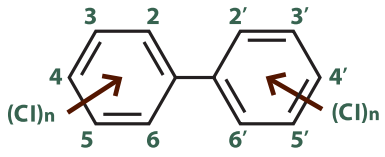
Community Report

Comparison of Exposures to Polychlorinated Biphenyls among Louisiana Residents

The Agency for Toxic Substances and Disease Registry (ATSDR) conducted a study to find out if Louisiana Residents had been exposed to dioxins and volatile organic compounds (VOCs). We tested blood samples of residents of Calcasieu and Lafayette Parishes for these exposures in 2002. Because of the laboratory test for dioxins, we also tested for polychlorinated biphenyls (PCBs). This report describes the PCB findings from that study.

About the Study

Calcasieu Parish is in southwest Louisiana. After petroleum and natural gas were found there in the 1920s, many chemical plants were built in Calcasieu Parish, particularly in the Lake Charles area. These plants make chemicals and solvents from petroleum. Calcasieu Parish residents were concerned about exposures to chemicals some of these plants had released. They were especially concerned about the dioxin exposures causing cancer or damaging their health in other ways. In 2002, ATSDR studied a group of people living in Calcasieu Parish to see if they had higher amounts of dioxins and VOCs in their blood than a comparison group. We chose our comparison group from Lafayette Parish because it is similar to Calcasieu Parish in characteristics like geography, total population, age and race mix, poverty level, diet and lifestyle, but it has fewer chemical plants. Because the laboratory test for dioxins also measured PCBs, we looked at the PCB results. This report compares the PCB results from Calcasieu Parish with those of Lafayette Parish and the general U.S. population.



What are PCBs?

PCBs are chemicals that some companies used in the past to insulate electrical equipment. The United States banned their use in 1979. PCBs do not break down easily. They stay in the environment a long time. We all have some PCBs in our blood. They enter our body when we breathe, eat or drink, or touch them. PCBs collect in body fat and build up in animals that eat smaller animals and in many fish species. People are exposed to PCBs when they eat those animals and fish. Blood tests can show if a person has a blood PCB level similar to most levels found throughout the general U.S. population.

Human and animal studies have shown that PCB exposure can harm our immune and reproductive systems. Studies among workers exposed to high levels of PCBs have shown that the exposures can cause an increase in certain cancers, and nerve and heart disease. Some studies have suggested that PCBs may be associated with diabetes, and may harm our endocrine system (our thyroid gland and adrenal glands are part of our endocrine system.

The Study Methods

In the 2002 study, ATSDR wanted to find out if Calcasieu Parish residents had higher amounts of dioxins and VOCs in their blood than Lafayette Parish residents. Although our main goal was to measure blood dioxin levels, we needed to measure PCBs to find the total blood dioxin levels. We tested for 27 PCBs that are generally found in human blood.

We enrolled 415 people in the study. These participants had to have lived in Calcasieu Parish for the last 5 years and be at least 15 years of age. The comparison group of people had to have lived in Lafayette Parish for the last 5 years, had to have never lived in Calcasieu Parish, and be at least 15 years of age. We divided Calcasieu Parish into three distinct areas: the industrial corridor, the industrial buffer, and the outer ring (see figure below). These areas were based on how close the residents lived to the sources of contamination. We told the study participants about their rights and they signed consent forms. We then drew blood samples from the study participants. Each person answered questions about their age, race, sex, present work and work history, how long they had lived in the parish, if they smoked, and if they ate locally caught fish.

We tested the blood samples for PCBs at the Centers for Disease Control and Prevention's (CDC) laboratory at their National Center for Environmental Health. We could not use 28 of the 415 samples. The 387 study participants included 274 people from Calcasieu Parish and 113 people from Lafayette Parish.

We compared blood PCB levels of participants living in Calcasieu and Lafayette Parishes. We also compared the combined blood PCB levels of participants living in both parishes with national levels. National levels are blood PCB levels of people in the general U.S. population. These levels are used to determine if people or groups of people have had unusually high exposures. The national PCB levels were taken from CDC's 2001 – 2002 National Health and Nutrition Examination Survey (NHANES). The NHANES survey gathers information about the health and nutritional status of the U.S. population.

