Health Consultation

Blood Lead Screening in Anniston, Alabama, August/September 2000

Anniston Lead Site
Anniston, Calhoun County, Alabama
EPA ID: ALN000407242

Prepared by:

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Division of Epidemiology
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Background and Statement of Issues

Sampling of areas within Anniston, Alabama, suspected of containing contaminants, specifically polychlorinated biphenyls (PCBs), was initiated by the Environmental Protection Agency (EPA) in February 2000. Routine analysis of the soil samples taken disclosed that, in addition to PCBs, lead levels in the soil were sufficiently high to warrant further testing. Surface soil samples from 150 residential, commercial, and non-developed properties were analyzed. Samples from 47 properties had surface soil lead levels greater than 400 parts per million (ppm) (range = 410 - 3080 ppm.). Further evaluation of these properties was recommended because of the potential for exposure.

During the summer of 2000, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated the lead data obtained from surface soil in Anniston, Alabama. As a result of their review of these data, ATSDR recommended various actions be conducted. These included a review of any existing blood lead data from individuals in the area, and proactive blood lead testing for area residents to determine whether a possible association existed between environmental lead in the residential soils and lead in the circulation of individuals living, working, or spending time in contaminated areas. The initial focus of testing would be with the population most sensitive to the effects of lead, namely children (1).

The Alabama Department of Public Health (ADPH) conducts the Alabama Childhood Lead Poisoning Prevention Project (ACLPPP). The mission of the ACLPPP is "to help every child in Alabama develop to maximum potential by promoting a lead free environment and healthy lifestyle." To accomplish this mission ACLPPP provides public outreach and education activities, case investigation, and case management services to help prevent lead exposure in Alabama's children (2). A portion of the data reviewed for the Anniston, Alabama, project was developed through this program. A blood lead level (BLL) greater than or equal to 10 micrograms/deciliter (≥10 µg/dL) is classified as a Group B Condition under Alabama Notifiable Diseases/Conditions, addressed under "Reporting Notifiable Diseases" (3, 4). As such, reporting of incidences of BLLs ≥10 µg/dL is mandatory.

In July 2000, ADPH reviewed ACLPPP data for Anniston for the years 1995 through 1999, the last five years for which the data set was complete. The rationale for this review was to determine whether existing data of childhood lead screening revealed elevated blood lead levels, particularly in children living in areas where surface soil sampling disclosed lead levels above 400 ppm. A review of ACLPPP records disclosed results of 509 BLL assays conducted during this period. This number reflects those BLL values obtained through testing Medicaid eligible individuals, those who were seen at the Calhoun County Health Department, and those children who had elevated BLLs. This does not reflect all the children who are seen by private physicians, because the physicians are not required to report BLLs that do not exceed the CDC guidance level of ≥ 10 µg/dL.

The blood lead data that had been amassed by ADPH ACLPPP could not be correlated to those properties where soil lead values were deemed alarming. Further soil and blood lead evaluation of residents whose surface soil lead levels equaled or exceeded 400 ppm was recommended (1). This health consultation reports the response of the ADPH to these recommendations.

ADPH offered blood lead screening for residents and frequent visitors at residences or other properties where surface soil lead was found to be greater than 400 ppm. ADPH undertook a blood lead sampling activity in August and September 2000 to determine whether any individual having frequent contact

with this level of lead contamination in the soil had an elevated BLL, and, if so, to initiate follow-up treatment.
This screening process would further build the database for lead within Alabama as well as provide insight into the relationship between environmental lead occurrence and health effects in individuals who might be exposed. The focus of this screening was children, but individuals of all ages were invited to participate.

These activities were conducted in collaboration with the ADPH Bureau of Communicable Disease, Risk Assessment and Toxicology Branch; ADPH Bureau of Family Health Services, Childhood Lead Poisoning Prevention Project; ADPH Bureau of Clinical Laboratories; and the Calhoun County Health Department.

