure for the people of a whole community.

Nutritional factors are also important. Children with less nutritious diets, especially when they have iron and calcium deficiencies or a large amount of fat in their diet, absorb and retain more lead than children with more nutritious diets. Low nutritional status exacerbates the dangers of exposure to lead for children. When these risk factors are combined it becomes clear why lead exposure is a silent epidemic. The poorest and youngest members of the population, those that we pay least attention to, are at greatest risk.

In 1985, the amount of lead recognized as a guideline for intervention was lowered from 30 to 25 micrograms (ug) of lead per deciliter (dl) of blood (USDHHS 1985). During recent years, a number of researchers have investigated the effects of exposure to low levels of lead on children. They have shown a progressive decline in the levels of exposure at which adverse health effects can be reliablydemonstrated. By the end of 1987, it was recognized that 10 to 15 ug/dl and even lower levels of lead exposure are associated with subtle and adverse effects on the central nervous system which affect hearing, memory, and attention span (Bellinger et al. 1987; ATSDR 1988; EPA 1986). These toxic effects influence the developing child's ability to learn. The toxic effects of lead on the central nervous system appear to be persistent and may be irreversible. Thus, even though there has been enormous progress in reducing lead exposure during the past decade, it has also become apparent that the scope of lead poisoning in childhood is far greater than had been realized before.

The relative degree of risk in various parts of the Twin Cities is illustrated in Figure 1. Data come from a large sample of children tested as part of a two-year survey in 1986-87 conducted by the Minnesota Department of Health. Note how blood lead in urban children compares with children from less urban areas. About twice as many of the children tested in south inner-city Minneapolis and inner-city St. Paul had blood lead contents of 15 ug/dl or more compared to children living in other city locations. None of the children tested in St. Cloud or Rochester had blood lead contents of 15 ug/dl or more. Risk from lead exposure appears to be very low in smaller cities. Fewer children in north inner-city Minneapolis had blood

Figure 1. PERCENT OF SAMPLE* WITH BLOOD LEAD CONTENTS OF 15 UG/DL OR MORE



* This is not a random sample of children in these communities. Children were tested within five blocks of soil samples measuring lead content of 1,000 ppm or more. Though the percents may not be accurate, they do show the relative differences among these communities.

lead contents of 15 ug/dl or more than in south inner-city Minneapolis. The lead risk maps show that the soils of north inner-city Minneapolis have lower lead contents than south inner-city Minneapolis. The potential risk from lead exposure varies according to city size and location of residence, especially, as shall be described, with respect to congested traffic in larger cities.

Lead Contents of Public Parks and Playgrounds

The parks and playgrounds sampled in the Twin Cities as part of this project were found to be very safe places for children. As a rule of thumb, a safe lead content for bare soil where children play is about 100 ppm or less. A soil with 100 ppm of lead will deliver about 25 ug lead per day to the 'average' child. This number is determined by multiplying the amount of soil-dust consumed times rate of absorption and retention times lead content of the soil (or 0.5 g x 0.50 x 100 ppm = 25 ug lead). None of the parks or playgrounds sampled in this survey contained soils with lead content anywhere close to 100 ppm. Park and playground soils have the lowest lead contents of the sites examined in the Twin Cities. Table 1, in the appendix, names and shows the lead contents of each park and playground sampled as a part of this survey. Map 4, in the appendix, shows the location of each of the parks and playgrounds with a tree. The letters next to the trees correspond to the letters on Table 1.

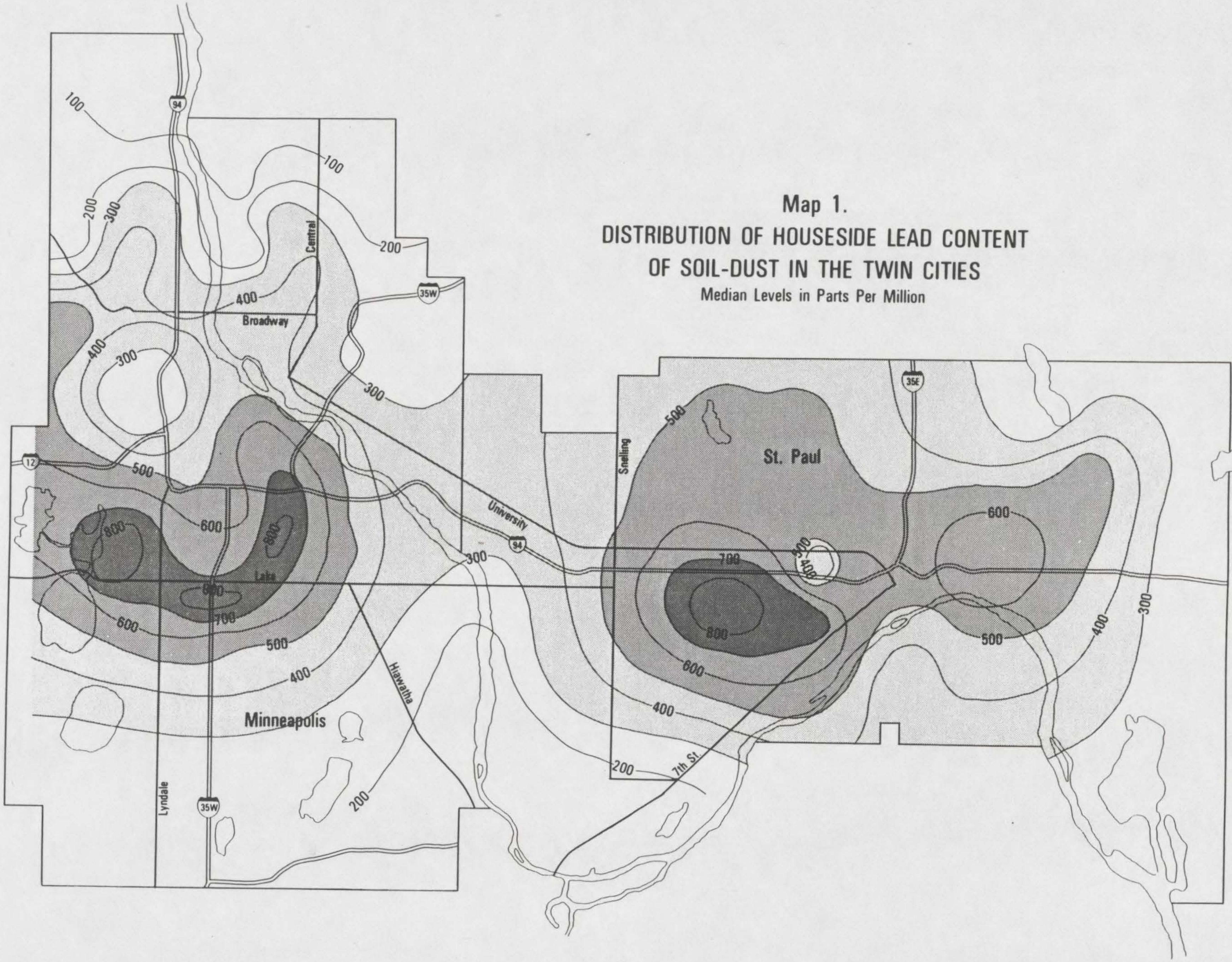
Lead Contents of Soil-Dust on Residential Properties

