

# **MANGANESE, LEAD, & VIOLENT CRIME**

## **IN CALIFORNIA: THE CASE OF SAN BERNARDINO**

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### **Introduction:**

It's essential to regulate manganese pollution because its harmful effects on human health and behavior have now been well documented. Recent scientific research has explored two key issues. **FIRST**, damage to brain chemistry and behavior from manganese has been traced in detail, linking this heavy metal with increased rates of costly problems such as violent crime. However, to do so, it's important to consider other toxins like lead, whose effects are seriously increased where exposure to lead is combined with manganese pollution. **SECOND**, there is good evidence that these problems place heavy burdens on California taxpayers. Counties pollution from these toxins have higher crime than those without industrial releases of manganese or lead. The difference is very clear when San Bernardino County is compared with Riverside (a generally comparable county with lower levels of heavy metal pollution).

### **I. Why Manganese Pollution, Like Lead, Costs Taxpayers \$Billions**

Numerous scientific studies show that, like lead, manganese is a toxin that has harmful effects on brain chemistry often leading to learning disabilities, substance abuse, and violence. The public has often heard of the harmful effects of lead on IQ and educational success, but much less is said about manganese. Particularly notable are findings that in counties where the EPA reports either manganese pollution or lead pollution, violent crime rates (along with other behavioral problems including learning disabilities and substance abuse) are significantly above average. Taking other factors associated with crime into consideration, not only does manganese have problems like those due to lead, but the combination of these two poisons has worse effects than either one alone. In other words, manganese pollution is harmful, but it is much worse wherever children are also exposed to lead (whether from lead paint in old houses, lead residues in water or soil, or other sources such as some painted pottery and toys).

Research in brain science explains why this issue needs public attention. A variety of compounds called "neurotransmitters" are needed for the activity of different connections in the brain. Both manganese and lead are "neurotoxins" – that is, they lower activity of specific neurotransmitters and therefore interfere with the firing of specific connections. Like lead, manganese interferes with the neurotransmitter dopamine, which is very important for inhibiting impulsiveness and planning. Manganese also harms the firing of brain cells that depend on at least one other neurotransmitter (norepinephrine). As a result, manganese has been linked to hyperactivity (ADHD) and Parkinson's symptoms as well as poor self-control, weaker planning, and substance abuse. One consequence is that violent criminals often have above average of levels of manganese, lead, or both in their blood. Because manganese

aggravates the harm from lead in addition to its direct disturbance of normal brain function, its necessary to compare the effects of these two toxins separately or when they are combined.

When there are excessive levels of manganese or of lead in children's blood (for which we have the best measurements by locality), the toxins have to come from somewhere. While there are many possible sources in consumer products of various sorts for which we don't have good statistics, the EPA keeps records of industrial pollution with many toxins including both manganese and lead. As a result, where there are reliable statistics of harmful behaviors, EPA reports of manganese pollution or lead pollution have been compared with other social and environmental factors traditionally linked to crime. Taking into consideration up to a dozen such factors as poverty, population density, race, or education, the presence of manganese pollution increases rates of violent crime. So does lead pollution. And violent crime is even worse where both manganese and lead pollution are combined.

Reducing violent crime rates is therefore possible with identification and treatment of individuals with high body levels of lead and manganese (particularly while they are still children – and also often showing learning disabilities or behavior problems due to lead and manganese poisoning). Since incarceration costs about \$25,000 per prisoner per year, this research indicates that by focusing on toxins that harm the brain, Federal and state governments could save **billions of dollars** a year (and thus contribute to reducing budget deficits like those now plaguing California and many other states as well as the Federal government) .

## **II. Heavy Metal Pollution and Violent Crime in San Bernardino County**

Manganese is, like lead, called a “heavy metal.” Statistics gathered for research on the connection between these toxins and violent crime rates in 1993 show how manganese creates serious problems in California as a whole – and particularly in San Bernardino County. For all California Counties, the absolute number of violent crimes was under 3000 unless counties were exposed to both lead and manganese pollution, as was the case for both San Bernadino (where there were 8794 violent crimes) and Riverside (where there were 4791 crimes). The raw number of violent crimes in counties with neither lead nor manganese in the EPA Toxic Release Inventory is at least quadrupled where there is pollution with either of the toxins – and tripled again where both are present. Similar pattern are also found in California rates of arrest for drunk driving and – as shown in the Appendix -- in national rates of violent crime for other years, drunk driving, and homicide.