Discussion

Lead is believed to play a role in the disruption of mitochondrially mediated calcium transport in the body. As a competitive inhibitor to enzymes involved in this function, lead has been found to accumulate in tissues rich in mitochondria and requiring calcium transport for functioning, such as nervous system tissues. Infants and children are more sensitive to the effects from lead exposure than adolescents or adults because of the rapidly developing nature of their nervous systems (5). Because of this sensitivity, routes and means of exposure must be examined. Children potentially incur increased exposure to lead as a result of the following factors:

- Children are more likely to be exposed to outdoor media (air, soil, surface water) because they spend more time outdoors, and because they play and eat outdoors.
- Children are more likely to put unwashed hands in their mouth, or eat with unwashed hands.
- Some children practice pica, a tradition normally associated with cultural mores in an area. Pica is characterized by deliberately eating non-food items, such as soil.
- Children are shorter than adults, so they breathe more of the dust, soil, and air close to the ground.
- Children are smaller, so their exposure results in higher doses of contaminants in relation to their body weight.
- Children may sustain permanent damage if they experience lead poisoning during critical growth stages (6, 7).

Data discussed herein provided results in the form of total lead, irrespective of the species or form in which the lead appeared. Therefore, all conclusions drawn are based on worst-case estimates approximating the effects associated with the most active/dangerous of the forms of lead known. For lead to pose a concern to human health, it has to be able to enter the body in a form than can cause harm. The analyses of surface soil did not identify the form of lead present; therefore, it is impossible to estimate the bioavailability of the lead at these properties. Bioavailability is a measure of the rate at which and the extent to which the material of interest enters the general circulation, thereby gaining access to its site of action in the body. Different forms of a material may be absorbed at different rates and have different effects on differing areas of the body (8). Without speciation, it is difficult to determine the exact bioavailability factors and hence, the potential effects that may occur within the body.

Alabama Childhood Lead Poisoning Prevention Project (ACLPPP) Data Review

The ACLPPP database contains blood lead data for Medicaid eligible children, children screened at county health departments, and children reported by other health care providers as having elevated BLLs. The CDC defines elevated BLLs for children as ≥10 µg/dL (9). Health care providers in Alabama are required to report elevated BLLs as a notifiable disease/condition (3, 4). Therefore, the ACLPPP data base is representative of elevated BLLs of Anniston children who are screened.

The ACLPPP database does not document all children who are screened, because health care providers are not required to report BLLs < 10 µg/dL. Therefore, this database cannot be used to estimate rates of screened vs. non-screened children.

The CDC recommends screening children at 12 and 24 months of age (9). ADPH's initial data review for *one and two year old children* revealed 195 screening records for Anniston, Alabama, from January 1995 through December 1999. Elevated BLLs ranged from 10 to 18 µg/dL. The values of the eleven (11) elevated BLL assays centered around 12 µg/dL (mean = 12.82, median =12, mode = 12).

If children are not screened at 12 and 24 months of age, CDC recommends that screening be conducted between 36 and 72 months (3 - 6 years) (9). ADPH also reviewed ACLPPP data for *children of all ages* in Anniston. This review revealed 509 screening records of 467 individual children (including the one and two year old children above). Ages ranged from 4 months to 138 months (11.5 years). Forty-seven children had elevated BLLs ranging from 10 to 46 µg/dL. Appendix A contains, in table form, distribution of occurrences of blood lead levels among children entered into the ACLPPP database.

The 467 children resided in various parts of Anniston, as did the 47 children with elevated BLLs. There was no geographic clustering of elevated BLLs in the area of Anniston where lead had been found in surface soil. None of the 47 children lived at addresses where surface soil lead levels were greater than 400 ppm; therefore, BLLs could not be related to living at residences where surface soil lead levels were known for these persons. As a follow up activity, ADPH and CCHD offered blood lead screening for residents and frequent visitors at those residences.

Blood Lead Screening

ADPH evaluated the possibility of elevated BLLs in adults and children who lived at addresses known to be contaminated with lead. Addresses where soil lead levels were found to be greater than 400 ppm were provided to ADPH by EPA, who had previously corresponded with residents to tell of the findings for lead levels at their particular address.