Very young children probably do not spend much time playing in city parks and playgrounds. They are most likely to play in areas around their home. Unlike parks and playgrounds, residential properties may pose a risk of high lead exposure for children. The degree of risk varies with location. The maps provide a visual pattern of the urban lead contents of soil-dust for three different types of environments: alongside residential structures (houseside), next to streets (streetside), and within the middle of the yard (midyard).

EXPLANATION OF THE ENVIRONMENTAL LEAD RISK MAPS

The following sections describe the meaning of the houseside, streetside, and midyard maps in terms of the risks of lead exposure and the policy implications of the findings. Each map reflects the middle quantity (not the extreme quantity) of the actual lead content that was found in the soil. A fourth map, in the appendix, shows the locations of the fifty-two communities where the soil samples were taken for the CURA data set. They are indicated by lettered rectangles. The letters correspond with the letters on Tables 2 and 3, in the appendix, which give more details on the lead content of each site. The 109 census tracts where the MPCA collected soil are not indicated on map 4.

The contours on maps 1, 2, and 3 were interpolated statistically from the sampled areas of both the CURA data set and the MPCA data. The contours show graphically the observed lead contents in the Twin Cities around housesides, in midyards, and along streetsides.



Map 1.
DISTRIBUTION OF HOUSESIDE LEAD CONTENT
OF SOIL-DUST IN THE TWIN CITIES
Median Levels in Parts Per Million

Map 1. The Houseside Soil-Dust Lead Map

The highest lead contents found in soil-dust samples in the Twin Cities were found in houseside samples. In the twenty-one census tracts where both the MPCA and CURA collected samples, the results were in close agreement.* Lead has accumulated in the soil around the foundation and entrances of residential structures. Steps are a favorite play area for children and the bare dirt immediately around steps may be very enticing as a play area. These sites generally contain the highest lead contents found within the community. The map shows the distribution of houseside soil lead content by 'medians' for all the homes sampled, both painted and unpainted, in a community. 'Median' refers to the middle sample for a given sample set. Half of the samples measured above the median and half of the samples measured below the median. Each line or contour interval on the map connects areas which have corresponding soil lead quantities around the housesides. Note that the median lead content of soils around homes is above 100 ppm in most parts of the Twin Cities. The highest quantities are found in the inner-city communities of both south Minneapolis and St. Paul.

More detailed data about lead contents around homes are found in Table 2 of the appendix. The contours on Map 1 are not definitive toward the outside of the city. Only a few suburban areas were sampled. Therefore, because data was lacking, the contours are poorly defined or lacking on the outskirts of the city.

