

Anniston Community Health Survey (ACHS)

Summary Booklet

PCB AND DIOXIN EXPOSURE IN ANNISTON,
ALABAMA: 2005-2007 AND 2014



**U.S. Department of
Health and Human Services**
Agency for Toxic Substances
and Disease Registry





CONTENTS

I.	Introduction	4
II.	How Anniston Residents Were Chosen as Study Participants	6
III.	Summary Results: ACHS Published Journal Articles.....	8
IV.	References.....	24

Introduction

Anniston is a city of about **24,000** residents located in Calhoun County in Alabama. Anniston is also the site of a plant that produced polychlorinated biphenyls (PCBs) for **42 years (1929–1971)**. The former plant owners operated from **1935 until 1997**.

Although the levels of PCBs in humans have decreased over time, PCBs in landfills, hazardous waste sites, and contaminated soils continue to be a risk for exposure. PCB production ended in Anniston **in 1971**, and PCBs were banned in the US **in 1979** because of concerns over their toxicity and persistence in the environment. However, PCBs continue to accumulate in the food chain and can be detected in virtually all human beings. Eating contaminated food, such as fish, is just one possible way to become exposed to PCBs.

In 1995, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated PCB levels in residents of Anniston. The exposure investigations found increased levels of PCBs in some Anniston residents, which caused community concerns over possible health effects. In response to those concerns and the **2002 congressional hearings** that followed the major PCBs exposure litigation, ATSDR funded the Anniston Environmental Health Research Consortium to conduct exposure and health studies **in Anniston in 2003**.



The initial study approved for funding through the Consortium was the Anniston Community Health Survey (ACHS I), conducted from **2005–2007**. Participants for the ACHS I were recruited from all parts of Anniston, based in part, on how close they lived to the PCB manufacturing plant (more people were recruited in areas closer to the plant).

Eleven hundred residents participated in the **2005–2007** study, and 766 residents had PCBs and chlorinated pesticides [hexachlorobenzene (HCB), β -hexachlorocyclohexane (β -HCCH), β -HCCH, oxychlorane, trans-nonachlor, dichlorodiphenyltrichloroethanes (p,p'-DDE, p,p'-DDT, o,p'-DDT) and mirex] measured in their blood serum. Funded by the National Institutes of Health, a process to develop a follow-up study started in 2011. The follow-up study, ACHS II, included measurements of PCBs, evaluation of questions on health issues identified in ACHS I, and additional assessments of dioxin-like compounds.

In 2014, ACHS II was conducted on 359 Anniston residents to evaluate if their PCB levels were decreasing and learn how their health had changed since the first study in **2005–2007**. Additionally, ACHS II was designed to examine associations with dioxin-like compounds, which are related to PCBs, but had not been measured previously. Only those Anniston residents who participated in the first study, ACHS I, were eligible to participate in the second study, ACHS II.

This booklet lists results from the ACHS I and ACHS II surveys and studies that have been published in scientific journals and presented at scientific meetings. Please check ATSDR website or with West Anniston Foundation on any further analyses updates or results. The accompanying booklet also answers commonly asked questions about PCBs.

How Anniston Residents Were Chosen as Study Participants

ACHS I

- We started with a list of 3,202 randomly selected addresses in East and West Anniston (within the city limits). About 8,000 people lived in West Anniston, an area close to the plant.
- Any adult currently living at one of the 3,202 addresses was eligible to participate.
- Selection for participation was random. This means not all addresses on each street were selected and participation was not based on residents' health.
- Participation included completing a questionnaire given by an interviewer; physical measurements: height, weight, waist, and blood pressure; a review of medications; and a sample of blood for lab analysis of glucose (sugar), lipids (fats), 35 different polychlorinated biphenyls (PCBs), and 8 pesticides and herbicides.

