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UMASS

THE PROXIMITY OF HIGH VOLUME DEVELOPMENTAL NEUROTOXIN POLLUTERS TO SCHOOLS: VULNERABLE POPULATIONS AT RISK

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ABSTRACT

A substantial amount of environmental justice research has taken the form of "proximity studies" that analyze the race and class composition of populations living in close proximity to *general* sources of pollution. Such studies often find disproportionate minority, poverty, and low-income populations proximate to the pollution source. This proximity study has a different starting point. We begin by locating nearly 700 of the nation's highest volume polluters of *specific* toxins that put children's health and learning abilities at risk: developmental neurotoxins. We then examine (a) the numbers of schools and children located within two miles of each polluter, and (b) the race and class compositions of the populations within two miles. The result is a study of the proximity of vulnerable populations to pollution that highlights the vulnerability of children, not just that of minorities and the poor. We find thousands of schools and hundreds of thousands of children at risk. We also find that a substantial proportion of the high volume polluters studied are surrounded by disproportionate minority, poverty, and low-income populations.

Key Words: proximity studies; environmental inequality; developmental toxins; neurotoxins; high-volume polluters; vulnerable populations: race and class, schools and children

JEL Codes: Q53; I19; I29; J15

INTRODUCTION

Recently, *USA Today* published a special report entitled “The Smokestack Effect: Toxic Air and America’s Schools”. The series presented information on the air pollution levels around almost 128,000 schools nationwide, documenting the widespread, but little-recognized, problem. Research for this special report was conducted by the Political Economy Research Institute (PERI) at the University of Massachusetts, Amherst. Given the seriousness of the problem, the topic warrants additional study. We begin with a focus on <u>specific</u> toxins that put children’s learning abilities at greatest risk. Then we identify those facilities nationwide that release these in greatest volumes. Finally, we analyze the educational, demographic, and economic characteristics of the populations/places proximate to these sites.

Specifically, we use data from the Toxics Release Inventory (TRI) to generate lists of the one hundred highest volume polluters (HVPs) of precisely those toxins that put children at greatest risk of learning and behavioral disorders: recognized developmental toxins to air and suspected neurotoxins to air. We also select several specific developmental neurotoxins to “profile”, generating lists of the top 100 HVPs for each. The specific toxins selected are lead, mercury, carbon disulfide, manganese, and toluene. Using EPA data, we then generate counts of the number of schools within one and two miles of these polluters. Then, we use GIS-based circular area profile data (CAPs), provided by The Missouri Census Data Center (mcdc2.missouri.edu/websas/caps.html) to specify the age, race, and class demographics of the circular areas with radii of one and two miles surrounding each HVP. This enables us to assess the degree to which pollution, schools, children, race, and class are interconnected. Therefore, our work may be considered an environmental justice study.

A substantial amount of Environmental Justice research has taken the form of "proximity studies". That is, scholars study the race and class composition of populations living in close proximity to general sources of pollution such as facilities on the Toxics Release Inventory, Superfund sites, and commercial hazardous waste facilities. Such studies often find disproportionate minority, poverty, and low-income populations proximate to the pollution source. This study, while also a proximity study, has a different starting point. We begin by locating the highest volume polluters in the nation of those specific toxins that put children's health and learning abilities at risk. We then specify (a) the numbers of schools and children located near each polluter, and (b) the race and class compositions of the populations nearby. The result is a study that highlights the vulnerability of children, not just that of minorities and the poor. In the aggregate, we find thousands of schools and hundreds of thousands of children at risk. We also find that a substantial proportion of the high volume polluters studied are surrounded by disproportionate minority, poverty, and low-income populations.

DATA AND METHODS

We began our research by selecting two categories of toxins and five specific chemicals within these categories that put children at greatest risk for health and learning difficulties. For each category and chemical we used www.scorecard.org to generate a list of the 100 highest volume polluters (HVPs) in the nation in 2002. This website, originally sponsored by Environmental Defense and now maintained by Green Media Toolshed, is designed to give citizens ready access to information on the sources and types of toxic pollution in their communities.

Once we generated lists of HVPs, including their latitude-longitude coordinates, we next determined the number of schools in the surrounding area (within 0.5, 1, and 2 miles) by using the EPA's Enviromapper for Environmental Justice and Geographic Assessment (www.epa.gov/enviro/ej). This is a GIS-based mapping tool that allows users to generate maps after specifying a latitude-longitude coordinate. The maps provide information on a wide range of pollution sources. They are most useful to us because they allow researchers to add features to each map, including the precise location of all schools proximate to the HVP's latitude-longitude point. The resulting map, which centers the HVP and locates all schools, may then be digitized, permitting precise measurement of the distance between each school and the HVP.

While the initial focus of our research was to examine schools and their proximity to HVPs, we also recognized the importance of documenting the number of children who live near the high volume polluters and are, therefore, put at environmental risk both at school and at home. We used the Missouri Census Data Center's Circular Area Profiles (CAPs) application that "aggregates 2000 census data to approximate circular areas as specified by the user using a point location and one or more radius values" (mcdc2.missouri.edu/websas/caps.html). We entered the latitude-longitude coordinates of each HVP to determine the number of children under the age of five within two miles, and the number of children between the ages of five and seventeen (i.e., school aged children) within two miles.

We also used the CAP application to retrieve race and class demographic information for the circular areas with radii of one and two miles around each HVP. Specifically, we gathered data on percent minority, percent poverty, and median family income (MFI). While gathering the circular area data on each HVP, we discovered that about 10-50 percent (depending on the category or chemical) of the factories had no information available. Facilities with missing data are usually either in a rural area more than one or two miles away from any residential area, or in a large industrial park far removed from residential populations.

