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School Rifle Teams Exposed to Lead at Indoor Firing Ranges

Background

In January 2002, a rifle team coach with a competitive target shooting program located at a K-12 school was found to have an elevated blood lead level of 44 µg/dL. The rifle team members were identified and tested; all had elevated blood lead levels (Epidemiology *Bulletin* No. 16 July 22, 2002).

As a result of this experience, the Environmental Public Health Program (EPHP) initiated a statewide review with superintendents and principals in each school district and with state agencies to identify school sponsored rifle teams. The purpose was: 1) to provide blood lead screening to determine if any team member or coach had an elevated blood lead level; 2) to determine the exposure source if elevated blood lead levels were detected; and 3) to provide education about recommended cleaning and hygiene practices to reduce lead exposure of indoor firing ranges.

Initially, six rifle teams using three indoor firing ranges were identified. Eighty-seven students and six adults were participating in the team activities. Free blood lead testing was offered to all team members, their parents, siblings, and coaches. Thirty-six students and thirty-five adults (including family members and six coaches) participated in the blood lead testing.

Blood Lead Test Results

Blood lead levels for students tested during the exposure investigation of school rifle teams.*					
Team #	Firing Range	Number Tested	Blood lead results (µg/dL)		
			Average	Geomean**	Range
1	A	6	1.5	1.3	1-3
2	A	2	4.0	3.9	3-5
3	B	7	8.9	8.1	3-14
4	C	10	28.5	27.9	17-37
5	C	3	12.7	12.0	8-18
6	C	8	12.5	12.2	8-17

Blood lead levels for five team coaches and one range officer associated with Firing Range C.***			
Number Tested	Blood lead results (µg/dL)		
	Average	Geomean	Range
6	15.7	12.4	5-31

Blood lead levels for teenagers and adult shooters who were not associated with a school rifle team.					
Age	Firing Range	Number Tested	Blood lead test results (µg/dL)		
			Average	Geomean	Range
<18 yrs.	various	3	6.7	6.3	5-10
≥18 yrs.	various	23	9.1	6.6	2-39

*Childhood level of concern is ≥10 µg/dL.

**The geometric mean was used because blood lead levels do not follow a normal distribution (i.e., the "standard curve"). The geometric mean was calculated by taking the anti-logarithm of the mean of the logarithms of the lead levels. Base e or natural logarithms were used.

***Adult level of concern is ≥25 µg/dL

None of the eight student members tested from Teams 1 & 2 had elevated blood lead levels. The geometric mean blood lead results were 1.3 µg/dL and 3.9 µg/dL, respectively. The lead levels for these team members were similar to the NHANES III (a randomly selected sample of more than 13,000 persons in the United States from 1988-1991) geometric mean of 2.3 µg/dL.

Teams 1 and 2 were using Firing Range A, which observes a regularly scheduled cleaning procedure and has a written maintenance and lead concentration monitoring protocol. The range was not a source of lead exposure.

The blood lead analysis results of students from Team 3 using Firing Range B indicated a small but measurable level of lead exposure to the student shooters. Two of seven team members had elevated blood lead levels (≥10 µg/dL). The geometric mean for Team 3 members was 8.1 µg/dL, which is higher than the NHANES III geometric mean of 2.3 µg/dL. The most likely source of their exposure was Firing Range B, a multi-use area that had not been evaluated for lead since 1992. The EPHP is collaborating with the school district to ensure that the potential for lead exposure is minimized for all users of the facility.

Teams 4, 5, and 6 used Firing Range C. Nineteen of twenty-one students tested had elevated blood lead levels, indicating a significant lead exposure to the students. The geometric mean was 27.9 µg/dL for Team 4, 12.0 µg/dL for Team 5, and 12.2 µg/dL for Team 6. An environmental assessment of the range by a certified consultant revealed extensive lead contamination. Based on these findings, the range voluntarily closed.

The geometric mean blood lead level for the coaches of Teams 4, 5, and 6 that used Range C was 12.4 µg/dL. The highest level was 31 µg/dL, above the adult level considered elevated (≥25 µg/dL).

Twenty-six persons not associated with any rifle team who had used Firing Range C were tested. Of 3 children (<18 yrs.) tested, one had a slightly elevated blood lead level of 10 µg/dL. One adult (≥18 yrs.) had a blood lead level of 39 µg/dL.

Conclusions and Recommendations

The elevated blood lead levels noted in this report were not associated with illness, and no long term adverse health effects are expected. No specific medical treatment is indicated at this time. Careful monitoring of the situation is necessary, and follow-up testing is scheduled. All persons were removed from ongoing lead exposure.

Lead exposure from firing ranges is often due to improper operation, an inadequate or malfunctioning ventilation system, or improper cleaning and maintenance procedures including failure to implement and follow lead safe practices.

- Firing Range C was closed and arrangements made for a thorough environmental evaluation. The range will not reopen until remediation and renovation is completed.
- All shooters who were exposed should receive a follow-up blood test. Following removal from a lead exposure source, blood lead levels should decrease by one-half within 25 to 30 days.
- EPHP recommends voluntary follow-up blood lead testing for all rifle team members at the completion of this shooting season. In addition, all rifle team members should have their blood tested for lead at the beginning and end of each shooting season. If elevated blood lead levels are detected, a thorough environmental assessment should be conducted.
- Firing ranges should use approved cleaning practices. No dry sweeping should occur in the facility under any circumstance. Dry sweeping can distribute minute particles of lead into the air that can stay suspended for up to 10 hours. Alternative methods to remove spent casings include using a squeegee to push casings into a scoop or using a specialized high efficiency particle air (HEPA) filter vacuum.