OF THE 3,202 RESIDENTIAL ADDRESSES:

- » **489** buildings were vacant or nonresidential
- » **890** addresses could not be located
- » **1,823** residents were contacted

OF THE 1,823 RESIDENTS:

- » **713** residents declined to participate
- » **1,110** residents agreed to participate and completed the survey
- » **778** of the **1,110** residents completed the survey and the clinic visit: **766** had PCBs measured in their blood (*serum*)

ACHS II:

OF THE **766** FORMER PARTICIPANTS FROM ACHS I:

- » **114** participants were confirmed deceased from the Social Security Index. Cause of these deaths were not determined.
- » **69** participants had moved out of the study area
- » **438** participants were successfully contacted for ACHS II

OF THE **438** FORMER PARTICIPANTS:

- » **359** participants enrolled and completed the survey
- » **338** of the **359** participants who completed the survey also completed the clinic visit and had PCBs and dioxins measured in their blood

EXECUTIVE SUMMARY

Participants of ACHS I were found to have PCB levels 2 to 3 times higher than US general population (Pavuk et al. 2014a). Age and race were the most important predictors of PCB levels with older people having higher levels and blacks having higher levels than whites (Pavuk et al. 2014b).

The most important health findings were the increased risk of hypertension and elevated blood pressure related to PCBs (Goncharov et al., 2010, 2011) as well as a higher risk of diabetes (Silverstone).

We also found some associations between PCBs and lipids (Aminov et al, 2013), liver disease (Clair et al, 2017), and telomere length (Callahan et al., 2017). Little or no association was observed for thyroid hormones (Benson et al., 2017) and metabolic syndrome (Rosenbaum et al. 2017). In the follow up study (ACHS II), we found that in addition to higher PCBs, a related group of chemicals called dioxins were also increased but to a lesser degree than PCBs. The levels of PCBs decreased in the eight years since the first study (ACHS I).

01 Summary Results: ACHS Published Journal Articles

PCB Levels in Adults ACHS Participants

[Pavuk et al., 2014a, *Science of the Total Environment*]

BACKGROUND:

- Polychlorinated biphenyls (PCBs) last for a long time in the environment, and all humans have some level of exposure to them in their lifetime.
- Exposure to PCBs has been connected to many different health outcomes, including high blood pressure, diabetes, adverse thyroid/metabolic health effects, immune system effects, and some cancers.

WHAT WE FOUND:

Of the **764 ACHS I** participants included in this study:

- » Average PCB levels were **2-3 times higher in blacks than in whites**, but there was no major differences between men and women.
- » **Anniston participants had 2-3 times higher PCB levels** when compared to the same age and race groups from the general population from the National Health and Nutrition Examination Survey (NHANES).
- » PCB levels were highest in those **60** years old and older and lower in participants younger than **40** years old.



Predictors of PCB Levels

[Pavuk et al., 2014b, *Science of the Total Environment*]

BACKGROUND:

- There are many things that can contribute to PCB levels in the body, such as eating food products like fish, beef, pork, chicken, and dairy, a person's age, gender, and body mass index (BMI).
- Understanding how these different exposures raise overall PCB levels in the body is important to predict someone's risk of a negative health outcome.

WHAT WE FOUND:

Of the **765 ACHS I** participants included in this study:

Higher levels of PCBs were found in participants who were:

- » **Older** (levels increased with age)
- » **Black** (race)
- » **Living in Anniston** (specifically West Anniston)
- » **Current smokers**
- » **Eating local fish, meat (beef/pork), and clay**
- » Lower levels of PCBs were found in participants with higher levels of **education**



Blood pressure, Hypertension, and PCB'S

[Goncharov et al., 2010, *Journal of Hypertension*]

BACKGROUND:

- In the United States, **29%** (1 out of every 3) adults have high blood pressure (hypertension); 9 of every 10 adults are likely to get high blood pressure sometime in their lifetime.
- High blood pressure can cause a stroke or heart attack.
- Lifestyle factors like being overweight, not exercising, smoking, stress, eating very salty foods, and having diabetes or high cholesterol can increase your risk of getting high blood pressure.
- In the US, blacks are more likely than whites to get high blood pressure, and women are more likely than men.

WHAT WE FOUND:

Of the 758 participants in ACHS I: 57% had high blood pressure

- » **364** (48%) had high blood pressure and were on blood pressure medication
- » **72** (9%) had high blood pressure and were not taking blood pressure medication
- » **332** (43%) did not have high blood pressure
- » For ACHS I participants, higher risk of high blood pressure was seen with higher PCBs.
- » Women were twice as likely as men to have high blood pressure, and whites were about as likely as blacks to have high blood pressure.
- » Whites were about as likely as blacks to have high blood pressure.
- » In ACHS I participants, the chances of higher blood pressure was greater as you get older if your weight increased.

