

Introduction and Hypothesis

Lead was banned from the use in gasoline in 1986 because of toxic conditions. For many years before 1986, gasoline emissions with lead was carried by the wind and deposited in soils near traffic areas. Lead resides in soils for a long period of time. Soils near stop light intersections should have accumulated high concentrations of lead because of the time cars waited for the stop light to change. The prevailing wind direction could help deposit the gasoline emissions in soils at certain quadrants at stop light intersections.

I believe the concentrations of lead in soils adjacent to traffic intersections are higher in samples located downwind (NE and SE quadrants) compared to the upwind samples (NW and SW quadrants). I also believe some soil samples will have higher lead concentrations than acceptable by the EPA. Also, I believe that the concentrations of lead in the soils at intersections are higher where the traffic density is higher.

Procedure

I visited the traffic engineer of Springfield Missouri and got traffic intersection data for Springfield, Missouri streets. I also got a wind rose (prevailing wind directions) for Springfield Missouri for the years 1941-1971 from the U.S. Weather Service. After studying these, I made my full hypothesis. I chose 6 traffic intersections with stop lights within or near the central city of Springfield. I checked on two important factors; the soil samples I collected were not disturbed by previous road construction and there were no old houses which were painted with lead contained paint. The samples were also collected in the following way. At each intersection, I collected the soil samples in the quadrants on a diagonal at an equal distance from the center of each intersection. Each sample was collected from 0-1 inch deep and from an area of 1 square foot. I collected soil samples at the following traffic intersection streets: Benton and Division; Bennett and Fremont; Grant and Portland; Kimbrough and Madison; Grant and Nichols; Grand and Fremont. These samples were the test samples for this project. Five additional soil samples were collected away from a stoplight intersection in the center city of Springfield. These samples were the control or background in this study. Each sample was placed in a labeled plastic sandwich bag and brought to my basement to dry. Each

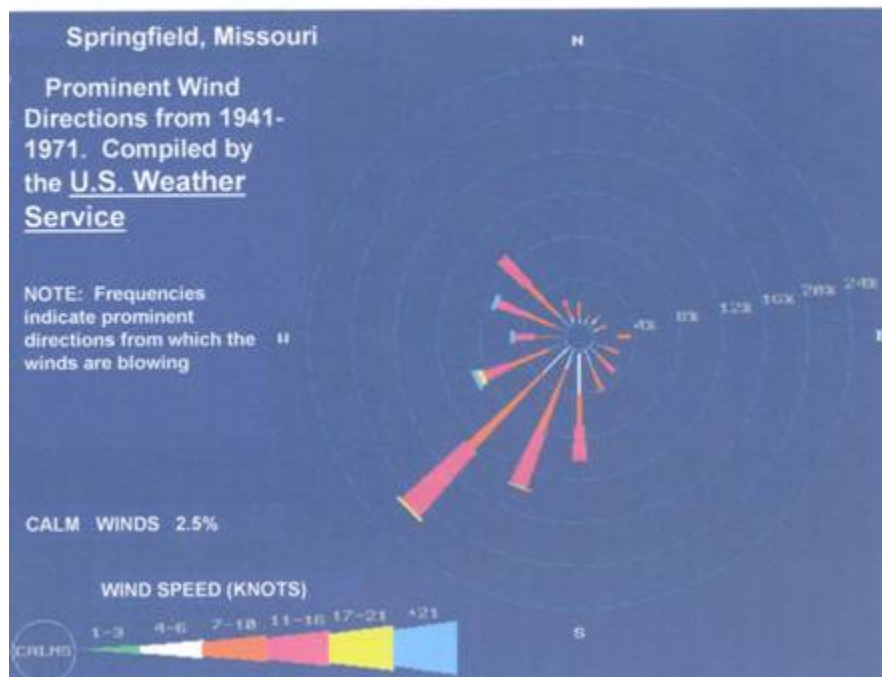
dried sample was sieved and the sieved portion less than 60 mesh grain size was saved.

I brought the samples to a laboratory at Missouri State. Each sample was weighed to 1.00 gram on a Sartorius analytical balance and placed in a labeled centrifuge bottle. Twenty milliliters 3N nitric acid was added to each sample bottle. Each bottle was placed in a hot water-shaker bath for 24 hours at 70 degrees Celsius and 50 rpms. The samples were centrifuged at a high speed for 4 minutes. The liquid portion of each sample was poured into a labeled analysis bottle. Element standards and blank solutions were used to determine the concentration of lead in each sample. A Varian ICP Spectrophotometer was used to determine the concentration of lead in each test and control sample.

Discussion of Results

The wind rose for the years of 1941 to 1971 and my calculations of the sum of the main directions of the prevailing winds in Springfield are shown below.