As noted above, the majority of studies of environmental inequality have focused on race and class inequalities. Much of this research has found that people of color and the poor bear a disproportionate burden of exposure to environmental toxins. Therefore, incorporating race and class into our analysis will permit us to specify the degree to which children's exposure to developmental neurotoxins both at home and at school is linked to ascriptive inequalities based on race and class. In other words, are minority children and poor children disproportionately exposed to HVPs? At this point, we must consider the meaning and measurement of "disproportionate" exposure. The term "disproportionate" implies a comparison. Do HVP circular area demographics reflect a concentration of minorities and the poor in each circular area relative to some meaningful spatial reference group? The circular area demographics could be compared to any number of reference categories, ranging from zip codes and census tracts, through counties and states, to the nation as a whole. Categories most proximate to each HVP (i.e., zip codes and census tracts) are likely to be demographically quite similar to a specific circular area within their boundaries. In contrast, a focus on the race/class demographics of the nation as a whole is likely to mask important regional differences. Consequently, we will define a disproportionate minority and/or poverty presence in a circular area as one that exceeds the minority/poverty percentage for that state in which the HVP is located. Similarly, a disproportionately low MFI circular area is one that has a lower MFI than its state. In sum, our spreadsheets include (a) percent minority at one and two miles, percent poverty at one and two miles, and MFI at one and two miles for the circular areas around each HVP; and (b) state percent minority and poverty and MFI for each HVP. Simple ratios are computed dividing the circular area demographics by the comparable state demographic. For percent minority and percent poverty, a ratio greater than one indicates disproportionate minority/poverty presence in a circular area. For MFI, a ratio less than one indicates disproportionately low MFI for a circular area. Ratios well above one (or well below one for MFI) indicate high degrees of disproportionality. Note that all of the state data come from U. S. Census 2000.

Following the completion of the seven spreadsheets, we conducted both tabular and correlation analyses of the data. Table 1 presents the simple number of HVPs for all categories/chemicals that had one or more schools within one-half mile, one mile and two miles: among the top 100 HVPs of recognized developmental toxins, for example, 77 are located within two miles of at least one school. Table 2 presents the total number of schools at each distance from HVPs for all seven chemicals or chemical groups. Table 3 shows the total number of children in two age ranges (under 5 and between 5 and 17) within two miles of all seven types of chemicals. Tables 4 and 5 incorporate demographic information regarding the circular areas with radii of one and two miles around each HVP. Table 4 displays the percent of circular areas around the top 100 HVPs for each category/chemical that have disproportionate minority presence, disproportionate poverty presence and disproportionately low MFI (at both distances). This table does not consider the fact that, as noted above, some 10-50 percent of HVPs in each category are not close to residential areas. It simply notes that, for the 100 HVPs on each list, x percent had documented disproportionate race/class demographics within one or two miles. Table 5 “replicates” Table 4, but takes the missing data into account. That is, it presents the percent of circular areas around only those HVPs that are close to residential areas that have disproportionate race/class demographics. While Table 4 does tell us what percentage of the top 100 polluters put vulnerable populations at risk (including those polluters that are not close to residential areas), Table 5 tells us the percent of HVPs in residential areas that are surrounded by disproportionate minority, poverty, and low-income populations. Table 6 presents the results of a correlation analysis. Finally, Table 7 presents data on individual HVPs, each of which is located within two miles of 20 or more schools.

Because our 100 HVPs are all big polluters, there is relatively little variation in the amount of pollution produced by each facility. However, there is considerable variation in (a) the numbers of schools and children in the circular areas surrounding each HVP, and in (b) the race/class demographics of the circular areas around each HVP. Therefore, for each of our seven categories and chemicals, we do a "circular area correlation analysis", computing correlations between (a) number of schools at one mile, number of schools at two miles, number of children under age 5 at two miles, and number of children ages 5-17 at two miles, and (b) percent poverty, disproportionate poverty ratio, MFI, disproportionately low MFI ratio, percent minority, and disproportionate minority ratio.

FINDINGS

Let us begin by briefly examining Tables 1-3, which simply describe the degree to which schools and children are located in close proximity to HVPs. In Table 1 we see that, for each category/chemical, fewer than 20% of HVPs have schools within half a mile. Numbers increase sharply, however, when the radius is extended to 1 and 2 miles. Roughly one fifth to one half of

HVPs have one or more schools within a mile; two fifths to four fifths of HVPs have schools within 2 miles. If we exclude high volume polluters of manganese, which are much less likely to be close to schools, 58-80% of HVPs have one or more schools within 2 miles.

When we examine the actual number of schools near HVPs in Table 2, we find some noteworthy patterns. At one mile, results range from 77 schools near high volume polluters of manganese to 150 schools near sources of toluene. At two miles, the range is 260 schools near manganese pollution to 546 schools near high volume polluters of toluene.

Table 3 shows the numbers of children living within two miles of each category/specific toxin. Over 33,000 young children live close to manganese sources. The number of young children living close to the other toxins ranges from 55,687 to 102,471. The data for the larger cohort of school-age children are as follows: from 92,542 for manganese up to 271,545 for toluene.