Blood pressure, PCBs, and Pesticides

[Goncharov et al., 2011, *Environmental Health Perspectives*]

BACKGROUND:

For blood pressure measurements, if the systolic reading (top number) is below 120 mmHg and the diastolic reading (bottom number) is below 80 mmHg, blood pressure is normal. The numbers are read as “blood pressure: 120 over 80” and written as “120/80 mmHg.”



WHAT WE FOUND:

Of the **394** ACHS I participants included in this study:

- » Exposure to PCBs was related to an increase in both systolic and diastolic blood pressure readings for those who were not taking blood pressure medication.
- » Exposure to pesticides was not related to an increase in systolic or diastolic blood pressure readings.
- » As expected, chances of having higher blood pressure were greater as you got older, and if you gained weight.

Diabetes and PCBs

[Silverstone et al., 2012, *Environmental Health Perspectives*]

BACKGROUND:

Diabetes is a life-long disease that affects how the body handles glucose, a kind of sugar, in your blood. There are three main types of diabetes: type 1, type 2, and gestational diabetes (**most adults with diabetes have type 2**).

- 27 million adults in the US have type 2 diabetes (**about 9%**)
- 86 million adults in the US are pre-diabetic

Obesity significantly increases your chances of developing diabetes. Body Mass Index (BMI) is one way to determine if someone is at a healthy weight. BMI is calculated based on your height and weight.

- Underweight: BMI is less than 18.5 (**2% of adults in the US**)
- Healthy weight: BMI is 18.5 to 24.9 (**35% of adults in the US**)
- Overweight: BMI is 25 to 29.9 (**21% of adults in the US**)
- Obese: BMI is 30 to 39.9 (**38% of adults in the US**)
- Morbidly Obese: BMI is 40 or higher (**4% of adults in the US**)

WHAT WE FOUND:

Of the **774** ACHS I participants included in this study:

- » **41%** of participants had a BMI of **30** or higher
- » **27%** of participants had diabetes
- » **Exposure to PCBs was related to an increased risk of diabetes** overall, especially **in women** and in people less than **55** years old



Lipids and PCBs

[Aminov et al., 2013, *Environmental Health*]

BACKGROUND:

High cholesterol levels increases the risk for cardiovascular diseases like heart attack and stroke.

Cholesterols include:

- High-density lipoprotein (HDL), also called “good” cholesterol
- Low-density lipoprotein (LDL), also called “bad” cholesterol
- Triglycerides

WHAT WE FOUND:

Of the **575 ACHS I** participants included in this study:

- » Higher levels of PCBs and chlorinated pesticides were related to higher lipid levels, cholesterol, and triglyceride levels for study participants not taking cholesterol medications.
- » The effects on lipid levels are different for different types of PCBs and pesticides.



Lipids and Race

[Aminov et al., 2014, *Environment International*]

BACKGROUND:

- Lipid levels in blood serum are major risk factors for cardiovascular disease.
- Serum (blood) lipid levels can be affected by several biological factors, including diet, exercise, genetics, age, and race.
- Serum lipid levels may be impacted by exposure to some chemicals such as PCBs and pesticides.

WHAT WE FOUND:

- » Compared to whites, blacks had lower levels of total lipids and triglycerides and higher concentrations of HDL cholesterol, PCBs, and pesticides.
- » For both whites and blacks, total pesticides in serum was associated with total lipids and triglycerides; in blacks total pesticides were also associated with total cholesterol.
- » For both whites and blacks, tri- plus tetra-ortho PCBs were associated with total lipids; in blacks, tri- plus tetra-ortho PCBs were also associated with triglycerides.

Body Burden of PCBs and DDE (1,1-bis-(4-chlorophenyl)-2,2-dichloroethene)

[Jandacek et al., 2014, *Journal of Nutritional Biochemistry*]

BACKGROUND:

- Increased levels of PCBs are associated with some health conditions such as hypertension and diabetes, and there have been no actions to reduce PCB levels in populations that have been highly exposed like Anniston.
- Olestra is an FDA approved non-absorbable lipid that has been shown in some studies to increase removal of PCBs from the body, thereby lowering overall levels of PCBs in the body.
- Participants with elevated serum PCBs were randomized into two groups and received crisps with olestra or vegetable oil.