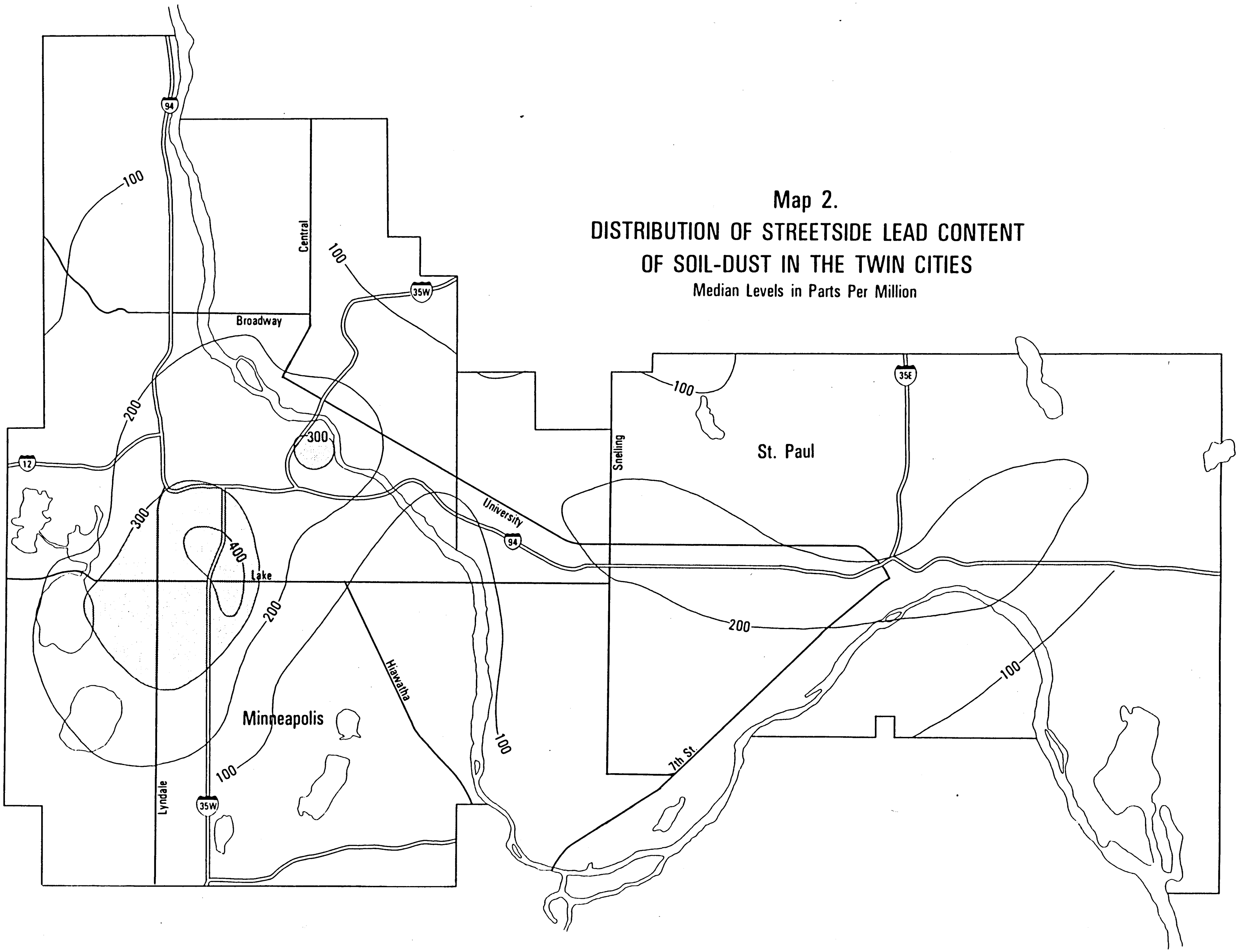
One community in inner-city St. Paul (community Z on Table 2 and Map 4) has much lower lead contents than the surrounding communities. This community, just west of the Rice Street Sears store, was rebuilt and relandscaped during urban redevelopment. It provides a practical example of the steps that can be taken to ameliorate environmental lead in a community with high concentrations of lead. A suburban community in St. Louis Park (not shown here, but marked as MCC on Map 4) has higher lead levels than expected. It is located near a former secondary lead smelter. Although the soils around older homes generally contain more lead, the homes of one of the oldest communities, North St. Paul (on Map 4), exhibit far lower lead levels than communities of a similar age within the inner-city.

Table 2, in the appendix, breaks down the houseside lead content in each community sampled by the type of siding on the structure. In general, within each community, soils around painted structures have about twice the lead contents that soils around brick, stone, and stucco structures have.

Since paint is often regarded as the major source of lead, this fact is remarkable because of the large difference in area of paint found on each type of home. Generally, painted structures have four to six times more paint on them than comparable brick, stone or stucco structures. In some communities, the soil around brick, stone, or stucco structures has a higher lead content than around painted structures (Minneapolis communities MP, MS, and MCC and St. Paul communities L and W on Map 4 and Table 2). The painted structures of Minneapolis inner-city community MJ (Map 4 and Table 2) have soil lead contents that are several times higher than the brick, stone, and stucco structures of the same community. Given the lead content of old paint this is to be expected. However, brick, stone, and stucco structures also have unsafe amounts of lead contaminated dirt around them. The major point is that regardless of type of siding, soils around houses are the most contaminated in the urban environment. Children need the assistance of adults to guide them away from these areas, and efforts to prevent children from being exposed to these highly lead contaminated soils should be undertaken as a matter of public policy.

* The Pearson correlation coefficient was 0.66 (P-value = 0.001).

Map 2.
DISTRIBUTION OF STREETSIDE LEAD CONTENT OF SOIL-DUST IN THE TWIN CITIES
Median Levels in Parts Per Million



Map 2. The Streetside Soil-Dust Lead Map

Streetsides are also sites where soils contain elevated lead content. Again, in the twenty-one census tracts where both the MPCA and CURA collected samples, the results were in close agreement.* The distribution of median lead content for streetside soil-dust closely follows the pattern found in houseside soil-dust. In the CURA data set there is a very strong association between the two types of samples.** Table 3 of the appendix lists soil-dust lead of streetsides by community.