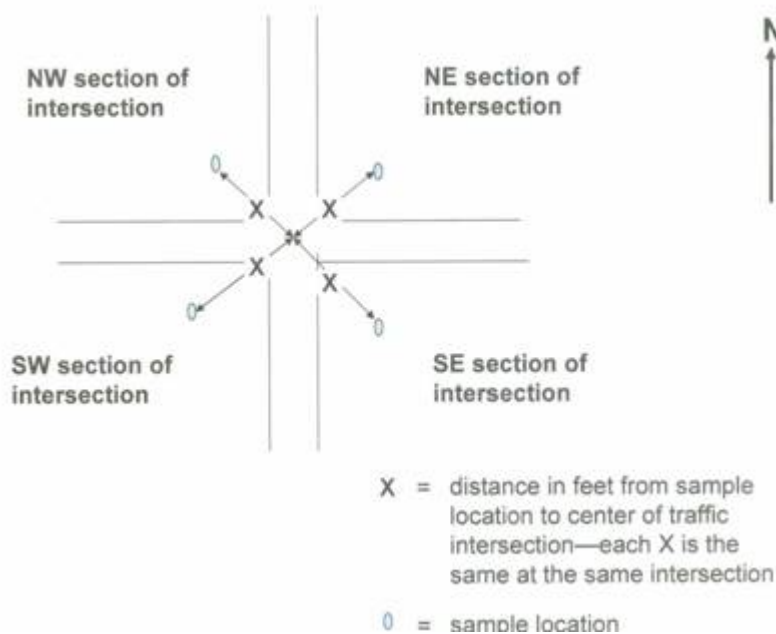
Prominent Wind Directions for Springfield, MO. (Wind Rose) for 1941- 1971



Sum of the Wind Directions (%) in Springfield, Missouri From 1941-1971 Taken From the Wind Rose Chart	
Direction of Blowing Wind	Sum of the % (approximate)
NE	45
SE	18
NW	11
SW	5
Due, E ,W, N and S	E (5), W (4), N (10), S (2) = 21

The main downwind directions of the winds are NE and SE. The pattern I used to collect the samples from each intersection is shown below.

General Map of Sample Locations at Intersections

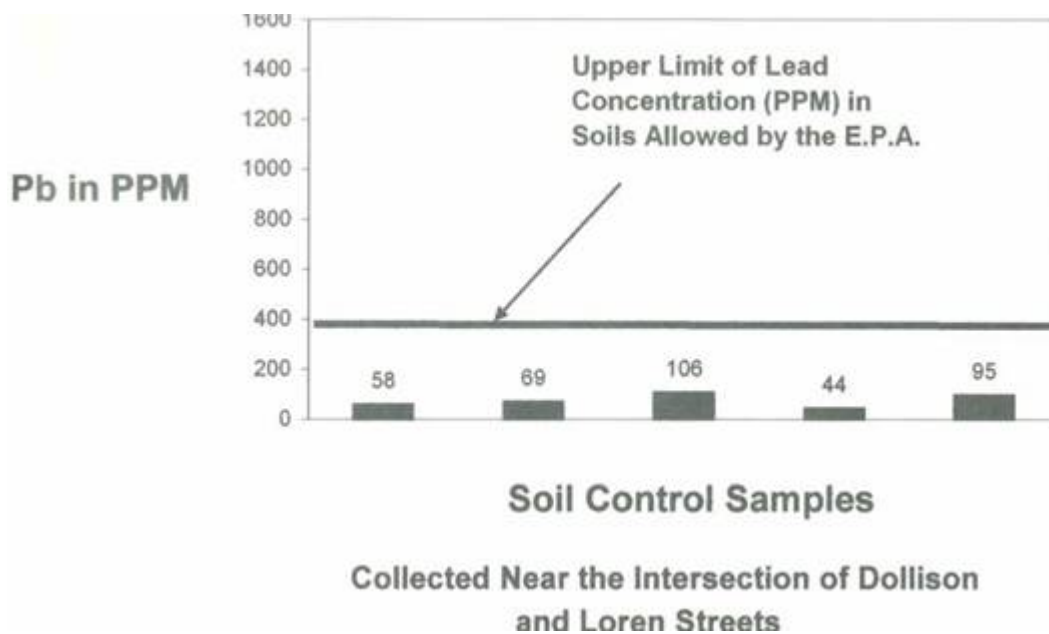
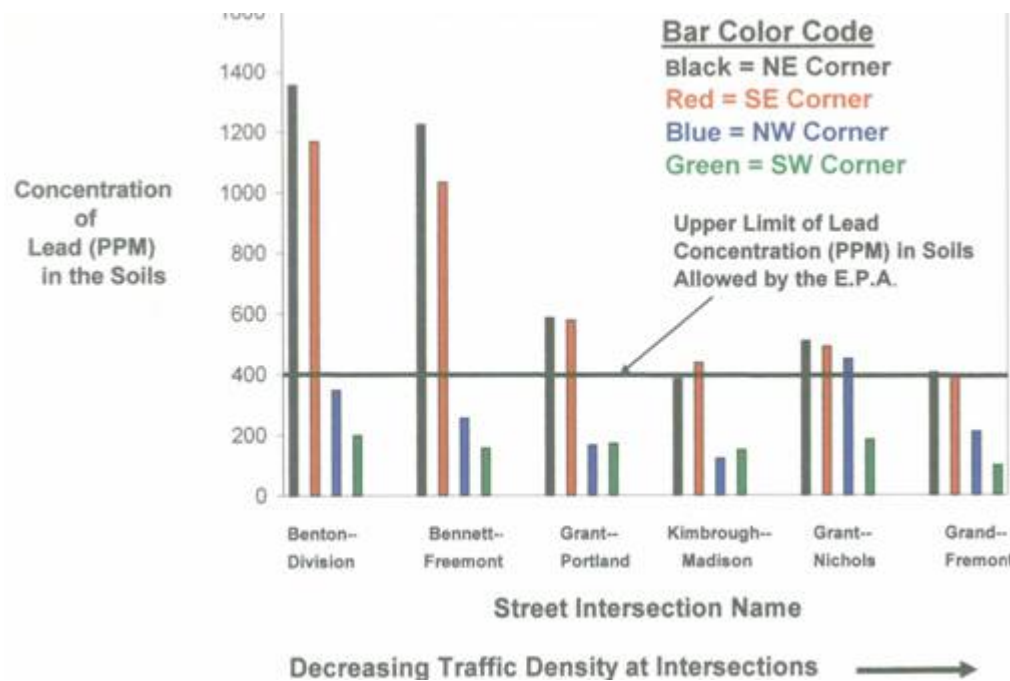


