

Health Consultation

Anniston PCB Air Sampling

ANNISTON PCB SITE

ANNISTON, CALHOUN COUNTY, ALABAMA

EPA FACILITY ID: ALD000400123

FEBRUARY 4, 2015

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Public Health Service
Agency for Toxic Substances and Disease Registry (ATSDR)
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Contents

Acronyms.....	iv
Summary.....	v
Statement of Issues	1
Background.....	1
Description of Sampling and Analysis	2
Meteorological Data.....	2
Sample Results and Screening.....	3
Discussion.....	5
Public Health Implications	6
Child Health Considerations	7
Conclusions and Recommendations	8
References.....	9
Prepared by	11
Figure 1. Locations of PCB Air Sampling Stations and Meteorological Station.	3
Table 1. Results of June 25-27, 2013, Anniston PCB Air Sampling (in ng/m ³)	4
Table 2. Comparison of June 2013 PCB Sampling to Other PCB Sampling Results.	7

Acronyms

ATSDR = Agency for Toxic Substances and Disease Registry

CREG = Cancer Risk Evaluation Guide

CV = Comparison Value

EPA = United States Environmental Protection Agency

ng/m³ = nanograms per cubic meter of air

PCB = Polychlorinated Biphenyl

µg/cu.m = micrograms per cubic meter

Summary

The Public Health Issues

The United States Environmental Protection Agency (EPA) Region IV requested that the Agency for Toxic Substances and Disease Registry (ATSDR) evaluate air data collected at the perimeter of a former polychlorinated biphenyl (PCB) manufacturing facility in Anniston, Alabama on June 25-27, 2013. This health consultation evaluates the ambient air PCB data collected by the EPA on those days. In the past, Anniston-area community members have posed questions and voiced concerns regarding PCB levels in their air (ATSDR, 2003).

Conclusion

On the basis of the data reviewed and if the sampling on June 25-27, 2013 is representative of typical conditions, ATSDR concludes that concentrations of PCBs in air at the F, I, and J sampling stations were low and are not expected to result in an increased cancer risk or other harmful health effects in people living in the neighborhoods outside the perimeter of the former PCB manufacturing facility.

Basis of Conclusion

The estimated cancer risk, based upon the maximum total PCBs detected in air on June 25-27, 2013 is 1.9×10^{-6} . This estimated risk is within EPA's target risk range of 1×10^{-6} to 1×10^{-4} . Overall, the June 2013 PCB sample results represent an estimated insignificant to slight increase in cancer risk.

Limitations

The data set is limited to two 24-hour samples taken at each of the three sampling locations (plus one duplicate). While of high quality, these are not enough data to make a statistically-relevant conclusion about the site unless they are taken together with previous datasets.

Recommendations

ATSDR recommends that periodic seasonal air sampling is conducted for PCBs in residential areas surrounding the Solutia Inc. facility to better determine community exposures.

For More Information

If you have concerns about your health, you should contact your health care provider. For questions or comments related to this Public Health Consultation please call ATSDR at 1-800-CDC-INFO

Statement of Issues

The United States Environmental Protection Agency (EPA) Region IV requested that the Agency for Toxic Substances and Disease Registry (ATSDR) evaluate environmental data collected June 25-27, 2013, in Anniston, Alabama. This health consultation discusses the ambient air polychlorinated biphenyl (PCB) data collected by the EPA on those days. In the past, Anniston-area community members posed questions and voiced concerns regarding PCB levels in their air (ATSDR, 2003).

Background

Between the early 1930s and the early 1970s polychlorinated biphenyls (PCBs) were manufactured in Anniston, AL (ATSDR, 2006). The term PCB refers to any of the 209 configurations of organochlorides with one to ten chlorine atoms attached to a molecule composed of two benzene rings (“biphenyl”). PCBs were widely used as coolant fluids in transformers, capacitors, and electric motors. The Solutia facility in Anniston, Alabama, is one of two facilities in the United States that manufactured PCBs (US EPA, 2013a). The manufacturing process included on-site burial of PCB-waste materials and consequent releases of PCBs to the environment (ATSDR, 2006). The Solutia Anniston plant (also called the Anniston Polychlorinated Biphenyl (PCB) Site), is located about one mile west of downtown Anniston and occupies 70 acres of land. The site is bounded to the east and west by residential properties, to the south by U.S. Highway 202, and north by the Norfolk Southern and Erie railroads. Manufacture of PCBs ceased in 1971 in Anniston (US EPA, 2013a). The site has been investigated by the U.S. Environmental Protection Agency (EPA), the Alabama Department of Public Health (ADPH), and the Alabama Department of Environmental Management (ADEM) (US EPA, 2013a). The Agency for Toxic Substances and Disease Registry (ATSDR) also completed several assessments of site-related contamination in Anniston, Alabama.¹