In California, Chart #1 shows that whereas lead pollution is associated with an increase of almost 4 times in acts of violent crime, manganese pollution is associated with about 6 times the number of violent crimes in unpolluted counties. And where there's both manganese and lead pollution, the average number of violent crimes is almost 22 times that in unpolluted counties and over 5 ½ times greater than in counties with only lead pollution. These raw statistics in California suggest manganese can not

only be more dangerous than lead but, like mixing drinks, the combination of these toxins can be much worse than either one alone.<sup>1</sup>

Getting to specific counties, a detailed comparison of manganese and lead pollution data from the EPA shows levels of both toxins are substantially higher in San Bernardino County than in Riverside County (despite the fact that the two counties are similar in size and San Bernardino has only slightly higher levels of poor citizens than Riverside County). Moreover, the reported level of manganese pollution by industry (2,167,365 lbs) in San Bernardino County is among the highest in the U.S. and almost 10,000 times higher than manganese pollution in Riverside County (250 pounds). Since these two counties are roughly comparable on most measures, this difference can provide a good indication of the harmful effects of manganese on health and behavior.

Studies of the effects of toxic pollution on violent crime rates per 100,000 population take into consideration differences between cities and small towns. Using this statistic for U.S. crime rates in several different years shows that, other things being equal, higher levels of pollution are indeed linked to more violent behavior. Parallel to the higher levels of manganese pollution in San Bernardino, the 1993 violent crime rate per 100,000 in San Bernardino County is 50% higher than in Riverside County. But even rates in Riverside County (409 per 100,000) – where lead pollution is substantial -- are almost triple the national county average of 142 per 100,000. Whether measured as the raw number of crimes or the rate per 100,000 population, lead is connected to more violent crime, but the effect of manganese seems to be even worse – and adding manganese to lead pollution can create truly dangerous conditions.