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The Study Results

Table 1 describes the study participants. The age, sex, race, and smoking status of the participants in both parishes were similar. The ages of the participants from both parishes ranged from 15 to 91 years; 44% of the participants were men, and 90% of the participants were white. More people in Calcasieu Parish had lived in the parish greater than 20 years compared to people in Lafayette parish (Calcasieu Parish 62%; Lafayette Parish, 45%). More Calcasieu Parish participants reported eating one or more types of locally caught fish than did Lafayette Parish participants (Calcasieu Parish, 87%; Lafayette Parish, 48%).

We tested the blood samples of 387 participants for 32 PCBs. We could measure 27 of the 32 PCBs because we found them in 50% or more of the blood samples. We could not measure 5 of the 32 PCBs because we did not find them in at least 50% of the blood samples. We compared answers to questions we had asked participants from both parishes to see if behaviors were related to blood PCBs levels (Table 2). We then examined the blood PCB levels by age group. The average blood PCB level among people aged 60 years and older was significantly higher in Lafayette Parish than in Calcasieu Parish. The average blood PCB levels in both parishes among the three younger age groups (15 – 29, 30 – 44, and 45 – 59) were similar. In addition, the average blood PCB level among African-American participants was higher than among white participants in Lafayette Parish, but not in Calcasieu Parish. Blood PCB levels among participants in both parishes increased with age. Blood PCB levels were similar in Calcasieu and Lafayette Parish participants when compared by self-reported behaviors such as eating locally caught fish and work exposures. Table 3 shows the blood PCB levels of Calcasieu Parish participants in three areas: the industrial corridor, the industrial buffer, and the outer ring. These areas were based on how close the residents lived to the sources of contamination. The averages of blood PCB levels among participants in these three areas were similar to each other and similar to participants in Lafayette Parish. The averages for blood PCB levels in Calcasieu and Lafayette Parish participants were the same when looking at sex, race, time lived in parish, and smoking status. Different types of PCBs were found in both parishes equally.

We then compared the blood PCB levels of the Calcasieu and Lafayette Parish participants with the national levels (Table 4). We used eight PCBs commonly found in the blood to compare the results. We compared blood PCB levels between Calcasieu and Lafayette Parish participants and compared the combined levels of the two parishes with the general U.S. population. The average levels of the PCBs among Calcasieu and Lafayette Parish participants were similar to each other, and were both lower than the levels from the U.S. population.

Discussion and Conclusion

We analyzed the test results to see if blood PCB levels were higher among Calcasieu Parish participants living closer to industries. We chose Lafayette Parish as the comparison group because it had fewer industries and was similar to Calcasieu Parish in characteristics like the number of residents, age and race mix, poverty level, diet and lifestyle. Our analysis indicated that Calcasieu and Lafayette Parish participants had similar blood PCB levels overall. However, the average blood PCB levels among participants aged 60 years and older were higher in Lafayette Parish than in Calcasieu Parish. Participants in the other age groups had similar blood PCB levels in both parishes (Table 2). Both parishes had similar numbers of common types of PCBs.

We then divided Calcasieu Parish into three areas based on how close they were to the industries (see figure below). The averages of blood PCB levels among participants in these three areas were similar to each other and similar to participants in Lafayette Parish (Table 3).

To find out how this region differed from the U.S. population, we compared the blood levels of the eight most common PCBs from the national data among participants in Calcasieu and Lafayette Parishes and compared the levels of participants in both parishes combined, with national levels (NHANES 2001 – 2002). We found that the overall blood PCB levels for all participants were lower than the national estimates (Table 4). We did not find total PCB levels in the region to be different. Blood PCB levels increased with age in both parishes, and in the national data.