Because PCBs are often discussed in different ways, three definitions of PCBs are provided here: Aroclor, congener number, and congener class (or homolog). A PCB Aroclor is a name given to formerly commercial PCB products. Aroclors were named according to the different percentages of chlorine, by weight that the PCB mixture contained. For example, Aroclor 1242 contained approximately 42 percent chlorine, by weight. A PCB congener number refers to the specific location(s) of the chlorine(s) on the biphenyl molecule. From one to ten chlorines can be found on a biphenyl structure. For example, PCB congener number 28 is a trichlorinated biphenyl, with chlorines attached at the 2, 4, and 4' locations on the biphenyl carbons. There are a total of 209 possible congener numbers. Finally, PCB congener numbers can be grouped into congener classes (mono-through deca-) by number of chlorines and these are known as homologs. For

¹ ATSDR's previous work in Anniston, Alabama is available at: <http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=AL>

example, PCBs with congener numbers 4 through 15 each have two chlorine atoms; these 12 congeners make up the dichlorobiphenyl congener or homolog class. It should be noted that individual Aroclors were made up of varying amounts of PCBs by congener class. For example, Aroclor 1242 contained varying amounts of mono-through hexa-PCB congener classes (ATSDR, 2000).

Description of Sampling and Analysis

EPA Region IV collected 24-hour air samples on two days in June 2013 at three locations (Stations F², I, and J) on the Solutia Inc. property boundaries. Figure 1 displays the locations of both the EPA air sampling stations and the meteorological station (see section below). Sampling Station F is located north east of the site. Station I is located southwest of the Solutia Inc. site and Station J is located north of the site. Station F is located near a school, Station I is located near private residences, and Station J is located on Solutia-owned property (US EPA, 2013b). It should be noted that these are the same station locations EPA used for sampling in October, 2012 (ATSDR, 2013)

The EPA collected 24-hour samples in accordance with EPA Method TO-4A, and a contract laboratory analyzed the samples using a gas chromatograph (GC) with an electron capture detector (ECD), as described in EPA Method TO-4A (US EPA, 2013b). Eight samples were collected, including those samples needed for quality assurance and quality control purposes. Duplicate samples were taken at Sampling Station J, and a field blank was collected on the first day. Samples were analyzed for PCB congener numbers 1 through 209 and for PCBs by congener class mono- through deca-PCBs.

Meteorological Data

The EPA set up a temporary station to collect meteorological data for the two sampling periods (see Figure 1). The first meteorological sampling period was from June 25, 2013, 9:10 a.m. until June 26, 2013, 11:00 a.m. The second meteorological sampling period was from June 26, 2013, 9:22 a.m. until 11:11 a.m. on June 27, 2013. It did not rain during the sampling period. Wind speed varied from 0.4 to 5.7 miles per hour with occasional gusts up to 13 miles per hour during the first sampling period and from 3.5 to 8.1 miles per hour with occasional gusts up to 22 miles per hour during the second sampling period. During the first sampling period the wind direction was variable and during the second sampling period the wind was primarily out of the southeast (US EPA, 2013b). It is worth noting the wind direction during the June 2013 sampling period was different from the wind directions reported during previous sampling periods. During EPA's October 2012 sampling for PCBs in Anniston air, the wind direction was from the east and northeast while EPA's June 2000 sampling for PCBs in Anniston air, the wind direction was

² Sample Station F was also used in the EPA's June 2000 sampling of PCB's in Anniston air. The other two stations were not.

primarily from the southwest (ATSDR, 2003). Similarly, Hermanson et al. notes the wind in Anniston typically comes from the south southwest (Hermanson et al., 2003). Therefore, the wind directions on June 25-27, 2013 may not be typical of the Anniston area.

Figure 1. Locations of PCB Air Sampling Stations and Meteorological Station.