Streetside samples are most likely contaminated from emissions from vehicles that have used leaded gasoline during the past five decades or so. But only a portion of the lead emitted from vehicles ends up along the streetside. The lead particles from vehicle emissions follow a bimodal distribution. That is, about half of the airborne particles are large enough to fall out within 300 feet of the roadway and the other half are so small that they become entrained in the air. When these tiny airborne lead particles hit a structure they collect on the surface and eventually wash down into the surrounding soil. The buildings of the city are generally within fifty to seventy-five feet of the streetside so that they receive the major quantity of lead emissions from vehicles. The whole picture is complicated by the fact that buildings contain varying amounts of leaded paint. Most likely, the reason that soils next to brick, stone, and stucco structures contain about half the lead levels that soils next to painted structures contain is that they, like painted residences, are collection surfaces for airborne lead emissions. Most likely, the reason that the soil-dust of parks and playgrounds has been spared from severe contamination is that there are no massive structural surfaces in them to collect airborne lead particles.

The major finding is that accumulations of lead in the Twin Cities' streetside soil-dust are closely related to accumulations found in soil-dust around housesides. Comparison of the houseside and streetside maps shows that where traffic patterns have been historically congested, the houseside soil-dust lead contents are highest. Where traffic flows have been relatively low and uncongested, the quantity of lead in houseside soil-dust is lowest. The streetside-houseside relationship provides a major handle on the lead problem because it gives instant recognition of which parts of an urban area are most likely to have the highest accumulations and pose the greatest danger to young children.

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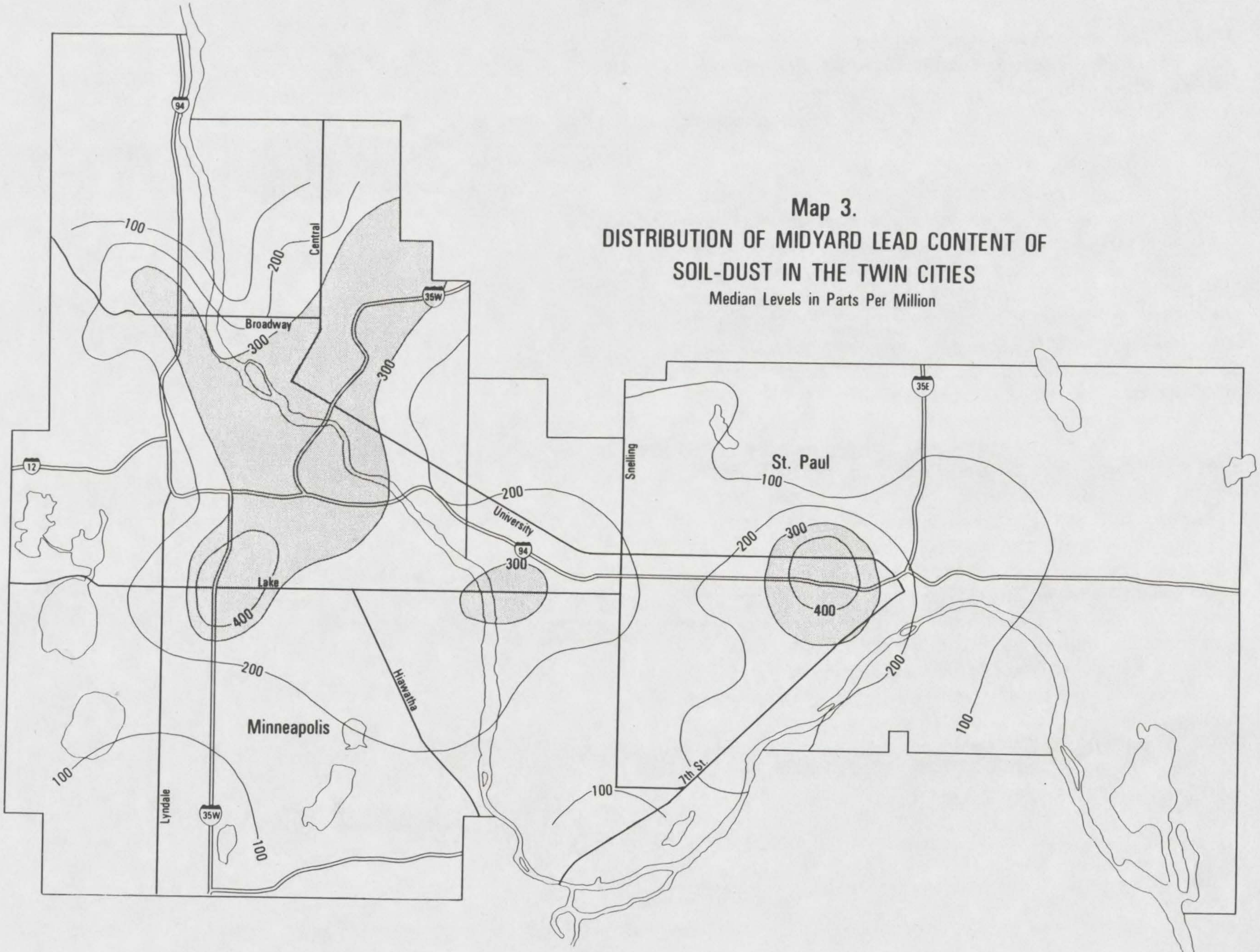
* The Pearson correlation coefficient was 0.60 (P-value = 0.01).

