State of Alaska Epidemiology **Bulletin**

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Lead and Copper Exposure at an Anchorage Elementary School - Kids and Teachers Get Clean Bill of Health

The Alaska Department of Environmental Conservation (DEC) requires public water supplies to be tested for a variety of contaminants. All tests need to be done according to specific protocols; for example, lead and copper are tested by collecting the first 1.0 liter of water from a tap that has not been used for 6-8 hours. The Anchorage Water and Wastewater Utility tests "city water." Anchorage schools not using city water must have their water tested.

At one such school, Bear Valley Elementary School, routine testing during 1993-1999 revealed high copper and lead concentrations. The overall mean copper and lead levels were 1.673 mg/L and 0.064 mg/L, respectively. DEC mandates remedial action if more than 10% of samples from a water system are above 1.30 mg/L for copper or 0.015 mg/L for lead - both levels were exceeded at Bear Valley. Follow-up tests showed that lead and copper concentrations fell to very low levels when water was allowed to run for 3 minutes before being sampled. This indicated that pipes and fixtures at the school were leaching lead and copper into the water during evenings and weekends when water was not being used.

In order to determine if students or staff at the school had elevated blood lead levels, the Section of Epidemiology and Anchorage Department of Health and Human Services offered lead testing to all interested students and staff.

Methods: Venous blood samples were collected using standard techniques and lead-free blood tubes. All specimens were submitted to ESA Laboratories (Chelmsford, MA) and tested for lead by graphite furnace atomic absorption spectrophotometry. In order to calculate means, blood lead levels reported as <1 µg/dL were considered to have a value of 0.9 µg/dL. For reference, the US Centers for Disease Control and Prevention considers blood lead levels ≥ 10 µg/dL to be elevated.

Results: Testing was completed for 246 (48%) of 517 full-time students, 25 (45%) of 55 faculty or staff, and 5 (6%) of 88 part-time students. The geometric mean blood lead levels were 1.0 µg/dL, 1.2 µg/dL, and 1.1 µg/dL for full-time students, faculty or staff, and part-time students, respectively. The highest blood lead levels found for students and staff were 4 µg/dL and 6 µg/dL, respectively.

For full-time students, blood lead levels were not associated with four potential measures of lead exposure: duration of enrollment at Bear Valley, teacher assessment of water consumption, concentration of lead in classroom water, and campfire participation (campfire was examined because first-of-day water samples had elevated lead levels and campfire participants used the school building before school started). For faculty and staff, blood lead levels were not associated with two potential measures of lead exposure: Estimated total water consumption and estimated first-of-day water consumption.

Discussion: Compared to national blood lead levels reported by the Third National Health and Nutrition Survey (NHANES III), the levels at the school were extremely low.[1] NHANES III tested a large sample of the US population during 1988-1991: the geometric mean blood lead level of 6-11 year old children was 2.5 µg/dL (Table 1). For Bear Valley, both the mean blood lead levels and the proportions of students and faculty tested who had levels either ≥ 5 µg/dL or ≥ 10 µg/dL were well below national comparisons.

Table 1. Comparison of Bear Valley lead levels to results of the Third National Health and Nutrition Survey (NHANE III)

a. Children: NHANES III data is for 6-11 year olds.

	NHANES III	*Bear Valley*
Geometric mean (µg/dL)	2.5	1.0
Blood lead ≥5 µg/dL (%)	4.0	0
Blood lead ≥10 µg/dL (%)	16.9	0

b. Adults: NHANES III data is for ages 20-49 and 50-69 years.

	NHANES III		
	20-49 yrs	*50-69 yrs*	*Bear Valley*
Geometric mean (µg/dL)	2.6	4.0	1.2
Blood lead ≥5 µg/dL (%)	21.0	34.9	4.0
Blood lead ≥10 µg/dL (%)	3.3	7.0	0

Copper, the other metal found in the school's water, is an essential nutrient needed for healthy growth, development, and metabolism. Water with more than 2.6 mg/L of copper has a metallic taste.[2] Since several water samples at the school were above this level, it is very likely that the high copper levels were responsible for previous complaints that water tasted bad. If more than 0.06 mg of copper per kilogram of body weight is ingested at one time, gastrointestinal irritation results - symptoms include nausea, vomiting, abdominal pain, or diarrhea. In order to ingest enough water to become sick (0.06 mg per kg), a small kindergarten student weighing 16 kg (35 lbs.) would need to drink 0.19 liters (0.8 cup) of water with 5.06 mg copper/L, the highest copper level measured at the school. Water containing this much copper would have a strong metallic taste, so most children would probably stop drinking after one or two sips. Some students could have consumed larger amounts on some occasions, and it is conceivable that they could have developed symptoms. Because copper is quickly cleared from the blood, testing is useful only when symptoms possibly caused by copper are present.

Summary: Students and staff did not have any elevated blood lead levels.

- Copper levels in water have been high enough to cause a metallic taste and it is theoretically possible that some students could have ingested enough copper to cause gastrointestinal irritation. Fortunately, copper is an essential nutrient that would not cause other symptoms or any long-term health problems.
- Additional blood testing - either of former students or untested current students - is not necessary.
- Until the water system meets DEC water quality standards, any faucet or tap used for drinking should be allowed to run for 30-60 seconds before being used each day.
- The Anchorage School District should continue to work with DEC to ensure that water quality standards are met.

References:

1. Brody DJ, Pirkle JL, Kramer RA, et al. Blood lead levels in the US population: phase 1 of the third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). *JAMA* 1994; 272:277-283.

2. ATSDR. Toxicological profile for copper. US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry; Atlanta, GA. 1990.

(Thanks to all the students, teachers, staff, and parents who contributed to the testing program. Submitted by Michael Beller, MD, MPH, Section of Epidemiology.)