TABLE 1: # OF HVPs WITH SCHOOLS WITHIN:			
Pollutant	**0.5 Mile**	**1 Mile**	**2 Miles**
Recognized Developmental Toxins	18	46	77
Suspected Neurotoxins	17	43	69
Lead	18	36	60
Mercury	17	34	58
Carbon Disulfide	11	34	67
Manganese	8	22	40
Toluene	18	49	80

TABLE 2: # OF SCHOOLS NEAR HVP, WITHIN:			
Pollutant	**0.5 Mile**	**1 Mile**	**2 Miles**
Recognized Developmental Toxins	29	96	379
Suspected Neurotoxins	23	118	469
Lead	33	129	396
Mercury	24	93	328
Carbon Disulfide	14	80	447
Manganese	13	77	260
Toluene	33	150	546

TABLE 3: # OF CHILDREN WITHIN 2 MILES OF HVP:		
Pollutant	**Under Age 5**	**Ages 5 to 17**
Recognized Developmental Toxins	91,904	244,177
Suspected Neurotoxins	59,103	158,519
Lead	85,541	204,266
Mercury	55,687	152,232
Carbon Disulfide	91,017	243,940
Manganese	33,561	92,542
Toluene	102,471	271,545

TABLE 4: RACE AND CLASS CHARACTERISTICS OF CIRCULAR AREAS AROUND HVP						
	% of Disp. Minority Presence at:		**% of Disp. Poverty Presence at:**		**% Disp. Low MFI at:**	
Pollutant	**1 mile**	**2 miles**	**1 mile**	**2 miles**	**1 mile**	**2 miles**
Recognized Developmental Toxins	37	42	34	49	55	69
Suspected Neurotoxins	30	40	37	49	47	61
Lead	28	32	25	37	40	46
Mercury	16	23	28	35	38	52
Carbon Disulfide	29	32	40	47	47	55
Manganese	19	25	29	39	39	41
Toluene	35	43	37	50	58	73

TABLE 5: RACE AND CLASS CHARACTERISTICS OF CIRCULAR AREAS AROUND HVP FOR ONLY THOSE HVPs CLOSE TO RESIDENTIAL AREAS						
	% of Disp. Minority Presence at:		**% of Disp. Poverty Presence at:**		**% Disp. Low MFI at:**	
Pollutants	**1 mile**	**2 miles**	**1 mile**	**2 miles**	**1 mile**	**2 miles**
Recognized Developmental Toxins	49	47	42	53	71	75
Suspected Neurotoxins	50	50	62	60	77	75
Lead	55	46	52	54	80	67
Mercury	31	30	51	47	64	67
Carbon Disulfide	48	41	61	56	70	66
Manganese	39	40	58	60	76	63
Toluene	43	45	43	52	67	75

While Tables 1-3 demonstrate that substantial numbers of schools and children are found in close proximity to the largest releases of the very toxins that put children’s health and learning abilities at greatest risk, Tables 4 and 5 begin to document the race and class characteristics of the populations living near the HVPs. Table 4 shows the percentage of HVPs for each category or type of toxin that has disproportionate minority, poverty, or low MFI populations living nearby. Focusing on the 2 mile radius, we find that 23-43% of HVPs are surrounded by disproportionate minority populations; 37-50% by disproportionate poverty; and 41-73% by low MFI. So, roughly one fourth to three fourths of the HVPs reflect environmental inequalities. While these proportions are substantial, it is worth noting that many of the top 100 HVPs in each category are (fortunately) not close to residential populations. Table 5 takes this into account, showing the percent of disproportionate minority, poverty, and low MFI around only those HVPs that are close to residential areas. Of course, because the number of polluters is reduced for each observation, while the number of disproportionate cases remains the same, the percentages all increase. It is worth noting that 29 of 42 calculations are greater than or equal to 50%, while only 2 are lower than 40%, and 11 actually exceed 66%. So, when focusing on only those HVPs that are close to residential areas, we find strong patterns of environmental inequality. That is, with few exceptions, high proportions of the HVPs studied are surrounded by circular areas characterized by disproportionate minority, poverty, and low MFI populations.

TABLE 6: CORRELATION OF (A) NUMBER OF SCHOOLS AND CHILDREN IN HVP CIRCULAR AREAS WITH (B) RACE AND CLASS DEMOGRAPHICS (* p<.05)				
	# schools <1	**# schools <2**	**# children <5**	**# children 5-17**
Recognized Developmental Toxins				
% poverty	0.38*	0.41*	0.27*	0.28*
disp. Poverty	0.33*	0.33*	0.28*	0.26*
MFI	-0.27*	-0.29*	-0.09	-0.1
disp. MFI	-0.29*	-0.29*	-0.22*	-0.2
% minority	0.5*	0.51*	0.46*	0.47*
disp. Minority	0.36*	0.44*	0.35*	0.38*
Suspected Neurotoxins				
% poverty	0.2	0.21	0.11	0.11
disp. Poverty	0.12	0.18	0.12	0.11
MFI	-0.14	-0.13	0.01	0.02
disp. MFI	-0.17	-0.20	-0.12	-0.1
% minority	0.24	0.29*	0.27*	0.28*
disp. Minority	0.23	0.33*	0.29*	0.31*
Lead				
% poverty	0.6*	0.42*	0.37*	0.38*
disp. Poverty	0.61*	0.48*	0.46*	0.47*
MFI	-0.32*	-0.17	-0.14	-0.11
disp. MFI	-0.3*	-0.19	-0.23	-0.21
% minority	0.33*	0.32*	0.48*	0.47*
disp. Minority	0.34*	0.37*	0.5*	0.49*
Mercury				
% poverty	0.13	.34*	0.19	0.18
disp. Poverty	0.15	.36*	0.19	0.2
MFI	-0.15	-0.14	-0.02	0.02
disp. MFI	-0.19	-0.28*	-0.26*	-0.22
% minority	0.32*	0.35*	0.49*	0.50*
disp. Minority	0.28*	0.41*	0.41*	0.43*
Carbon Disulfide				
% poverty	0.41*	0.4*	0.27*	0.25*
disp. Poverty	0.32*	0.44*	0.3*	0.26*
MFI	-0.32*	-0.33*	-0.13	-0.1
disp. MFI	-0.33*	-0.34*	-0.21	-0.19
% minority	0.37*	0.46*	0.59*	0.59*
disp. Minority	0.36*	0.61*	0.54*	0.5*
Manganese				
% poverty	0.22	0.36*	0.25*	0.24
disp. Poverty	0.24	0.54*	0.4*	0.37*
MFI	-0.17	-0.31*	-0.19	-0.19
disp. MFI	-0.21	-0.37*	-0.32*	-0.31*
% minority	0.41*	0.41*	0.36*	0.38*
disp. Minority	0.42*	0.58*	0.46*	0.46*
Toluene				
% poverty	0.23*	0.26*	0.18	0.18
disp. Poverty	0.28*	0.33*	0.35*	0.33*
MFI	-0.13	-0.12	0.04	0.03
disp. MFI	-0.24*	-0.18	-0.12	-0.1
% minority	0.41*	0.41*	0.37*	0.39*
disp. Minority	0.38*	0.42*	0.45*	0.45*