The average total blood PCB levels in Calcasieu and Lafayette Parishes did not differ by gender, race, time lived in parish, and smoking status (Table 2). Calcasieu Parish participants reported eating more locally caught fish than Lafayette Parish participants, but blood PCB levels did not show these differences (Table 2).

Our study had some limitations. We could measure 27 of the 32 PCBs because we found them in 50% or more of the blood samples. We could not measure 5 of the 32 PCBs because we did not find them in 50% or more of the blood samples. Another limitation was the lack of information on height, weight, and obesity, which we did not collect. Information on weight would have allowed us to assess the relationship between PCB levels and body weight.

Our study had several strengths. The study design allowed us to compare the results to the entire U.S. population. We used blood tests which are the best way to find exposures to PCBs among people. We compared a regional and a national group to evaluate PCB exposures in the target population. We had strong support from the community and they were actively involved in developing this study.

In summary, total blood PCB levels in Calcasieu and Lafayette Parishes were similar to each other. Blood PCB levels among people throughout Calcasieu Parish, no matter how close they lived to the contamination, were similar to each other and to people living in Lafayette Parish. The sums of eight commonly found PCBs in Calcasieu and Lafayette Parishes, and in both parishes combined, were lower than the general U.S. population.

Table 1: Comparison of self-reported participant characteristics by parish

Characteristics	Calcasieu Parish (n = 274)	Lafayette Parish (n = 113)
Sex		
Male	127 (51%)	47 (42%)
Female	147 (49%)	66 (58%)
Age (years)		
15 – 29	72 (23%)	23 (19%)
30 – 44	65 (23%)	30 (32%)
45 – 59	73 (32%)	30 (29%)
60 and older	64 (22%)	30 (20%)
Race		
White	243 (85%)	101 (91%)
African-American	27 (15%)	10 (9%)
Ever ate locally caught fish		
Yes	239 (89%)	54 (54%)
No	30 (11%)	48 (46%)
Ate locally caught fish in past year		
Yes	165 (75%)	37 (74%)
No	67 (25%)	14 (26%)
Year moved to parish		
1981 and later	105 (39%)	62 (56%)
1961 – 1980	90 (34%)	27 (24%)
1941 – 1960	63 (23%)	18 (16%)
1900 – 1940	16 (4%)	6 (4%)
Work exposure to dioxin		
Yes	62 (23%)	12 (11%)
No	212 (77%)	101 (89%)
Use pesticides		
Yes	234 (81%)	102 (91%)
No	39 (19%)	10 (9%)
Ever smoked		
Yes	167 (67%)	66 (60%)
No	107 (33%)	47 (40%)
Currently smoke		
Yes	76 (84%)*	24 (73%)*
No	23 (16%)	10 (27%)
Smoked in past 5 years		
Yes	99 (62%)**	34 (52%)**
No	68 (38%)	33 (48%)

n = number of participants
* For this row n=99 for Calcasieu, n=34 for Lafayette
** For this row n=167 for Calcasieu, n=67 for Lafayette

Table 2: Average total blood PCB levels (sum of 27 PCBs) by characteristics and by parish

Characteristics	Calcasieu Parish (n = 274)	Lafayette Parish (n = 113)
Overall average	154.1	168.0
Sex		
Male	132.1	190.9
Female	181.1	154.2
Age (years)		
15 – 29	62.1	54.4
30 – 44	135.4	149.9
45 – 59	209.1	219.4
60 and older	293.1	403.6
Race		
White	148.8	157.0
African-American	208.4	316.9
Ever eat locally caught fish		
Yes	148.8	169.5
No	208.4	160.3
Eaten locally caught fish in past year		
Yes	149.5	155.3
No	140.1	231.6
Year moved to parish		
1981 or later	137.7	140.6
1961 – 1980	124.4	154.5
1941 – 1960	215.8	284.4
1900 – 1940	382.1	423.3
Work Exposure to Dioxin		
Yes	157.4	185.0
No	153.1	166.7
Use pesticides		
Yes	153.3	175.0
No	161.1	117.9
Ever smoked		
Yes	153.9*	177.0*
No	154.5	156.5
Currently smoke		
Yes	145.2**	126.7**
No	88.6	138.5

n = number of participants
* For this row n=99 for Calcasieu, n=34 for Lafayette
** For this row n=167 for Calcasieu, n=67 for Lafayette