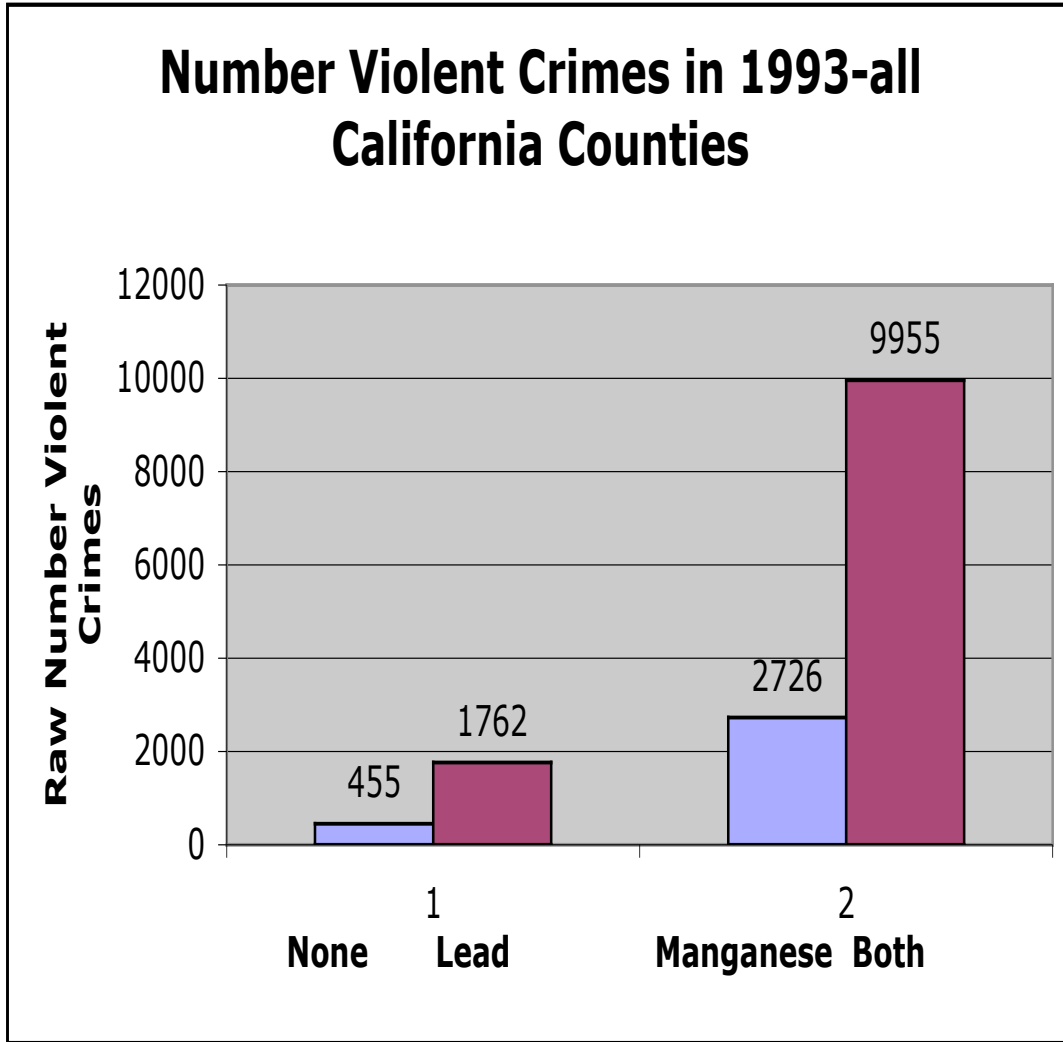
### **Conclusion**

It follows that steps to reduce exposure to manganese (such as action on the dangers of soy formula, which usually contains high levels of manganese) are urgently needed. While more research (like that being conducted at the University of California Irvine) is needed, there's every reason to test the concept of comprehensive screening, assessment, and treatment for entire classrooms in impacted areas like the city of San Bernardino (which has been called the most violent city in the U.S.) Given large public expenditures associated the aberrant behaviors caused by lead and manganese, continuing to ignore scientific evidence of how these toxins harm the brain results in unnecessary government spending at a time of tight budgets. With the prospect of huge savings for taxpayers, the cost of a test program to screen and remove toxins for up to 1000 children (probably under \$200,000) would be trivial. But whatever is done, it's time to pursue research and policy aimed at reducing the harmful behaviors linked with lead and manganese (including learning disabilities and drunk driving as well as violent crime).

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<sup>1</sup> Obviously, these “raw numbers” don't take into consideration differences in the total population and other social factors in each county. Since similar numbers are found for rates of violent crime per 100,000 residents (which controls for population size) and multivariate statistical analyses confirm that these differences are not due to differences in rates of poverty, ethnic population, income, education, or other factors linked to crime.