Table 6 brings our descriptive analyses of polluters, schools, race, and class together in the form of a circular area correlation analysis for HVPs with at least one school within one or two miles. For each category and type of toxin, we correlate all of our measures of absolute and disproportionate race and class with (a) the number of schools within one mile of each polluter, (b) the number of schools within two miles, (c) the number of young children within two miles, and (d) the number of school age children within two miles. So, for example, for recognized developmental toxins, percent poverty in the circular areas with radii of one mile is positively and significantly correlated with the number of schools within one mile (r=.38), while percent poverty at two miles is positively and significantly correlated with the number of schools at two miles (r=.41), and so on. Table 6 reveals a number of meaningful patterns. First, 108 of 168 (64%) correlation coefficients are statistically significant. So, the numbers of schools and children near HVPs are frequently correlated with measures of race and class inequality. Moreover, the frequency of correlations for each measure of race and class is strongly patterned. Both measures of minority presence (i.e., absolute percent minority and disproportionate minority) are almost always statistically significant (54 of 56 observations); the absolute and disproportionate poverty measures are frequently significant (37 of 56); while the MFI measures are significant only about a third of the time (18 of 56). But note that the measure of disproportionate MFI is significant more often (12 of 28 observations) than is the measure of absolute MFI (6 of 28). Note, too, that throughout Table 6, the disproportionality coefficients are higher than their respective absolute coefficients in 62 of 84 cases (i.e., 74%).

Taken together, these findings show that there are large numbers of schools and children in close proximity to HVPs, and that these proximity measures are frequently correlated with measures of race and class inequality. This convergence of ascriptive forces – of race and class and polluted places, and of children with multiple overlapping vulnerabilities – can be documented in one additional, quite revealing way. A close examination of our lists of HVPs shows that some polluters are within two miles of particularly large numbers of schools. In fact, 24 HVPs are close to 20 or more schools. We think of these as "hot spots" or "the worst of the worst" in terms of proximity to vulnerable populations. It is a simple matter to count the number of hot spots with disproportionate poverty, minority, and low-income ratios at distances of one and two miles (see Table 7). At one mile, 20 of 24 HVPs have disproportionate poverty populations in their circular areas (83%); 18 of 24 have disproportionate minority populations (75%); and 23 of 24 have disproportionately low MFI (96%). At two miles, the corresponding results are: 21 of 24 (88%) for poverty; 20 of 24 (83%) for minority; and 23 0f 24 (96%) for MFI. In other words, we made 6 observations for each of our 24 cases (n=144), and 125 of these observations (86.8%) showed demographic or economic disproportionality. So, the intersection of race, class, and place ascriptions is particularly high for hot spots.

TABLE 7. Hot Spots: HVPs with at least 20 schools within 2 miles, with ratios of circular area demographics to comparable state demographics.

HVP	Schools(N)	Ratios: %Minority		%Poverty		MFI	
Recognized Developmental Toxins		1 mi.	2 mi.	1 mi.	2 mi.	1 mi.	2mi.
1. Exxon Mobil Refinery, Baton Rouge, LA[a]	24	2.52	2.49	1.81	1.99	.65	.60
2. Nailite International, Miami, FL[b]	34	2.71	2.72	1.93	1.88	.87	.84
3. Exxon Mobil Chemical Plant, Baton Rouge. LA[c]	20	2.47	2.49	2.39	2.04	.52	.62
Suspected Neurotoxins							
4. Eastman Kodak, Rochester, NY	20	.74	1.11	1.00	1.47	.83	.73
5. Exxon Mobil Refinery, Torrance, CA	20	.93	1.15	.49	.73	1.16	1.09
6. Owens Corning, Newark, OH[d]	22	.36	.42	1.81	1.60	.77	.76