Table 3: Average total blood PCB levels by characteristics in three areas of Calcasieu Parish

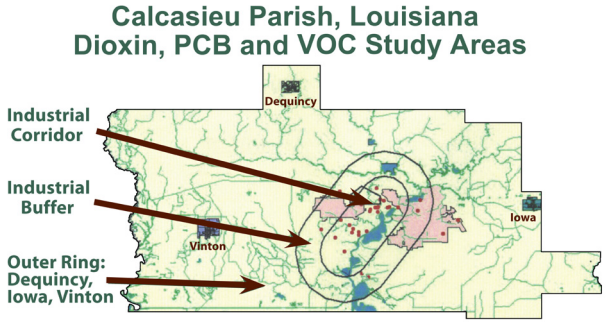
Demographic and other characteristics	Calcasieu Industrial Corridor	Calcasieu Industrial Buffer	Calcasieu Outer Ring	Calcasieu Total (n = 274)
Overall average	163.1	156.9	124.5	154.1
Sex				
Male	161.4	126.3	130.8	132.1
Female	165.3	204.6	119.9	181.1
Age (years)				
15 – 29	77.3	59.6	54.4	62.1
30 – 44	110.8	152.1	102.3	135.4
45 – 59	220.3	206.1	209.8	209.1
60 and older	286.9	305.0	259.7	293.1
Race				
White	165.2	148.5	120.7	148.0
African-American	159.7	198.9	99.6	187.4
Ever ate locally caught fish				
Yes	164.0	149.0	127.8	148.8
No	160.8	253.3	NA	208.4
Ate locally caught fish in past year				
Yes	152.5	151.8	133.0	149.5
No	172.0	135.2	117.3	140.1
Year moved to parish				
1981 or later	113.9	149.1	109.9	137.7
1961 – 1980	155.5	119.5	109.2	124.4
1941 – 1960	224.4	210.6	263.6	215.8
1900 – 1940	385.7	452.5	236.2	382.1
Work exposure to dioxin				
Yes	167.0	162.1	126.6	157.4
No	162.8	155.4	123.7	153.1
Use pesticides				
Yes	170.0	154.0	119.5	153.3
No	124.8	169.7	158.0	161.1
Ever smoked				
Yes	175.8	154.9	119.7	153.9*
No	150.3	162.3	132.3	154.5
Currently smoke				
Yes	181.2	153.7	71.9	145.2**
No	154.6	70.5	NA	88.6

n = number of participants. *For this row n=99 for Calcasieu
** For this row n=167 for Calcasieu

Table 4: Comparison of blood levels of 8 commonly detected PCBs between each parish, and between combined parishes and National Health and Nutritional Examination Survey (NHANES) 2001 – 2002

By age group (years)	Characteristics	50th p (ppb)	75th p (ppb)	95th p (ppb)
Overall 15 and older	NHANES 2001 – 2002	119.70	222.50	467.90
	Calcasieu 2002	131.80	183.40	334.50
	Lafayette 2002	125.50	220.20	426.30
	Both parishes combined	125.50	203.50	372.40
15 – 29	NHANES 2001-2002	47.60	67.40	140.80
	Both parishes combined	33.80	43.40	73.90
30 – 44	NHANES 2001 – 2002	101.90	143.30	277.00
	Both parishes combined	109.20	150.70	238.10
45-59	NHANES 2001 – 2002	172.40	253.00	455.60
	Both parishes combined	158.50	207.00	309.90
60 and older	NHANES 2001 – 2002	279.80	404.60	701.10
	Both parishes combined	249.10	349.20	593.00

P: percentile (concentrations are a sum of the 8 PCBs)
Ppb: parts per billion



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