Forty-seven properties were identified where lead levels ranged from 410 to 3080 ppm by x-ray fluorescence analysis. ADPH found telephone numbers for the resident and/or property owner at each of the target addresses. An ADPH staff member called each location identified on this list. The purpose of the call was two-fold. It assisted ADPH in developing demographic information for the location, and provided the opportunity for residents to be offered blood lead screening to determine the impact on BLL of residing at or visiting a site with high lead levels in the soil. Of the 47 addresses, 37 individuals responded to the telephone call and agreed to have blood drawn. In a number of other instances, individuals were not interested in participating either in contributing to demographic data or in blood

drawing. Thirteen individuals reported that there were no children present at the residence; therefore, there was no interest in participating. Three locations were either business properties or city-owned lots with no residents living thereon. Individuals at six of the locations could not be reached by phone.

Blood screening was conducted at the Calhoun County Health Department. The ACLPPP Elevated Blood Lead Environmental Surveillance Form was completed for each individual prior to screening to expedite follow-up of clients, if necessary. The surveillance information also provided insight into activities that could identify pathways of exposure to lead in soil. Educational material on the health effects of lead exposure and documents on strategies for reducing exposure were provided to participants at the time of screening. Blood samples were collected by nurses and laboratory technicians, refrigerated, and shipped to the ADPH Bureau of Clinical Laboratories for analysis following an existing ACLPPP protocol. The laboratory results were reported to CCHD, who subsequently mailed a copy of the lab report with an explanatory cover letter to each individual or parent/guardian.

No elevated (≥10 µg/dL) BLLs were discovered in any of the individuals who participated in this study. Seventeen of the thirty-seven individuals having contact with properties with high soil lead levels had measurable levels of lead in their blood (range = 0 – 7 µg/dL, mean = 2.57 µg/dL). The highest BLL, 7 µg/dL, was found in an adult; the highest BLL found in a child was 6 µg/dL. Since those BLLs indicated that some exposure had occurred; parents were provided with information describing the seriousness of blood lead poisoning and presentation of information on reducing exposure. (See Appendix B.)

Conclusion

The Anniston Lead Site poses no apparent public health hazard. Of the 37 responding to have blood drawn, none had blood lead levels that approached concentrations of concern (≥10 µg/dL) The range of blood lead levels was 0 – 7 µg/dL, and the mean equaled 2.57 µg/dL.

Recommendation

No further action necessary.

Public Health Action Plan

Public Health Activities Completed

ADPH completed an ACLPPP data review for Anniston and for properties identified by EPA as having soil lead levels >400 ppm.

ADPH and CCHD completed quantified individual biological measurements (blood lead screening) for individuals in contact with properties identified by EPA as having soil lead levels >400 ppm.

Public Health Activities Recommended

None at this time. ADPH stands ready to assist if future data become available.

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References

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2. Alabama Department of Public Health. Alabama Childhood Lead Poisoning Prevention Project. Montgomery, AL: ADPH, undated brochure.

3. Code of Alabama, 1975, Section 22-11A-1.

4. Notifiable Disease Act of 1987, Alabama Law No. 87-574, Section 1.

5. Lippmann, M. (Ed.) 2002. Environmental Toxicants. Human Exposures and Their Health Effects. 2nd ED. Wiley Intersciences, New York, NY, Chap. 14.

6. Agency for Toxic Substances and Disease Registry. Chlidren and Hazardous Waste Sites. Atlanta, Georgia: U.S. Department of Health and Human Services, March 2001.

7. Agency for Toxic Substances and Disease Registry. Focus on Children. Atlanta, Georgia: U.S. Department of Health and Human Services, March 2000.

8. Paustenbach, D. 1989. The Risk Assessment of Environmental and Human Health Hazards: A Textbook of Case Studies. John Wiley & Sons, New York, NY, p. 305-308.

9. Centers for Disease Control and Prevention. Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials. Atlanta: CDC, 1997.