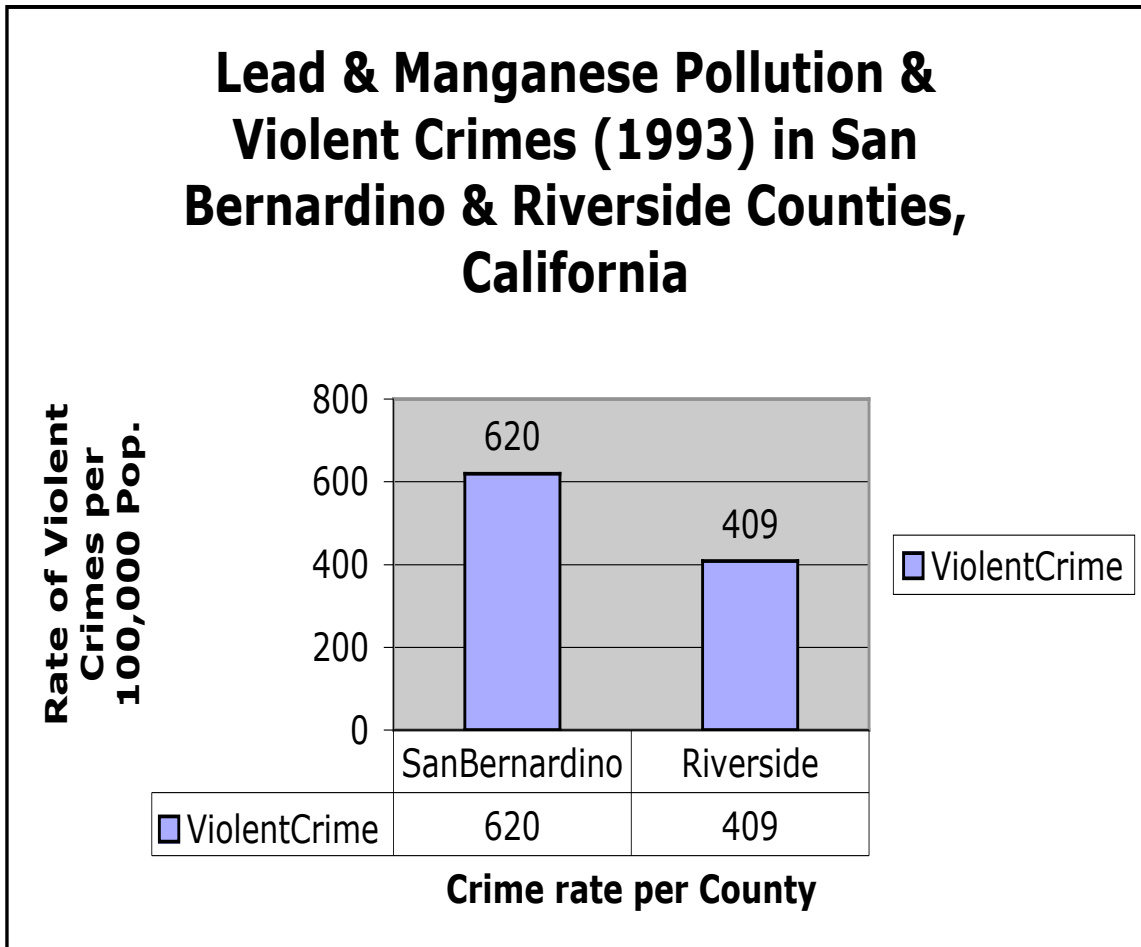
Chart #1



**EPA REPORT OF TOXIC RELEASES OF MANGANESE OR LEAD**

Number in parentheses is average number of violent crimes in all counties for each of four categories (no pollution, lead only, manganese only, or both heavy metals). Although raw numbers can be challenged on grounds that they are influenced by the population size of each county, this effect is controlled by computing each county's rate of violent crime per 100,000 population (for example, see Chart #2).

Chart #2



Numbers are the rate of violent crime for each 100,000 residents of each county. This statistic takes into consideration differences in population.

**APPENDIX: ADDED EVIDENCE FOR OTHER YEARS AND EFFECTS**

Skeptics will, quite reasonably, ask whether the statistics reported above are an accident since something else – the “real” cause – is also associated with pollution.

The Table and Charts below indicate this is not likely. Table 1 uses a statistical method called “multiple regression” to show that both lead and manganese pollution have significant effects on violent crime rates in all U.S. counties taking many other factors into consideration. Since such statistics are not widely familiar, supplementary graphs provide data for California on heavy metal pollution and violent crime rates in 1995 (Chart #3) and for the association between manganese pollution and drunk driving (Chart #4) as well as with the homicide rate (Chart #5).