7. Honeywell International, Baton Rouge, LA	23	2.34	2.30	2.89	1.92	.54	.67
8. GMVM, Lansing, MI	26	2.24	1.74	2.26	1.78	.77	.84
<u>Lead</u>							
9. Kennedy Valve, Elmira, NY	20	.57	.39	2.02	1.50	.57	.66
10. Intermet Foundry, Decatur, IL	21	1.69	1.15	4.12	2.66	.55	.68
11. Cathedral Art Metal, Providence, RI	30	3.79	3.28	3.66	3.04	.49	.57
12. H. Kramer, Chicago, IL	42	2.75	2.43	3.27	2.75	.71	.91
<u>Mercury</u>							
13. National Steel, Ecorse, MI	25	.74	1.07	1.11	1.18	.91	.89
14. Gainsville Regional Utilities, Gainsville, FL	20	1.23	1.30	2.41	2.86	.67	.65
15. Atlantic States Cast iron Pipe, Phillipsburg, NJ	20	.40	.52	.92	.78	.71	.72
16. Saginaw Metal Castings, Saginaw, MI[e]	26	4.10	3.19	5.20	3.46	.38	.56
<u>Carbon Disulfide</u>							
17. Atofina Chemicals, Beaumont, TX	22	1.78	1.45	2.78	2.02	.48	.73
18. Rhodia, Hammond, IN	29	4.93	4.18	2.07	2.55	.76	.73
<u>Manganese</u>							
19. WCI Steel, Warren, OH	20	2.81	1.93	3.32	2.44	.53	.67
20. ISG, Cleveland, OH	32	2.08	2.93	3.44	4.56	.57	.46
<u>Toluene</u>							
21. Calumet Lubricants, Shreveport, LA	21	2.33	2.28	1.58	1.82	.63	.61
22. 3M, Bedford Park, IL	20	1.37	.77	.83	.76	.86	.97
23. Ideal Tape, Lowell, MA	20	2.26	2.26	1.03	2.07	.83	.75
24. 3M, St. Paul, MN	26	4.33	4.18	3.22	3.24	.67	.69

[a] also on the carbon disulfide list

[b] also on the toluene list

[c] also on the suspected neurotoxin list

[d] also on the lead list

[e] also on the manganese list

CASE STUDIES

The quantitative, aggregate data presented in this project suggest a striking pattern of disproportionate exposure of poor, minority schoolchildren to developmental and neurotoxins in the air around their schools. However informative these numbers may seem, they do not paint a complete picture of the potential consequences of working, playing and learning in the shadow of a major industrial facility. The aggregate data can be complemented by case studies in order to more fully comprehend a disturbing trend: the patterned proximity of air pollution that has the potential to damage a child's learning and social capacity to precisely those children who are *already disadvantaged* in terms of academic and social potential because of other ascriptive factors such as race and class. Below are three case studies of some of the apparent toxic "hotspots" that emerged on the various lists of top polluters. These sites were chosen both for the high quantities of reported emissions of various toxins and the high concentrations of schools that are located in the immediate vicinity (within two miles) of these facilities.

The first site, Kodak Park in Rochester, NY, stood out on the list of the top 100 polluters of suspected neurotoxicants to air (it was number 46) both because of the site's status as one of the nation's top polluters of a myriad of chemicals and our finding that 20 schools serving mostly poor, minority students are located within two miles of the facility—including 6 schools within one mile and 2 schools within half a mile.

The second site, US Steel Gary Works in Gary, IN is among the top 100 polluters of manganese—an understudied chemical which has been shown to produce learning and neurological difficulties on a "continuum of dysfunction." Gary Works was chosen not only because it was the nation's 12th worst polluter of manganese and is located within two miles of

17 schools (at least 4 of which are within one mile), but also because a recent class-action lawsuit was filed against US Steel and 10 other local industrial facilities ("Lake County, Indiana…" 2009). The suit claims that children attending some of these Gary schools (which, according to our research, are almost entirely composed of African American students) are already experiencing a number of serious health problems.

The third case study, on East Baton Rouge Parish in LA, stood out for several reasons. Two ExxonMobil facilities, located within 0.7 miles of each other, were each on multiple HVP lists. The ExxonMobil Chemical Plant was among the top 100 HVPs of recognized developmental toxins and suspected neurotoxins. ExxonMobil Refinery and Supply was among the top 100 HVPs of recognized developmental toxins and carbon disulfide. Both facilities were within two miles of 20 or more schools. This may well be the prototypical "hot spot", putting children at risk from large volumes of many toxins.

Kodak Park, Rochester NY

In operation since 1891, Eastman Kodak Company's Kodak Park is one of the largest industrial complexes in the U.S. It is also the world's largest manufacturer of photographic products (EPA 2004). According to the EPA, "[t]he facility consists of approximately 2000 acres and extends approximately 4 miles through the City of Rochester and the Town of Greece, New York" (2004). In 1990, it was reported that this facility employed 47,000 people (Hanley 1990). In 2004, that figure was reported elsewhere to be 19,000 (EPA 2004). In the past, media outlets such as *The New York Times* have repeatedly reported the benefits of having such a facility within New York state; in 1990 Hanley wrote that Kodak paid approximately "$13.3 million annually in property taxes [and] has donated millions to education, culture, and social services." The Kodak website touts the company as being on the cutting edge of environmental innovation, striving to create a cleaner Rochester community. On the surface, this may sound like a win-win situation for the Rochester area and the Kodak Corporation.

However, some Rochester residents and scientific experts tell a different story about the role of Kodak in the Rochester community. For example, many residents have noticed the unusually high rates of certain kinds of cancer within the area. New York's Department of Health reported that in the 1990's "women living near Kodak park had approximately an 80% greater risk of developing pancreatic cancer, increasing to 96% for women living near Kodak for more than 20 years" (Niman 2003). According to information from the National Cancer Institute, "the Rochester area is in the top ten percent for death rates from 13 different types of cancers" (Niman 2003). In the report "Kodak's toxic moments," Niman mentions that one mother found that 33 children in the immediate vicinity of the Kodak plant had been diagnosed with brain cancer in one year. The parents of five of these children were suing Kodak for $75 million because they believed that the company's pollution was to blame for their children's conditions.