Anniston, Alabama; June 25-27, 2013



Met Site = Location of temporary meteorological station.

Source: US EPA, 2013b

Sample Results and Screening

The sample results are presented in Table 1 by total PCBs and PCB class. Table 1 also shows ATSDR's comparison value for PCBs in air.

Comparison Values (CVs) are chemical and media-specific concentrations in air, soil, and drinking water that are used by ATSDR health assessors and others to identify environmental contaminants at hazardous waste sites that require further evaluation. CVs are conservative and non-site specific. CVs are based on health guidelines with uncertainty factors applied to ensure that they are adequately protective of public health.

Table 1. Results of June 25-27, 2013, Anniston PCB Air Sampling (in ng/m³)

Analyte	Field Blank ng/m ³	Station F ng/m ³	Station I ng/m ³	Station J ng/m ³	Station J Duplicate ng/m ³	Station F ng/m ³	Station I ng/m ³	Station J ng/m ³	Station J Duplicate ng/m ³	CV ng/m ³
Sample Date	6/25/2013	6/25/2013	6/25/2013	6/25/2013	6/25/2013	6/26/2013	6/26/2013	6/26/2013	6/26/2013	(CREG)
Monochlorobiphenyl (Total)	<0.00025U	0.16	0.23	1.3	1.4	0.19	0.022	1.8	1.9	
Dichlorobiphenyl (Total)	0.026	0.73	2.5	3.6	3.7	1.3	0.34	5.4	5.5	
Trichlorobiphenyl (Total)	0.017	0.97	3.6	4.6	4.6	1.7	0.47	6.9	7.1	
Tetrachlorobiphenyl (Total)	0.017	0.71	1.3	2.7	2.4	0.97	0.38	3.6	3.0	
Pentachlorobiphenyl (Total)	0.01	0.3	0.2	0.64	0.64	0.35	0.066	0.86	0.8	
Hexachlorobiphenyl (Total)	0.012	0.12	0.066	0.22	0.22	0.14	0.035	0.032	0.3	
Heptachlorobiphenyl (Total)	0.0012	0.031	0.013	0.059	0.058	0.033	0.0085	0.079	0.077	
Octachlorobiphenyl (Total)	<0.00025 U	0.0062	0.0035	0.0077	0.0077	0.0069	0.0038	0.015	0.014	
Nonachlorobiphenyl (Total)	<0.00025 U	0.0014	<0.0012 U	0.0032	0.0033	0.0018	0.0013	0.003	0.0031	
Total PCBs	0.084	3.0	8	13	13	4.7	1.3	19	19	10
ng/m ³ = nanograms per cubic meter CV = Comparison Value CREG = Cancer Risk Evaluation Guide U = The analyte was not detected at or above the reporting limit. Source: US EPA 2013b										

The comparison of environmental data with ATSDR CVs is one of the first steps in the public health assessment process. The results of this screening step give health assessors an understanding of the priority contaminants at a site. When a contaminant is detected at a concentration less than its respective CVs, exposure is not expected to result in health effects, and it is not considered further as part of the public health assessment process. It should be noted that contaminants detected at concentrations that exceed their respective CVs do not necessarily represent a health threat. Instead, the results of the CV screening identify those contaminants that warrant a more detailed, site-specific evaluation to determine whether health effects may occur. CVs are not intended to be used as environmental clean-up levels.

CVs can be based on either carcinogenic or non-carcinogenic effects, but no ATSDR or EPA CVs exist for the non-carcinogenic effects of PCBs in air. Therefore, Table 1 shows the Cancer Risk Evaluation Guide (CREG) developed by ATSDR for PCBs in air. Cancer Risk Evaluation Guides (CREGs) are media-specific comparison values that are used to identify concentrations of cancer-causing substances that are unlikely to result in a significant increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor or inhalation unit risk, a target risk level (10^{-6}), and default exposure assumptions. The inhalation unit risk is the quantitative estimate in terms of risk per $\mu\text{g}/\text{cu.m}$ air breathed. Furthermore, CREGs account for a lifetime exposure (70 years). Only Station J on June 25-27, 2013 had a total PCB concentration above the CREG.