The Table of Data from the chemical analyses of lead in the soils at the intersections is shown below.

TABLE OF DATA

★ Intersection Name and Quadrant Location of Sample		Concentration of Pb in Soil Samples in PPM	Distance in Feet (X) From Sample to Center of Intersection	Average Daily Thru Traffic Density at Intersection for the Year 1976--(a blank means no data available, a---- means traffic density is very low)			
1. Benton-Division	NE	1354	69	N	S	E	W
	SE	1168		-----	-----	6821	6878
	NW	347					
	SW	197					
2. Bennett-Fremont	NE	1223	34	N	S	E	W
	SE	1032		2659	1816	3879	3505
	NW	254					
	SW	155					
3. Grant-Portland	NE	584	43	N	S	E	W
	SE	576		2466	3469	-----	-----
	NW	165					
	SW	171					
4. Kimbrough-Madison	NE	381	51	N	S	E	W
	SE	436		2420	2282	-----	-----
	NW	121					
	SW	148					
5. Grant-Nichols	NE	507	60	N	S	E	W
	SE	488		2121	2608	-----	-----
	NW	448					
	SW	182					
6. Grand-Fremont	NE	402	45	N	S	E	W
	SE	387					
	NW	208					
	SW	97					

The data from the table above is shown in the bar graph below. Also, shown below is the lead concentration of the background or control used in this study.



The concentrations of lead in the test soils are higher in the 2 east quadrants of the intersections (northeast and southeast). Also, the concentrations of lead are also higher at the intersections with higher traffic densities. The concentration of lead in eleven of the 24 test soil samples are above the EPA limit of 400 PPM. The concentrations of lead in the control or background samples are much lower than the concentrations of lead in the test samples.

Conclusions

The results of this research support my hypothesis. There can be problems concerning the concentrations of lead in the soils originating from wind blown gas emissions from the past. The lead concentrations in soils at daycare centers and grade schools close to major traffic intersections on the east side may contain dangerous levels of lead. Small kids at these places can become sick and have brain damage because of the high lead concentrations of lead in concentrate in the stream sediments. Lead concentrations could be ingested by smaller vertebrates or invertebrates and passed onto fish and us. I would like to do further research on this and study lead concentrations in soils at daycare centers and schools close to major traffic intersections.

Acknowledgements

I would like to thank people at the Springfield Traffic Engineering Department for supplying me with traffic density tables and help. I would also like to thank the U.S. Weather Service for giving me a wind rose of the prevailing winds for Springfield, Missouri for the years 1941-1971. I would also like to thank Missouri State for the use of their labs and ICP machine. I would like to thank my dad for helping me be safe in the lab procedures.