** The correlation coefficient between streetside and houseside samples was 0.72 (P-value = 0.001).

Map 3.
DISTRIBUTION OF MIDYARD LEAD CONTENT OF SOIL-DUST IN THE TWIN CITIES
Median Levels in Parts Per Million



Map 3. The Midyard Soil-Dust Lead Map

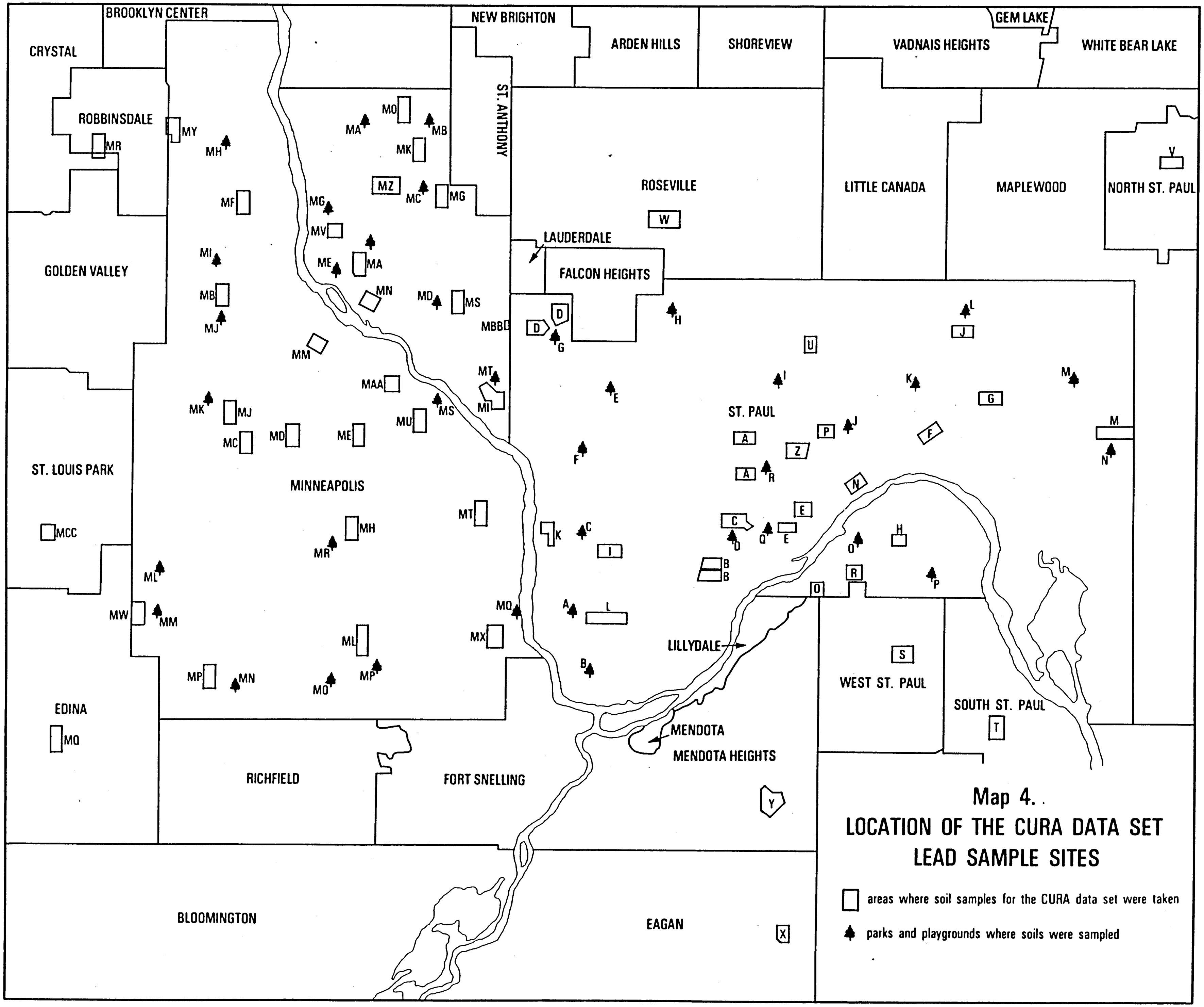
Samples from the middle of Twin Cities' yards were collected by the MPCA.* The map of midyard samples reveals a pattern which is similar to the other maps. Note again that the inner-cities of South Minneapolis and St. Paul both exhibit the highest soil-dust lead contents found in the Twin Cities.

* They have a correlation coefficient of 0.34 (P-value = 0.001) with houseside samples.

CONCLUSIONS

The maps in this report show the distribution of soil lead in the Twin Cities of St. Paul and Minneapolis, Minnesota. Lead is an extremely toxic substance that has been used in large quantities in our technological society. One of the outcomes of this usage has been the accumulation of lead dust in the soils of urban areas. Lead has accumulated in a pattern associated with geographic location within the city. All areas of the city have evidence of exposure problems, but the inner-city locations with highest traffic have the highest soil-dust lead contents. Childhood exposure as measured by blood lead contents follows the same trend as the pattern of lead in soil-dust. Some places within the city appear to be so lead contaminated that large numbers (over 20 percent) of the children who live there are at risk of suffering learning impairment due to lead exposure. These maps provide information that can be useful in ameliorating the problem. Dust may be controlled through a variety of practical measures, such as controlling the sources of interior and exterior lead dust; keeping children away from housesides; improving hygiene, diet, and nutrition; creating clean play spaces in yards and other play areas; and establishing a hardy ground cover (or some other barrier) to bare dirt. These are measures that should significantly reduce the risks of lead exposure for Minnesota's most vulnerable children.

APPENDIX



Map 4.