At Station J, there was good agreement between the sampling duplicates each day and between the sampling days (See Table 1). Station F had the lowest average concentration of PCBs of the three sampling stations which could be because it was not downwind of the site on either sampling day. Station F could also be located in an area of low PCB concentrations as it had the lowest concentrations in 2012 as well. Station I had the most variation between the sampling days (see Table 1) but this could be explained by the variable wind direction on June 25 and the wind direction out of the southeast on June 26. The average concentrations for Station I on both days, however, were below the comparison value for PCBs in air.

Low levels of PCBs were detected in the field blanks, but the EPA considers this "typical for air samples analyzed by this methodology" (US EPA, 2013b). Moreover, the levels detected in the field blanks are at least an order of magnitude below the levels detected in the samples.

Discussion

In general, airborne PCB levels in the US appear to be decreasing over time, with higher levels being detected in urban areas than in rural locations (ATSDR, 2000). For example, in June 1996, atmospheric concentrations of total PCBs measured in urban and rural locations in Baltimore, Maryland, were 0.4-3.4 and 0.02-0.3 ng/m^3 , respectively (ATSDR, 2000; Offenbergs and Baker, 1999). Additionally, several studies have indicated that indoor air concentrations of PCBs are generally greater than outdoor concentrations (ATSDR, 2000).

Public Health Implications

PCBs have been associated with several adverse noncancerous health effects in humans and animals, including liver, thyroid, dermal and ocular changes, immunological alterations, neurodevelopmental changes, reduced birth weight, and reproductive effects. Studies attempting to show the same health effects in humans that have been observed in animals have generally been inconclusive (ATSDR, 2000, 2003). Additionally, most studies documenting the noncancerous health effects of PCBs consider exposure to PCBs by ingestion rather than inhalation. Many studies also considered the noncancerous health effects from exposure to commercially available mixtures of PCBs which typically are not the same as mixtures of PCBs in the environment. ATSDR has not derived a CV for noncancerous health effects for PCBs in air due to lack of adequate data in humans and animals. However, it is worth noting the animal studies available involve concentrations of PCBs in air of 9,000-8,600,000 ng/m³, levels far above the concentrations shown in Table 1 (ATSDR, 2000). Studies of workers exposed to PCBs also typically involved concentrations much higher than those in Anniston (ATSDR, 2000), and the National Institute of Occupational Safety and Health's Recommended Exposure Limit³ for workers is 1,000 ng/m³ (NIOSH, 2007). The results from the June 2013 sampling are orders of magnitude below this recommended limit for workers.

As seen in Table 1, ATSDR's CREG for PCBs in air was exceeded on June 25 and June 26, 2013 at Station J. Therefore, ATSDR calculated an estimated cancer risk from breathing PCBs at this location. Estimated cancer risks are calculated by multiplying the concentration of a substance in air by that substance's inhalation unit risk (ATSDR, 2005). EPA's inhalation unit risk for PCBs is 1×10^{-4} per microgram per cubic meter or 1×10^{-7} per nanogram per cubic meter, based on liver tumors in rats exposed to PCBs (US EPA, 1997). Therefore, the estimated cancer risk for Station J based upon the June 25, 2013 sample result is 1.3×10^{-6} ($1 \times 10^{-7} \text{ ng/m}^3 \times 13 \text{ ng/m}^3 = 1.3 \times 10^{-6}$). The estimated cancer risk for Station J based upon the June 26, 2013 sample result is 1.9×10^{-6} ($1 \times 10^{-7} \text{ ng/m}^3 \times 19 \text{ ng/m}^3 = 1.9 \times 10^{-6}$).

It should be noted that sampling results taken over a longer period of time would better represent long-term cancer risk exposure. Short-term exposure to carcinogens is an area of considerable debate and research; however, it is generally believed that any exposure factors that are less than what was used for the calculations will significantly decrease the calculated risk (e.g., exposed for a shorter time period; exposed to lower concentrations; exposed less frequently during the time period, etc.). Nevertheless, the estimated cancer risk, based upon the maximum total PCB concentration, falls within EPA's target range of 1×10^{-6} to 1×10^{-4} .