**Table 1: Multiple Regression Analysis of Violent Crime Rates in US – 1991**

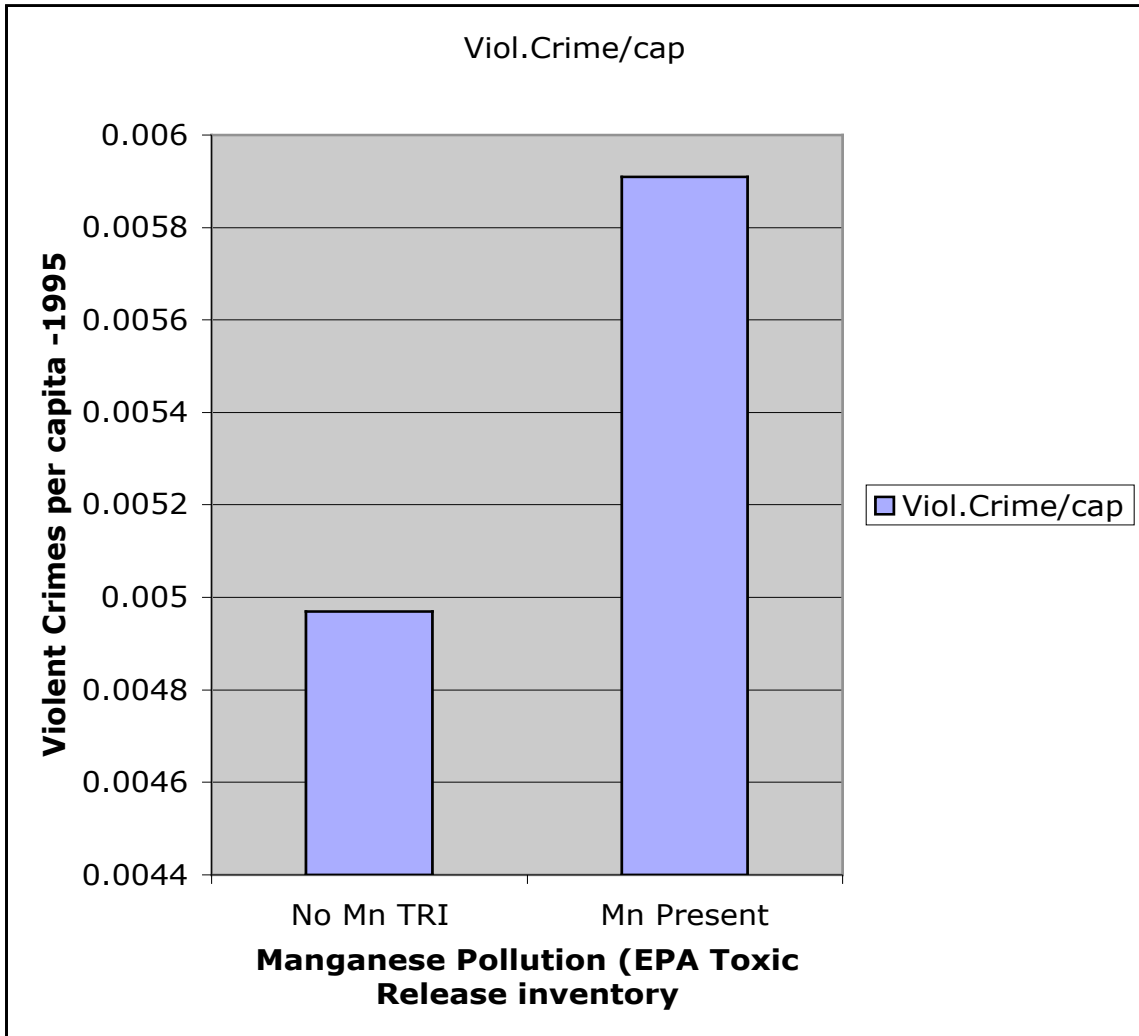
Variable	Unstandardized Coeff.	T-ratio	probability
Population Density	82.42	20.24	<.0001
Per capita income	-.0007	-2.74	<.0001
Unemployment	NOT SIGNIFICANT		
%BlackPoverty	40.06	2.33	<.05
% HispanicPoverty	62.11	2.79	<.005
PoliceperCapita	153423	16.56	<.0001
InfantDeath Rate	1.813	2.78	<.005
% housingpre1950	-526.75	-13.43	<.0001
Publicwater/cap	225.34	4.07	<.0001
MedianGradeComplete	24.68	3.50	<.005
LeadTRI present	40.80	4.67	<.0001
ManganeseTRI	58.71	6.68	<.0001
AlcoholDeathRate	101.62	11.55	<.0001
Alcohol&Lead#	21.48	2.54	<.05
Alcohol&Manganese#	55.40	6.54	<.0001
Lead&Manganese#	34.89	4.11	<.0001
Alcohol&Lead&Manganese#	19.21	2.27	<.05

Adjusted r-square: 0.369. F 97.45; DF 17.2783; p - .0000 # - interaction terms.

NOTE: this analysis indicates that the effects of manganese and lead pollution would have occurred only once in 10,000 changes for U.S. national crime data in 1991.

Source: Table III in Masters, R, Hone, B, and Doshi, A. (1998). “Environmental Pollution, Neurotoxicity, and Criminal Violence,” in J. Rose, ed., *Environmental Toxicology: Current Developments* (London: Gordon and Breach, 1998), pp. 13-48.