LOCATION OF THE CURA DATA SET LEAD SAMPLE SITES

Table 1. SUMMARY STATISTICS FOR PARKS AND PLAYGROUNDS: SOIL-DUST LEAD BY LOCATION

Combined Results for All Park and Playground Samples

Percentile:	25	50	75	90	Range (N)
ppm lead:	7	12	30	51	2-336(217)

Results by Each Park and Playground Location (in ppm lead)

Park Name*	Median	Range	Mean	Std. Dev.	(N)
St. Paul					
A: Hillcrest	8	8-22	11.6	6.07	(5)
B: Homecroft	6	5-20	8.5	5.82	(6)
C: Groveland	8	2-30	11.0	10.86	(6)
D: Linwood	10	2-22	11.0	8.26	(8)
E: Newell	12	2-27	13.1	9.55	(7)
F: Merriam	13	7-50	20.6	15.10	(7)
G: Langford Park	9	6-37	15.1	12.47	(7)
H: Northwest Como	10	5-20	11.6	5.68	(5)
I: Front	9	4-31	12.6	11.01	(5)
J: Valley	22	10-44	24.0	15.70	(6)
K: Wilder	10	4-73	20.8	29.37	(5)
L: Phalen Park	8	3-22	10.3	7.97	(6)
M: Hazel Park	13	4-123	36.8	46.92	(6)
N: Conway Heights	11	7-24	13.2	6.27	(6)
O: Baker	45	12-75	44.0	31.51	(3)
P: Belvidere	18	14-34	20.7	7.58	(6)
Q: Saint Clair	14	5-73	27.7	28.62	(6)
R: Martin Luther King	56	41-91	61.3	21.51	(6)

Park Name*	Median	Range	Mean	Std. Dev.	(N)
Minneapolis					
MA: Columbia	8	4-40	16.7	16.86	(6)
MB: Waite School	22	8-36	21.3	13.31	(6)
MC: Windom N.E.	10	8-60	23.3	22.83	(6)
MD: Van Cleve	12	12-32	16.0	8.00	(6)
ME: Dickman	30	4-100	37.3	38.92	(6)
MF: Logan	14	4-60	22.7	21.42	(6)
MG: Bottineau	22	4-36	20.7	14.84	(6)
MH: Folwell	16	4-24	15.0	8.87	(4)
MI: North Commons	8	4-36	13.3	12.82	(6)
MJ: Harrison	8	4-20	10.0	7.04	(6)
MK: Kenwood Park	16	12-20	16.0	5.66	(2)
ML: Linden Hills	14	4-28	14.7	10.01	(6)
MM: Pershing	16	8-56	21.3	18.18	(6)
MN: Kenny	10	4-12	8.7	3.93	(6)
MO: Diamond Lake	24	12-56	29.0	21.26	(4)
MP: Nokomis	12	4-336	68.0	131.77	(6)
MQ: Minnehaha	18	4-68	24.7	25.10	(6)
MR: Phelps	22	8-124	41.3	44.95	(6)
MS: Riverside	32	8-52	29.6	16.64	(5)
MT: Tower Hill	40	24-68	40.7	17.24	(6)

* See Map 4 for location by lettered trees.

Table 2. HOUSESIDE SOIL-DUST LEAD BY SIDING TYPE AND COMMUNITY: ST. PAUL (in ppm lead)

St. Paul Community		Painted Residences Percentile* 25	50	75	Range	(N)	Brick, Stone, or Stucco Residences Percentile* 25	50	75	Range	(N)	Other (Aluminum, Asbestos, or Composition) Percentile* 25	50	75	Range	(N)
A:	Frogtown	552	1120	2040	88-6800	(27)	269	430	974	216-1640	(8)	249	674	3500	132-5720	(6)
B:	Randolph & Lexington	158	306	529	76-3160	(22)	122	228	270	84-888	(13)	68	104	140	40-160	(7)
C:	Crocus Hill	480	1080	3480	112-10320	(23)	405	742	1044	88-8000	(30)	NA	NA	NA	NA	NA
D:	St. Anthony Park	156	476	932	52-3920	(47)	182	322	581	72-2520	(40)	228	520	1042	152-3040	(13)
E:	West Seventh/Ramsey Hill	408	784	1480	92-6360	(27)	380	760	1072	248-1360	(11)	NA	NA	NA	NA	NA
F:	St. John's Hospital	736	1280	3440	240-8200	(33)	431	554	1054	264-2160	(20)	453	887	1690	12-7200	(42)
G:	E. Minnehaha/Faux St.	404	820	1680	204-5120	(15)	66	280	593	48-1160	(8)	362	652	1230	208-1520	(18)
H:	Concord/S. Robert	300	1024	1650	120-2360	(10)	224	352	476	124-980	(7)	156	446	1087	28-2360	(26)
I:	Macalester/Groveland	288	656	1400	168-4480	(17)	166	316	534	64-988	(28)	110	176	404	68-728	(6)
J:	Payne/Phalen	100	288	760	60-956	(11)	108	178	223	36-768	(24)	164	424	944	144-3440	(13)
K:	Woodlawn/Randolph	136	424	1112	40-2760	(11)	131	206	334	64-580	(30)	NA	NA	NA	NA	NA
L:	Highland Park	60	103	200	52-224	(8)	113	164	281	48-1320	(24)	61	112	357	52-408	(10)
M:	Conway Heights	170	328	516	104-2120	(9)	44	68	104	24-240	(15)	69	104	182	36-472	(28)
O:	Cherokee Heights	327	440	821	116-2440	(10)	240	420	516	132-960	(15)	246	586	1042	100-2360	(25)
P:	University/Rice	668	1076	2400	504-2680	(5)	--	--	--	580	(1)	NA	NA	NA	NA	NA
R:	Prospect Park	182	504	5840	164-11120	(5)	136	244	272	60-820	(15)	194	318	608	104-1040	(10)
S:	West St. Paul	--	88	--	--	(2)	60	92	148	56-272	(15)	72	96	124	40-180	(21)
T:	South St. Paul	NA	NA	NA	NA	NA	106	220	278	56-504	(24)	205	296	413	108-3000	(22)
U:	Rice/Maryland	688	798	1262	556-2120	(6)	102	256	680	84-1520	(9)	453	724	1084	212-2080	(18)
V:	North St. Paul	160	264	416	88-556	(7)	78	130	161	44-1480	(18)	136	224	33	56-576	(21)
W:	Roseville	49	76	102	40-120	(6)	76	108	152	44-772	(27)	60	80	139	50-1076	(16)
X:	Mendota Heights	88	106	213	44-1600	(14)	68	88	116	48-460	(15)	72	92	128	60-152	(9)
Y:	Eagan	56	72	92	36-448	(31)	NA	NA	NA	NA	NA	60	72	99	44-140	(12)
Z:	Marion/Ravoux	NA	NA	NA	NA	NA	80	160	212	48-580	(46)	NA	NA	NA	NA	NA