A key limitation of the data reviewed for this consultation is that it only involved two days of sampling in June 2013, and two of the sampling stations (Stations F and I) would not have been downwind of the site on either day. ATSDR's previous health consultation of PCBs in Anniston air noted the general trend of PCB concentrations as being higher in the spring and summer

³ The Recommended Exposure Limit is for a 10 hour time weighted average exposure.

months than in the winter and fall months (ATSDR, 2003). However, this trend is not seen at all Anniston locations (ATSDR, 2003; Hermanson et al., 2003). PCB concentrations in October, 2012 were lower than PCB concentrations in June, 2013 for Stations F and J but not for Station I (ATSDR, 2013, US EPA 2013b). Additionally, the results of the June 2013 sampling can be compared to earlier results of PCB air sampling in Anniston as well as the results of PCB air sampling in other areas of the country. Table 2 shows these comparisons.

Table 2. Comparison of June 2013 PCB Sampling to Other PCB Sampling Results.

Sample Location, Date	Range of Total PCB Concentrations, (ng/m ³)
Anniston AL, EPA samples, Station F, June 2013	3.0-4.7
Anniston AL, EPA samples, Station I, June 2013	1.3-8.0
Anniston AL, EPA samples, Station J, June 2013	13-19
Anniston, AL, EPA samples, Station F, Oct. 2012	1.7-1.8
Anniston, AL, EPA samples, Station I, Oct. 2012	8.8-25
Anniston, AL, EPA samples, Station J, Oct. 2012	7.3-8.2
Anniston, AL, EPA samples, June 2000	0.2* -16.2
Anniston, AL, Mars Hill Station, 1997-1998	8.7-82
Anniston, AL, Carter Street Station, 1997-1998	1.1-39
Hudson Falls and Fort Edward, NY, 2000-2002	0.10-4.0
Glen Falls, NY, 2000-2002	0.08-2.4
Baltimore, MD, urban area, 1996	0.4-3.4
Baltimore, MD, rural area, 1996	0.02-0.3
New Brunswick, NJ, urban area, 1997	0.1-3.2
*half of analytical quantitation limit ng/m ³ = nanograms per cubic meter Sources: ATSDR, 2000, 2003; Brunciak et al., 1999; Hermanson et al., 2003; Palmer et al., 2008; Offenbergl and Baker, 1999; US EPA, 2013a, 2013b.	

As shown in Table 2, the results of the June 2013 PCB sampling are consistent with the PCB levels previously seen in Anniston. The sampling results from Station F for both days and Station I on day 2 (see Table 1) are similar to other urban areas in the country. The sample results from Stations I (on day 1) and J on both days are higher than other urban areas, but not higher than some of the previous sample results from the Anniston area.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults; this means they breathe dust, soil, and vapors closer to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification.

Thus adults need as much information as possible to make informed decisions regarding their children's health.

Several studies have reported that low-level PCB exposure during fetal or neonatal development can affect the infant's neurobehavioral development (Jacobson et. al., 1990; Rogan and Gladden, 1996). However, several limitations of these studies have been noted: (1) possible exposure to other neurotoxic chemicals besides PCBs (e.g., dioxins, mercury, lead, or organochlorine pesticides) that may have contributed to the effects; (2) inadequate control for confounding socioeconomic variables such as maternal smoking, alcohol, and other drug use; and (3) inadequate control for maternal birth weight and nonspontaneous deliveries (Schantz, 1997; Segal, 1996). In addition to these methodological limitations, different studies have measured different neurobehavioral endpoints, thus impeding comparisons between studies.

Therefore, these studies suggest, but do not conclusively prove, an association between prenatal or neonatal exposures to PCBs and neurobehavioral and developmental effects in young children. Furthermore, these studies involved exposures to PCBs primarily through ingestion rather than inhalation. It also should be noted that ATSDR CREGs (Cancer Risk Evaluation Guides) apply to lifetime exposures so no childhood-specific CREGs exist.

Conclusions and Recommendations

Conclusions

On the basis of the data reviewed and if the sampling on June 25 and June 26, 2013 were representative of typical conditions, ATSDR concludes that concentrations of PCBs in air at the F, I, and J sampling stations were low and are not expected to result in an increased cancer risk or other harmful health effects in people living in the neighborhoods outside the perimeter of the former PCB manufacturing facility.

Recommendations

ATSDR recommends that periodic seasonal air sampling is conducted for PCBs in residential areas surrounding the Solutia Inc. facility to better determine community exposures.

Public Health Action Plan

ATSDR will continue to evaluate PCB ambient air data from Anniston, Alabama as needed.

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