In all, Kodak was reported to be New York's top emitter of "recognized airborne carcinogens, waterborne developmental toxicants… suspected endocrine, gastrointestinal, liver, cardiovascular, kidney, respiratory and reproductive toxicants as well as neurotoxins" in 1999 (Niman 2003). Nationally, Kodak is known as one of the nation's largest sources of air pollution. According to the Political Economy Research Institute's (PERI) "Toxic 100," a listing of the top corporate air polluters in the US, Kodak ranked #9 based on data for the year 2006 (http://www.peri.umass.edu/toxic_index/). Locally, activists have organized "bucket brigades" to collect air samples using "low-tech devices…packed into a plastic bucket" which measure the concentrations of toxins in the air around the Kodak facility. Such groups have found the concentrations of carcinogens such as toluene and methylene chloride to be far above the state-recommended averages for human health.   Interestingly, when the Global Community Monitor reported the finding of the first such “bucket brigade,” toluene was mentioned as a carcinogen but its potential neurological and developmental effects were not noted. Such instances throughout the reports that do mention pollution in the Kodak area suggest that while there has been a fair amount of community resistance with respect to the cancer-causing effects of Kodak’s pollution, it seems that less attention has been paid to the more subtle potential neurological and developmental effects that such pollution may be having on children. According to Scorecard, Kodak emits large quantities of suspected neurotoxicants (which are also known developmental toxicants) such as mercury, lead and dichloromethane into the Rochester air (www.scorecard.org). As mentioned, neurotoxicants and developmental toxins have the ability to impair movement, coordination, learning and socialization, all of which are skills essential to performing well at school.

Current information from a school-locator database called Schooldigger.com, which compiles demographic and school performance data from the National Center for Education Statistics, the US Department of Education and state departments of education, shows that there are 22 schools (public and private) in a 2 mile radius of Kodak Park, 18 of which are public schools. Referencing these schools with the data from *USA Today*’s Smokestack Effect website shows that of the 21 schools for which data were available, 16 ranked in the top 2% nationally for toxic air pollution (http://content.usatoday.com/news/nation/environment/smokestack/index). Public data about the schools near Kodak Park reveal that 15 of the 22 schools are made up of mostly minority students, and in 14 of 18 public schools the vast majority of students are eligible for free lunch—an indicator of low-income status. As for academic performance (which was an indicator of "human capital" examined by Pastor *et al.* 2004), according to information gathered from state data about 2006 scores on the New York State Assessment Test in English, in 13 of the 18 public schools, more than half of the grades who took the test received scores below the state average. In nine of these schools, all of the grades who took the test scored below the state average.[1]

The above information suggests the possibility of a pattern of "environmental ascription" (i.e., harmful environmental impacts on learning and, therefore, life chances) in Kodak Park. As a consequence, those students who are already faced with academic disadvantages relating to their socioeconomic status have to face the double burden of being at increased risk for learning problems.

USX (US Steel) Gary Works, Gary IN

The city of Gary, Indiana was founded in 1906 when the United States Steel Corporation (today known as USX Corporation) decided to build a plant at the previously unpopulated site and needed a place to house its workers. Initially, people from all walks of life populated the neighborhoods directly surrounding the facility, so until roughly the World War II era Gary was a racially and economically diverse city. As historian Andrew Hurley noted in his in-depth study of Gary, *Environmental Inequalities,* during this period the burden of dealing with the environmental consequences of steel production (i.e., the discharge of "several hundred tons of

[1] Data on schools can be obtained from schooldigger.com by clicking on each school individually: http://www.schooldigger.com/go/NY/search.aspx?searchtype=7&address=1669+LAKE+AVE.&city=Rochester&zip=&within=2.

waste annually into Gary's atmosphere and waterways") was relatively equal for all residents (Hurley 1995:18). Following developments such as the construction of highways that allowed expansion into outlying suburban areas, however, most of the white and well-to-do families that worked in Gary were able to flee the city for cleaner surroundings. As a consequence of their economic situation and discriminatory real estate practices, most African American residents were forced to remain in the city where they bear the brunt of US Steel's toxic emissions. According to the 2000 Census, 84% of Gary residents are African American, making Gary the city with a population over 100,000 with the highest percentage of African American residents in the country. PERI's Toxic 100 (http://www.peri.umass.edu/toxic100/) calculates the minority share of exposure to pollutants from the USS Gary Works facility to be 66.3%.

According to Hurley, the situation in Gary became a microcosm of a trend in American urban areas where "[t]hrough the accumulation of private property and the manipulation of governmental authority, privileged Americans used their wealth and power to construct a *hierarchy of place* around divisions of race and class" (emphasis added) (Hurley 5). By illustrating the lengths that certain Americans will go to in order to build their communities away from the intrusion of industry and to exclude others from sharing in these amenities, Hurley reinforces the concept of place as an ascriptive force that can significantly impact life chances.