See Map 4 for the location of these sites.

NA = not applicable.

-- = insufficient data.

* Percentile refers to the ranking of quantities. For example, the quantity at the 25th percentile indicates that 24 percent of the samples measured lower and 74 percent of the samples measured higher than the quantity listed for the 25th percentile. The 50th percentile is the middle or median sample.

Note: N is not included here because it was collected in downtown St. Paul and was not composed of samples that are readily comparable to those collected in the neighborhoods.

Table 2. (continued) HOUSESIDE SOIL-DUST LEAD BY SIDING TYPE AND COMMUNITY: MINNEAPOLIS (in ppm lead)

	Painted Residences					Brick, Stone, or Stucco Residences					Other (Aluminum, Asbestos, or Composition)				
	Percentile*					Percentile*					Percentile*				
Minneapolis Community	25	50	75	Range	(N)	25	50	75	Range	(N)	25	50	75	Range	(N)
MA: E. St. Anthony, N.E.	124	808	1902	76-4760	(6)	336	422	685	84-2120	(21)	128	360	688	84-10400	(35)
MB: Near North	84	356	1320	48-2360	(11)	172	342	563	68-2840	(48)	33	40	926	24-1320	(8)
MC: Lowry Hill E., Calhoun-Isles	619	1142	1740	324-2640	(12)	570	720	1106	404-1120	(9)	740	1300	1710	388-6880	(16)
MD: Whittier, Central	590	822	1166	548-1400	(6)	372	906	1580	84-3480	(14)	466	824	1530	356-1920	(8)
ME: Phillips, Central	848	1360	1990	472-3680	(24)	614	920	2300	464-3440	(5)	297	698	1490	180-2280	(12)
MF: Hawthorne/Jordan, Near North	--	724	--	512-2920	(3)	308	472	676	208-1080	(19)	283	410	817	160-2520	(26)
MG: Windom Park, N.E.	--	368	--	364-5680	(3)	112	176	380	56-13,600	(39)	--	328	--	204-920	(3)
MH: Bancroft, Powderhorn	358	634	813	320-4680	(12)	192	272	540	100-1840	(23)	424	568	908	392-1064	(9)
MI: Prospect Park, Central	216	464	880	44-2040	(15)	201	406	604	104-1400	(26)	--	224	--	196-304	(3)
MJ: Lowry Hill, Calhoun-Isles	1154	2400	2520	704-2680	(9)	200	332	660	88-1360	(27)	910	1120	2540	568-4460	(9)
MK: Audubon, N.E.	NA	NA	NA	NA	NA	172	208	352	108-808	(23)	100	220	311	72-772	(18)
ML: Hale, Nokomis	217	278	469	196-820	(6)	121	200	295	80-1920	(32)	230	408	1094	196-1400	(5)
MN: Marty Holmes, Central	NA	NA	NA	NA	NA	134	196	318	112-504	(9)	167	312	836	48-2200	(18)
MO: Waite Park, N.E.	244	494	633	76-828	(6)	112	132	156	64-188	(17)	142	188	592	72-1800	(21)
MP: Armitage, S.W.	76	106	188	48-1080	(30)	67	210	466	64-904	(6)	97	224	354	56-536	(12)
MQ: Edina	NA	NA	NA	NA	NA	48	76	112	36-124	(6)	64	88	124	48-408	(39)
MR: Robbinsdale	111	204	308	56-1360	(18)	114	242	308	56-1000	(24)	79	98	185	64-260	(6)
MS: Como, Central	117	138	533	68-1160	(12)	290	396	496	180-1120	(13)	104	192	336	28-616	(27)
MT: Howe, Longfellow	NA	NA	NA	NA	NA	118	164	294	64-388	(29)	211	308	356	136-1360	(17)
MU: Seward, Longfellow	976	2060	3550	904-6040	(6)	121	390	928	88-1200	(8)	134	374	647	88-3240	(26)
MV: Sheridan, N.E.	NA	NA	NA	NA	NA	222	396	622	36-808	(21)	298	500	878	112-1760	(21)
MW: Fulton, S.W.	186	232	462	148-604	(5)	116	212	382	60-2080	(37)	NA	NA	NA	NA	NA
MX: Minnehaha, Nokomis	188	272	874	160-1400	(9)	106	196	348	32-640	(18)	117	226	479	52-1000	(14)
MY: Victory, Camden	281	792	1380	194-1720	(5)	127	186	284	44-620	(30)	214	300	445	184-592	(6)
MZ: Highland, N.E.	494	960	1320	320-2680	(9)	188	352	548	88-3080	(15)	280	596	1040	80-4400	(31)
MAA: Cedar-Riverside, Central	511	792	2850	436-3960	(6)	243	308	555	228-792	(6)	300	616	1320	68-1440	(15)
MCC: St. Louis Park	173	320	923	84-1320	(12)	296	580	925	120-980	(12)	324	584	856	216-1080	(11)

See Map 4 for the location of these sites.