WHAT WE FOUND:

Among the **22** participants who completed the study:

- » The elimination rate of PCBs in the olestra group was faster than in the control group over the one year trial.
- » The concentration of PCBs dropped by over 25% in two of the participants who ate the olestra crisps.
- » The study supports that olestra can safely reduce body burdens of PCBs.
- » Olestra has also shown to have some negative side effects, including stomach cramping and reduce absorption of certain vitamins and minerals.

Concentration of PCBs in serum over time

[Pavuk et al., 2015, *Organohalogen Compounds*]

BACKGROUND:

- One of the primary goals of the ACHS I follow-up study (ACHS II) was to track changes in levels of PCBs over time.
- The human body naturally removes PCBs, but this process takes a long time.

WHAT WE FOUND:

Of the **229** ACHS II participants included in this study:

- » As expected, PCBs levels in blood serum had decreased in most participants between the two studies.
- » Pesticide levels also decreased between the studies.
- » These decreases suggest that Anniston residents are not continuing to be exposed to PCBs since ACHS I.



Metabolic Syndrome, PCBs, and Pesticides

[Rosenbaum et al., 2017, *Environment International*]

BACKGROUND:

34% of adults in the US have metabolic syndrome

Metabolic syndrome is having **3 or more** of the following risk factors:

- A waist larger than **40 inches (men) or 34 inches (women)**
- Blood pressure **greater than 130/85 mmHg**
- HDL **<40 mg/dL (men) or <50 mg/dL (women)**
- Triglyceride level **≥150 mg/dL**
- Glucose **≥100 mg/dl**

WHAT WE FOUND:

Of the **774 ACHS I** participants included in this study:

- » **60%** had metabolic syndrome.
- » Exposure to **PCBs was not related** to an increased risk of metabolic syndrome.
- » Exposure to some pesticides was related to an increased risk of metabolic syndrome.
- » Pesticide concentrations were similar to those in the general US population.

PCBs and Telomere Length

[Callahan et al., 2017, *Environment International*]

BACKGROUND:

- Chromosomes are made of strands of DNA, the body's genetic map. Telomeres are like small end caps on your chromosomes that protect the DNA from fraying, much like plastic tips at the end of shoelaces.
- Both PCB exposure and having longer telomeres have been associated with cancers such as non-Hodgkin's lymphoma and melanoma.

WHAT WE FOUND:

Of the **559 ACHS I** participants included in the study:

- » Longer telomeres were found in whites and older blacks (**>64 years old**).
- » Some studies have found that people who have been exposed to PCBs have longer telomeres.
- » We did not observe changes in telomere length in Anniston participants with cancer.



PCBs and Liver Disease

[Clair et al., 2018, *Toxicology Sciences*]

BACKGROUND:

- In the US, **46%** of adults aged **40-60** years old have liver disease.
- The three most common causes of liver diseases are alcohol (alcoholic steatohepatitis, ASH), obesity/metabolic syndrome (nonalcoholic steatohepatitis, NASH), and environmental toxicants (toxicant-associated steatohepatitis, TASH).
- Liver disease can lead to conditions like hepatitis, cirrhosis of the liver, or death.

WHAT WE FOUND:

Blood samples from 766 Anniston participants are included in ACHS I results, and blood samples from 352 Anniston participants are included in ACHS II results:

- » In ACHS I, **60%** of the participants tested positive for liver disease based on a new liver disease test (**cytokeratine (CK-18)—not FDA approved**).
- » When more conventional liver disease testing was used (alanine aminotransferase, ALT), only **11%** of participants showed liver disease, which is similar to the general US population.
- » **81%** of the liver disease cases in ACHS I and **74%** of the liver disease cases in ACHS II were related to chemical exposures.

Thyroid and PCBs

[Benson et al., 2018, Chemosphere]

BACKGROUND:

- The thyroid is a butterfly-shaped gland that sits on the front of the neck below your Adam's apple.
- The thyroid produces hormones like thyroxin (T4) that control metabolism, growth and development, and body temperature.
- Higher PCB levels were found to be related to changes in thyroid function in other studies.

WHAT WE FOUND:

Of the **743** ACHS I participants included in this study:

- » Exposure to PCBs was NOT related to levels of thyroid hormones and antibodies.
- » PCBs did not show major clinical effects on the thyroid function.