**CHART #3: MANGANESE & CALIFORNIA VIOLENT CRIME RATES IN 1995**



CAL

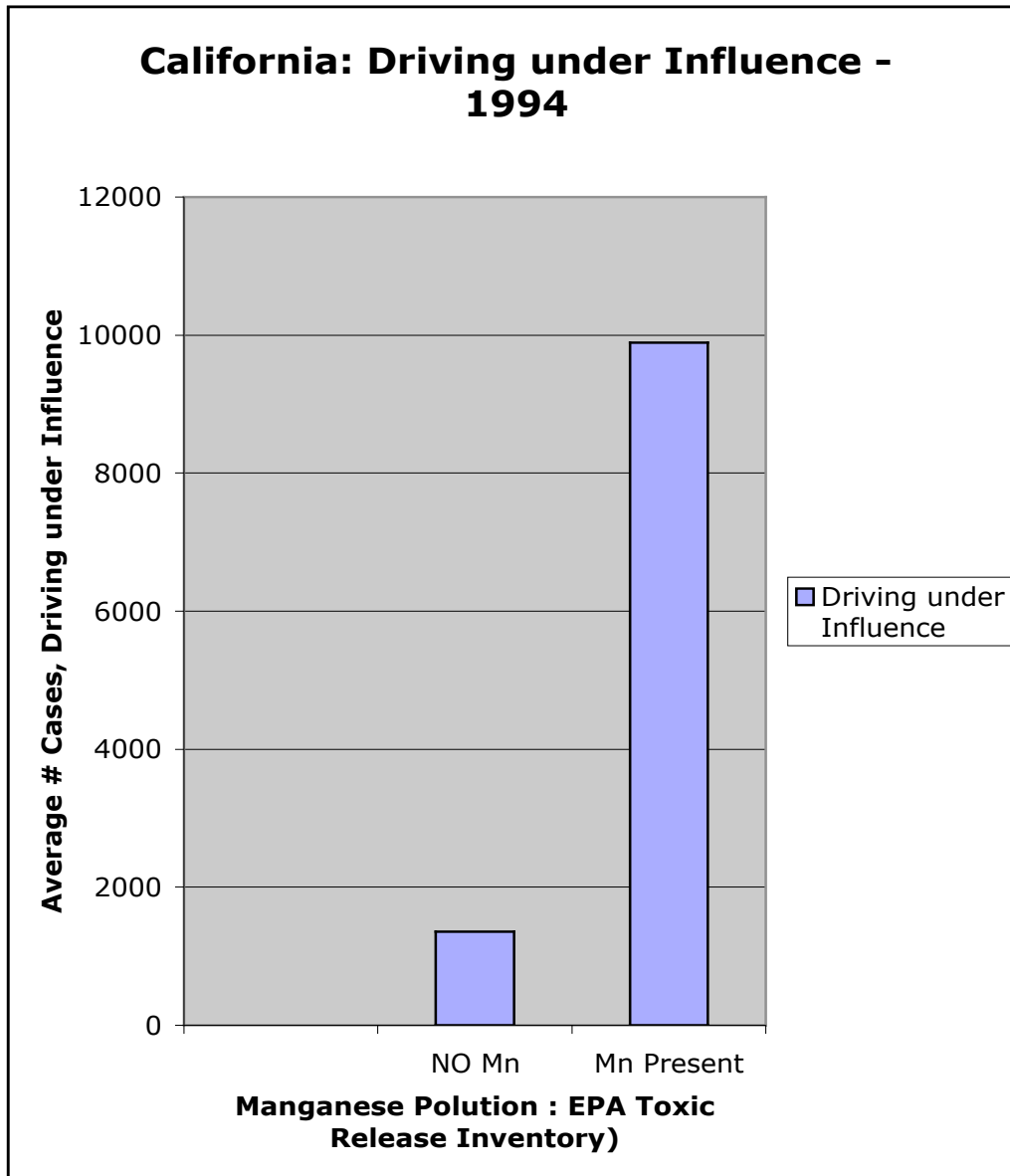
Number of Counties without Manganese Toxic Release: 43 (ave = 497 per 100,000)

Number of Counties with Manganese Toxic Release: 15 (ave. = 591 per 100,000)