NA = not applicable. -- = insufficient data.

* Percentile refers to the ranking of quantities. For example, the quantity at the 25th percentile indicates that 24 percent of the samples measured lower and 74 percent of the samples measured higher than the quantity listed for the 25th percentile. The 50th percentile is the middle or median sample.

Note: MM is not included here because it was collected in downtown Minneapolis and not composed of samples that are readily comparable to the neighborhood soil samples. MBB was collected from an industrial site and is also not comparable to neighborhood samples.

Table 3. STREETSIDE SOIL-DUST LEAD BY COMMUNITY: ST. PAUL AND MINNEAPOLIS (In ppm lead)

St. Paul Community		Percentile* 25	50	75	Range	(N)
A:	Frogtown	156	218	330	81-804	(34)
B:	Randolph & Lexington	106	148	183	43-712	(34)
C:	Crocus Hill	124	188	254	48-332	(17)
D:	St. Anthony Park	72	104	148	48-328	(35)
E:	West Seventh/Ramsey Hill	115	294	754	1-2000	(20)
F:	St. John's Hospital	212	332	443	72-3040	(36)
G:	E. Minnehaha/Faux St.	173	228	298	84-3440	(13)
H:	Concord/S. Robert	124	192	352	96-1000	(15)
I:	Macalester/Groveland	114	168	256	32-292	(17)
J:	Payne/Phalen	92	112	197	60-296	(16)
K:	Woodlawn/Randolph	80	112	144	48-252	(15)
L:	Highland Park	158	256	319	48-792	(16)
M:	Conway Heights	69	98	285	52-520	(16)
O:	Cherokee Heights	88	128	170	32-264	(17)
P:	University/Rice	--	160	--	120-952	(3)
R:	Prospect Park	97	162	424	60-1040	(16)
S:	West St. Paul	124	152	212	72-424	(15)
T:	S. St. Paul	90	144	196	44-364	(18)
U:	Rice/Maryland	150	204	344	48-584	(13)
V:	N. St. Paul	73	102	154	36-788	(20)
W:	Roseville	70	98	169	48-332	(18)
X:	Mendota Heights	75	134	180	60-200	(12)
Y:	Eagan	72	108	156	36-428	(15)
Z:	Marion/Ravoux					

See Map 4 for the location of these sites.

-- = Insufficient data.

* Percentile refers to the ranking of quantities. For example, the quantity at the 25th percentile indicates that 24 percent of the samples measured lower and 74 percent of the samples measured higher than the quantity listed for the 25th percentile. The 50th percentile is the middle or median sample.

Note: N is not included here because it was collected in downtown St. Paul and was not composed of samples that are readily comparable to those collected in the neighborhoods. Community Z does not have traditional streets.

Minneapolis Community		Percentile* 25	50	75	Range	(N)
MA:	E. St. Anthony, N.E.	148	176	253	88-616	(32)
MB:	Near North	118	144	189	68-396	(30)
MC:	Lowry Hill E., Calhoun-Isles	330	388	539	240-884	(17)
MD:	Whittier, Central	229	396	645	168-848	(16)
ME:	Phillips, Central	189	290	530	104-1040	(18)
MF:	Hawthorne/Jordan, Near North	164	216	348	56-896	(19)
MG:	Windom Park, N.E.	62	76	98	28-160	(17)
MH:	Bancroft, Powderhorn	60	86	134	48-1200	(18)
MI:	Prospect Park, Central	52	64	126	24-420	(17)
MJ:	Lowry Hill, Calhoun-Isles	136	202	269	120-408	(18)
MK:	Audubon, N.E.	120	148	306	88-524	(18)
ML:	Hale, Nokomis	72	100	142	56-176	(16)
MN:	Marty Holmes, Central	120	154	208	40-416	(16)
MO:	Waite Park, N.E.	111	122	141	56-172	(18)
MP:	Armitage, S.W.	48	84	128	36-196	(17)
MQ:	Edina	84	88	140	60-296	(17)
MR:	Robbinsdale	106	168	230	84-652	(17)
MS:	Como, Central	62	144	192	40-448	(17)
MT:	Howe, Longfellow	56	72	80	52-216	(17)
MU:	Seward, Longfellow	156	224	356	80-568	(15)
MV:	Sheridan, N.E.	98	124	272	72-708	(17)
MW:	Fulton, S.W.	90	152	236	68-1560	(17)
MX:	Minnehaha, Nokomis	54	64	82	40-100	(17)
MY:	Victory, Camden	82	120	180	48-392	(18)
MZ:	Highland, N.E.	80	108	195	16-656	(18)
MAA:	Cedar-Riverside, Central	236	406	513	132-980	(12)
MCC:	St. Louis Park	205	272	435	152-1170	(16)

Note: MM is not included here because it was collected in downtown Minneapolis and not composed of samples that are readily comparable to the neighborhood soil sample. MBB was collected from an industrial site and is also not comparable to neighborhood samples.

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CURA

CENTER FOR URBAN AND REGIONAL AFFAIRS

University of Minnesota
330 Hubert H. Humphrey Center
301 19th Avenue South
Minneapolis, MN 55455

(612) 625-1551