ACHS Methods (Follow-up and Dioxin Analyses)

[Birnbaum et al., 2016, *Environmental Sciences Pollution Research International*]

BACKGROUND:

- The follow-up to ACHS I sought to repeat measures of PCB serum concentrations in former ACHS I participants' blood and add measurements of dioxins, non-ortho PCBs, and heavy metals.
- **338** participants from ACHS I successfully gave blood samples for analyses in the follow-up ACHS II study.
- ACHS II also incorporates a questionnaire with extended sections on diet and occupational (work) history.

OBJECTIVES:

- » The two cross-sectional studies ACHS I and ACHS II made up a longitudinal design (taking measurements on the same group of study participants over time).
- » ACHS II allowed an opportunity to measure additional chemicals in a previously studied population.
- » Looking at results across ACHS I and ACHS II may clarify relationships between exposure to PCBs, dioxins, and other chemicals and effects on human health in high, non-occupational exposures.

Dioxin Levels in Adult ACHS II Participants

[Yang et al., 2018, *Science of the Total Environment*]

BACKGROUND:

- The follow-up study (ACHS II) included participants from the first study (ACHS I) who were still living in the study area and added a new group of chemicals to analyze (dioxins).
- The levels of dioxins in Anniston residents were compared to the levels in an average American using the National Health and Nutrition Examination Survey (NHANES).
- NHANES is a survey research program that assesses the health and nutritional status of adults and children in the US.

WHAT WE FOUND:

Of the **338 ACHS II** participants included in this study:

- » There were higher levels of dioxins in Anniston residents than in the general US population (NHANES).
- » There were higher levels of dioxins in blacks compared to whites.
- » There were higher levels of dioxins in women compared to men.

Dioxin Levels and trimethylamine N-oxide (TMAO) in Adult ACHS II Participants

[Petriello et al., 2018, *Environmental Research*]

BACKGROUND:

- The follow-up study (ACHS II) included participants from ACHS I who were still living in the study area and added new chemicals to the analysis, including dioxins and trimethylamine N-oxide (TMAO).
- TMAO is a molecule produced by the liver that has been connected to increased risk of heart disease in humans.

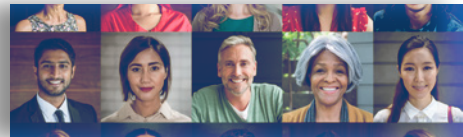
WHAT WE FOUND:

Of the **340** ACHS II participants included in this study:

- » TMAO levels were higher among people with higher dioxins and dioxin-like PCS.
- » TMAO levels were also higher in participants who self-reported diabetes and kidney disease.
- » TMAO levels depended on person's obesity status and whether they were male or female.

References

1. Pavuk M, Olson JR, Sjödin A, Wolff P, Turner WE, Shelton C, Dutton ND, & Bartell S for the Anniston Environmental Health Research Consortium. (2014). Serum concentrations of polychlorinated biphenyls (PCBs) in participants of the Anniston Community Health Survey. *Science of the Total Environment*. 473-474:286-297.
2. Pavuk M, Olson J, Sjödin A, Wattigney W, Shelton C, Dutton N, Turner WE, & Bartell SM. (2014). Predictors of human serum polychlorinated biphenyls (PCBs) concentration in the Anniston Community Health Survey. *Science of the Total Environment*. 496; 624-634.
3. Goncharov A, Bloom M, Pavuk M, Birman I, & Carpenter DO. (2010). Blood pressure and hypertension in relation to levels of serum polychlorinated biphenyls in residents of Anniston, Alabama. *Journal of Hypertension* 28(10): 2053-60.
4. Goncharov A, Pavuk M, Foushee HR, & Carpenter DO for the Anniston Environmental Health Research Consortium. (2011). Blood pressure in relation to concentrations of PCB congeners and chlorinated pesticides. *Environmental Health Perspectives* 119(3):319-25.
5. Silverstone AE, Rosenbaum PF, Weinstock RS, Bartell SM, Foushee HR, Shelton C, & Pavuk M. (2012). Polychlorinated Biphenyl (PCB) Exposure and Diabetes: Results from the Anniston Community Health Survey. *Environmental Health Perspectives* 120(5): 727-32.
6. Aminov Z, Haase R, Carpenter D, Turner W, & Pavuk M. (2013). Analysis of the effects of exposure to polychlorinated biphenyls and chlorinated pesticides on serum lipid levels in residents of Anniston, Alabama. *Environmental Health*. 12(1):108.
7. Aminov, A., Haase, R., Olson, J.R., Pavuk, M., & Carpenter, D.O. (2014). Racial differences in levels of serum lipids and effects of exposure to persistent organic pollutants on lipid levels in residents of Anniston, Alabama. *Environment International*. 73: 216-223.