Appendix A

Table 1. ACLPPP Data: BLLs of children of all ages, Anniston, AL, 1995-1999

Your Child's Test Results

Alabama Department of Public Health

Childhood Lead Poisoning Prevention Project

BLL	Number of Children* †	Comments*	Message
Not elevated: <10 µg/dL	419	Age Range: 04 – 138 mos. Mean Age: 31.52 mos. Median Age: 28.00 mos. Mean BLL: 3.6 µg/dL Median BLL: 3.0 µg/dL	Your child does not have lead poisoning. It is important to keep lead levels in the blood as low as possible. Follow your doctor's advice for preventing lead poisoning, and have your child retested in a year.
Elevated: 10 – 19 µg/dL	41	Age Range: 04 – 138 mos. Mean Age: 36.55 mos. Median Age: 36.00 mos. Mean BLL: 13.3 µg/dL Median BLL: 12.0 µg/dL	Your child's blood lead level is **too high**. Your child should be **tested again in 3-4 months**. Follow your doctor's advice. Check all the places your child spends time for sources of lead poisoning.
Elevated: 20 - 44 µg/dL	6	Age Range: 15 – 96 mos. Mean Age: 34.375 mos. Median Age: 26.000 mos. Mean BLL: 28.5 µg/dL Median BLL: 24.0 µg/dL	Your child's blood lead level is **very high**. Keep all appointments with your child's doctor or health center for repeat blood tests. Your local health department will visit your home to help you find the source of lead and advise you on how the lead poisoning can be reduced. Follow your doctor's advice for having your child treated and retested.
Elevated: 45 - 69 µg/dL	1	Age: 15 mos. BLL: 46 µg/dL	Your child's blood lead level is **seriously high**. The doctor may begin treating your child immediately with medicine to help get rid of the lead. Sometimes this is done in the hospital. Your local health department will visit your home to help you find the source of lead and advise you on how the lead poisoning can be reduced. Your child will be tested after treatment to make sure the lead level is down and stays down. After treatment, the child must return to a lead-free home. Follow your doctor's advice for having your child retested.
Elevated: ≥70 µg/dL	0		Your child is **very sick** and requires **immediate attention**. Your child will be immediately referred to a hospital that provides intensive care for children. Your local health department will visit your home to help you find the source of lead and advise you on how the lead poisoning can be reduced. After treatment, follow your doctor's advice for having your child retested.

* Columns were added to ACLPPP table to convey statistical detail.

† 467 children were screened, some multiple times, with results falling in multiple BLL ranges.

Appendix B

Table 2. ADPH Data: BLLs of screened individuals at properties where soil lead is > 400 ppm

Property Number *	Soil Lead Level in ppm by XRF	BLL in µg/dL and time spent at property **	
1	3080	5	20 yrs.
	3080	2	20 yrs.
	3080	1	
	3080	3	18 yrs.
2	2850		
3	2349		
4	2250	3	4 yrs.
	2250	6	4 yrs.
5	2189		
6	1190		
7	1100		
8	1100		
9	990		
10	848	3	16 yrs.
11	837		
12	834	1	13 yrs.
13	832		
14	825	7	6 mos.
	825	2	1 yr.
	825	3	10 mos.
	825	3	1 yr.
15	729		
16	694		
17	680		
18	664	1	15 yrs.
	664	3	11 yrs.
	664	2	8 yrs.
	664	4	6 yrs.
	664	2	1 yr.
19	662		
20	652		
21	646		
22	632		
23	631		
24	626		
25	621	0	10 yrs.
	621	2	10 yrs.
	621	1	10 yrs.
26	586	1	25 yrs.

Property Number *	Soil Lead Level in ppm by XRF	BLL in µg/dL and time spent at property **	
	586	3	25 yrs.
27	576	2	12 yrs.
	576	1	4 yrs.
	576	6	4 yrs.
	576	5	1 yr.
28	527		
29	515		
30	502		
31	492	1	6+ yrs.
32	481		
33	472		
34	472		
35	461		
36	457		
37	448		
38	439		
39	438		
40	428		
41	425		
42	422	2	5 yrs.
43	421	1	>15 yrs.
	421	1	15 yrs.
	421	3	10 yrs.
	421	1	9 yrs.
	421	1	2 yrs.
	421	2	1 yr.
44	418		
45	413		
46	411		
47	410		
A		5	
B		1	
C	300 to 400	5	

* Properties with lead in soil are identified by a number rather than the street address.

** Rows with no information indicate that residents at those properties declined to have blood drawn for lead analysis.