For a while, with the loss of such politically savvy citizens, heavy industries in cities such as Gary have had a much easier time polluting the air and water of impoverished, minority communities without having to make significant concessions as a result of regulatory or community backlash. However, when *USA Today* released national data that it had gathered about the air quality around 127,800 public and private schools, the results struck a chord with Gary residents. There are 17 schools within a two-mile radius of the site. Reuters reported that “the air quality in Lake County, Indiana [where Gary is located] is among the worst in the country, and... school-aged kids in the region inhale or ingest more toxins than nearly any other area in the US” (“Lake County, Indiana…” 2009). Armed with this information, which only confirmed what local residents had already suspected for decades, residents led by Lake County parent Ron Kurth filed a class-action lawsuit against US Steel and 7 other area corporations in order to force them to pay for lifetime medical monitoring for the children of Gary’s schools, to increase air quality monitoring around the city and to create “a public awareness campaign about the dangers of these chemicals” (“Lake County, Indiana…” 2009). This news report loosely connected the dots between the elevated presence of airborne toxins such as cadmium, manganese and lead, the potential for “increased risk of… behavioral problems, as well as mental disabilities” and the obvious fact the “the population of Lake County is economically disadvantaged,” but it did not emphasize the large African American population and the impact that this pollution may be having on academic performance. Of the 9 schools within 2 miles of US Steel for which current information was available, 8 schools are primarily attended by minority students and in five of these schools, every grade level that took the state ISTEP + English Test in 2006 scored below the state average (with three more schools scoring below average in the majority of grade levels), but the media has yet to focus on this aspect of the pollution problem in Gary.[2]

Still, there are hints of the beginning of an environmental justice debate around this lawsuit. One attorney for the plaintiffs was quoted as saying “Most people in Lake County don’t have the ability to pull up their stakes and move away to find a healthy place to raise their kid;

[2] See http://www.schooldigger.com/go/IN/search.aspx?searchtype=7&address=1+n.+broadway&city=gary&zip=&within=2.

they are stuck there… Regardless of how poor they are, we think Lake County children should have the right to breathe air that won't make them ill, or worse." ("Lake County, Indiana…" 2009).

The above quote, as well as the provision in the lawsuit that calls for a public awareness campaign, both emphasize the *ascriptive* aspect of these environmental disamenities of living near HVPs such as USS Gary Works—these residents do not *choose* to live like this, they are either unable to move because of racial or economic factors or they do not know enough about the consequences of toxic exposure to do anything about it. The fact that this problem has persisted for decades illustrates that it sometimes takes the enormous influence of national media outlets such as *USA Today* to spread awareness beyond the activists and scientific experts and into the broader community. Partially, this is due to a lack of access to specialized information. The other dimension of the historic lack of widespread community action against major corporations relates to the fact that most residents in cities such as Gary depend upon companies such as US Steel for their livelihood. *USA Today* summarized the dilemma this way:

> *Factories, chemical plants and other industries are the lifeblood of many towns, providing the jobs and the tax base that sustain communities. The industries and the schools nearby often have co-existed for decades. For just as long, residents in cities large and small have tried to accept—or simply ignore—the tradeoffs: air pollution that leads to breathing problems or worse.*

The fact that, directly following the release of the *USA Today* report, Lake County residents are reversing a long-standing imbalanced power equation by standing up to companies such as US Steel (despite their economic dependence on them) illustrates the power of mainstream national media to disseminate important technical information to people in a way that can be comprehended and hopefully acted upon. The disparate pieces of the environmental ascription equation are out there in the current media reports: the rise of developmental disabilities and their possible connection to exposure to developmental and neurotoxins, the problem of air pollution near schools, particularly in poor and minority communities, and the problem of children in poor communities being disproportionately affected by learning difficulties and other social problems. All that is needed is an explicit connection of these reports and a discussion of the potential economic and social implications for these communities and the nation as a whole.

ExxonMobil Refinery and Chemical Plant, East Baton Rouge Parish, LA

The East Baton Rouge parish in Louisiana is home to a population of 414,073 residents, 26.2% of which are children according to the 2000 Census. The local school district manages 82 schools with the admirable mission of "educat[ing] all students to their maximum potential in a caring, rigorous, and safe environment" (www.ebrschools.org). The last part of this mission, the provision of a "safe environment" for East Baton Rouge's children, has also been the focus of numerous local activist groups such as the Louisiana Environmental Action Network (LEAN) and the Louisiana Bucket Brigade. Such grassroots environmental organizations are interested in this area because 33 of those 82 schools (including 12,000 students and school employees) are located within 2 miles of both the second-largest oil refinery in the U.S., as well as "one of the largest chemical plants in the world" (exxonmobilbr.com), both of which are owned and operated by oil giant ExxonMobil, a company that is currently ranked as the second highest corporate (air) polluter in the US according to PERI's "Toxic 100" ("Common Ground" p.10; (http://www.peri.umass.edu/toxic_index/). Both LEAN (leanweb.org) and the Bucket Brigade (labucketbrigade.org) have produced numerous reports and filed lawsuits in order to increase public awareness about the oversights that have led *USA Today* to conclude that East Baton Rouge's schools are plagued by some of the worst air quality in the nation. Data from USA

Today's "Smokestack Effect" report indicate that of the 33 schools within 2 miles of the ExxonMobil Refinery, 10 of them are in the 1st percentile nationally in terms of health risk from polluted air, 14 of the schools are in the 2nd percentile, and 3 are in the 3rd (the remaining 6 schools had no available data) (www.usatoday.com/news/nation/environment/school-air.htm). An additional report from LEAN found that East Baton Rouge Parish "ranked 24 out of 2,265 counties in the United States in the EPA data base for human risk" (Wold 2008).