REFERENCES

8. Jandacek RJ, Heubi JE, Buckley DD, Khoury JC, Turner WE, Sjodin AE, Olson JR, Shelton C, Helms K, Bailey TD, Carter S, Tso P, & Pavuk M.(2014). Reduction of the body burden of PCBs and DDE by dietary intervention in a randomized trial. *Journal of Nutritional Biochemistry*. 25: 483-488.
9. Pavuk M, Dutton ND, Sjödin A, Lewin M, & Birnbaum LS. (2015). Temporal changes of serum concentrations of polychlorinated biphenyls and organochlorine pesticides in a residential cohort. *Organohalogen Compd*. 77: 472-47.
10. Rosenbaum P, Silverstone A, Weinstock R, Sjödin A, & Pavuk M. (2017). Metabolic syndrome is associated with exposure to organochlorine pesticides in residents of Anniston, AL. *Environment International*. 108:11-21.
11. Callahan CL, Pavuk M, Birnbaum LS, Ren X, Olson JR, & Bonner MR. (2017). Serum polychlorinated biphenyls and leukocyte telomere length in a highly exposed population: The Anniston Community Health Survey. *Environment International*. 108: 212-220.
12. Clair HB, Pinkston C, Pavuk M, Dutton ND, Brock G, Prough RA, Falkner CK, Wahlang B, McClaine CJ, & Cave MC. (2018). High prevalence of environmental liver disease and suspected toxicant associated steatohepatitis in a large United States residential cohort with elevated polychlorinated biphenyl exposures. *Toxicology Sciences*. 164(1):39-49.
13. Benson K, Yang E, Dutton N, Sjodin A, Rosenbaum PF, & Pavuk M. (2017). Polychlorinated biphenyls, indicators of thyroid function and thyroid autoantibodies in the Anniston Community Health Survey (ACHS). *Chemosphere*. 195:156-165. doi: 10.1016/j.chemosphere.2017.12.050.
14. Birnbaum LS, Dutton ND, Cusack C, Mennemeyer ST, & Pavuk M. (2016). Anniston community health survey: Follow-up and dioxin analyses (ACHSII)- methods. *Environmental Sciences Pollution Research International*. 23(3): 2014-2021.

15. Yang E, Pavuk M, Sjodin A, Lewin M, Jones R, Olson J, & Birnbaum LS. (2018). Exposure of dioxin-like chemicals in participants of the Anniston community health survey follow-up. *Sci Total Environ*, 637-638, 881-891. doi:10.1016/j.scitotenv.2018.05.074.
16. Petriello M, Charnigo R, Sunkara M, Soman S, Pavuk M, Birnbaum LS, Morris AJ, & Hennig B. (2018). Positive associations between serum levels of dioxin-like pollutants and the circulating cardiometabolic disease risk biomarker Trimethylamine-N-oxide. *Environmental Research*. 162:211-218.

Document Prepared by: Marian Pavuk, Tara Serio, Carol Cusack

ATSDR, Office of Community Health and Hazard Assessment
(OCHHA)

Acknowledgments: We would like to thank all of the study participants. The data used for the baseline study (ACHS I) were collected using a grant from ATSDR to Jacksonville State University, #5U50TS473215. Data collection for the follow-up study (ACHS II) was funded by the National Cancer Institute (NCI) through interagency agreements with the Centers for Disease Control and Prevention (CDC) (IAA#: 11-AT1-001-00; IAA#: 12-AT-12-ANNISTON) and by ATSDR. Funding for this project was also provided by the Intramural Program of the NCI. We would also like to acknowledge Andreas Sjödin, Wayman Turner, and Donald Patterson Jr. (formerly) at the National Center for Environmental Health, Division of Laboratory Sciences, for their expert chemical analyses for this study. This research was supported in part by an appointment to the Research Participation Program at the Centers for Disease Control and Prevention administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the U.S. Department of Energy and ATSDR. The authors declare they have no actual or potential competing financial interests.

The contents of this publication are solely the responsibility of the authors and do not necessarily represent ATSDR's or CDC's official views.