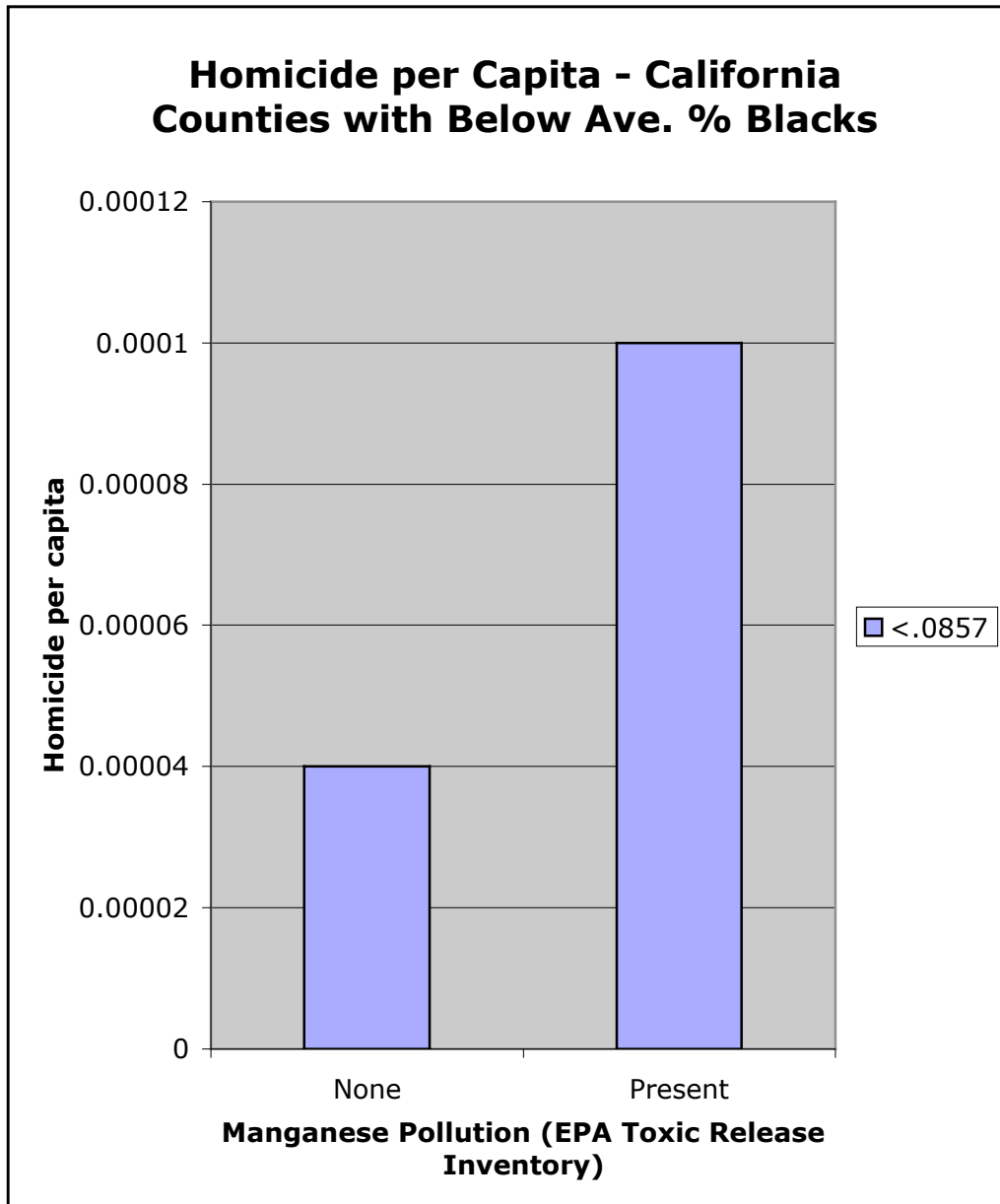
Statistical Significance:  $p = .10$

National Average, Violent Crimes per capita 1995: 183 per 100,000.

**CHART #4: DRUNK DRIVING & MANGANESE POLLUTION IN CALIFORNIA**



**CHART #5: CALIFORNIA HOMICIDE RATES & MANGANESE POLLUTION (1995) FOR COUNTIES WITH BELOW AVERAGE % BLACK POPULATION**



In California counties, the main factor significantly associated with Manganese pollution is above average % Blacks (>8.57%) in the population. Because crime rates are significantly higher in counties with more Blacks in the population, this chart considers the per capita rates of homicide only for counties that have fewer than 8.57% Blacks. In these counties, there is an average of 10 homicides per 100,000 where manganese pollution is present, and only 4 per 100,000 where manganese is NOT present (state ave. = 6). For the state as a whole, controlling for %Black, effect of manganese pollution on homicide is statistically significant (p = .04).

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APPENDIX CAN OBVIOUSLY BE LEFT OUT, BUT IT HAS ADDED EVIDENCE SO SKEPTICS HAVE TO TAKE IS SERIOUSLY.

On this issue, if you don't already know him, I suggest you contact:

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Tell him I suggested you contact him,

Charts 1-3 in "CalCrime" sheet 3 Chart 4 in Cal Crime2, sheet 3  
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