An additional dimension of the situation in East Baton Rouge is highlighted in the "Common Ground" report by the Louisiana Bucket Brigade (LABB). The report notes that even within the relatively small area of the Parish, there are intimations of certain vulnerable populations bearing a disproportionate burden in terms of exposure to the refinery's emissions. Specifically, the report cites 2000 Census data showing that the population of East Baton Rouge Parish is 39.6% black overall, yet that number jumps to 86.7% black in the 2 mile radius around the ExxonMobil Refinery. A similar pattern can be seen for median income ($38,542 overall, but $21,982 near the refinery), unemployment (6.3% versus 12.4%), and percent of children in poverty (23% versus 45.3%) ("Common Ground" p. 7). Another report from the Political Economy Research Institute, titled "Justice in the Air," found that Baton Rouge had the second-worst "discrepancy" in terms of minority and low-income share of exposure to pollutants compared to their share of the state population (Ash *et al.* 2009). These micro-level observations also reinforce the nation-wide patterns suggested by our data. Even on the town or parish level, not only can the place where children live and attend school potentially be considered an ascriptive characteristic (acting as a limiting force on potential life chances), but this environmental dimension of ascription clearly intersects with racial and class inequalities.

Much of the information revealed about the problems in East Baton Rouge has been a result of the relatively strong level of local environmental activism. However, the negative externalities of industrial production continue to be felt throughout the community. Reading further into the situation in East Baton Rouge suggests that meaningful progress in reducing harmful levels of pollution may be difficult for reasons that are similar to roadblocks faced in other communities where pollution from large corporations has become a chronic concern. In Louisiana, while some have noted the apparent “lack of meaningful zoning policies” (“Common Ground” p.10) as a partial culprit in the proximity of schools and residential areas to these major industrial facilities, activists have been primarily focused on what they perceive as a “failure” on the part of government agencies to enforce emissions guidelines (Lodge 2008). This distrust of the local government’s ability to effectively control the activities of a major corporation such as ExxonMobil was clear when LEAN, after having sued the state DEQ on several previous occasions, filed a lawsuit in 2008 against the federal EPA over Baton Rouge’s sub-standard air quality. Further frustration over the ability of companies to effectively avoid government enforcement of emissions standards is highlighted in the “Common Ground” report which focuses on reducing the “inordinate”(Brown 2009) number of “accidental” releases of mass quantities of pollution that go “beyond what refineries are legally allowed to release” (“Common Ground” p.3). According to the report, the ExxonMobil Refinery had the highest number of accidental releases in the state for the years 2005-2008, with a total of 456 accidents releasing 3,452,376 pounds of pollution, all within clear view from the Department of Environmental Quality offices in Baton Rouge. While such a large refinery can be expected to have a relatively high number of accidents, the numbers suggest that the plant had an average of 3.7 accidents *per week* in 2008 and that the company “failed to provide a cause for 59% of its accidents,” a step that is technically required by law in the reporting of accidental releases ("Common Ground" p.6-7).

With all of this reporting on the potentially high levels of disproportionate exposure of vulnerable populations, especially young children, to dangerous pollutants, why hasn't there been a more systematic effort to address the problem? Following the release of *USA Today*'s "Smokestack Effect" series, the Louisiana DEQ took a seemingly proactive approach by planning to monitor air quality in those areas that the model showed to be at greatest risk. According to a follow-up report by *USA Today*, regulators spent merely four hours monitoring the air "outside Wyandotte Early Childhood Center, a preschool blocks from an ExxonMobil refinery," and found the air quality to be in line with safety and health standards. Some activists suggest that drawing broad conclusions from such a limited amount of monitoring is misleading. John Balbus, the chief health scientist for the Environmental Defense Fund and a member of the federal Environmental Protection Agency's children's health protection advisory committee, commented to *USA Today* that "[t]he real question here is whether the states were trying to catch these facilities' emissions at their worst or at their best" (Morrison and Heath 2009). Marylee Orr of LEAN responded similarly, saying that the state "started out to prove that they *didn't* have a problem," while another expert cited an "obvious conflict of interest" for the state to have to prove that its previous environmental remediation efforts have been insufficient and potentially dangerous (Morrison and Heath 2009).

Information available on ExxonMobil's website suggests that the "conflict of interest" faced by the state in regulating corporate pollution may contain multiple facets. According to ExxonMobil, the company is the largest private employer in the East Baton Rouge Parish (3,225 people employed) and they were also the largest taxpayer in the parish as of 2006, paying $24.5

million in property taxes (or 8.5% of all property taxes) and $15.6 million in sales taxes. Further, the corporation claims to have generated $52.9 million in revenues for the parish in 2006 (exxonmobilbr.com). Additionally, the corporation made $1.9 million in "direct corporate contributions" to the community in 2007 (however, keep in mind that their 2007 *profits* totaled $4.6 million per hour) (exxonmobilbr.com; Mufson 2008). Environmental impacts may be overlooked in the face of such significant financial contributions, to the point where a representative of the East Baton Rouge school district told *USA Today* that the issue of air quality "just doesn't come up in conversation… it's just part of daily life out here" (Morrison, Heath and Jervis 2008).

CONCLUSIONS

As *USA Today*'s "Smokestack Effect" series originally showed, many schools in our nation are located in highly polluted places. By focusing on the locations with the highest emissions of developmental neurotoxins, we have augmented *USA Today*'s disturbing findings. In the aggregate, thousands of schools and hundreds of thousands of children are located within two miles of a relatively small number of HVPs. Substantial proportions of these HVPs are located in disproportionately minority, poor, and low-income communities. In other words, some of our nation's most vulnerable populations – children, minorities, and the poor – face disproportionate risks from this particular type of "smokestack effect".

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