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Lead Exposure from a Public School Indoor Firing Range

Case Report

On January 14, 2002 the Alaska Lead Poisoning Prevention Program's blood lead surveillance system identified an adult with a blood-lead level of 44 μ g/dL (micrograms per deciliter). By definition a blood-lead level (BLL) of \geq 25 μ g/dL in adults or \geq 10 μ g/dL in children is considered elevated by the Centers for Disease Control and Prevention (CDC). The reported BLL prompted a routine investigation by staff of the Environmental Public Health Program (EPHP), Section of Epidemiology.

Discussions with the health care provider who ordered the blood test indicated that the patient was the chief range officer for a competitive target-shooting program. The program, which was being conducted in an indoor firing range at a K-12 school, involved two additional range officers and seven high school student team members. The firing range was owned by the local school district and was located on property adjacent to the main classroom building.

Program Review and Site Visit

On January 30, EPHP staff, the assistant range officer, and an EPA/HUD*-certified lead hazard risk assessor visited the range and discussed the target-shooting program in detail. We also met separately with the chief range officer. According to the range officer, shooters used small-bore (22 caliber) rifles specifically designed for target shooting. Practice sessions lasting about two hours were conducted 3-4 times per week. During practice sessions, each participating team member fired approximately 70 to 100 rounds.

Carpet had been installed on the shooting deck floor for team member comfort for firing in the prone position. The lead hazard risk assessor collected dust-wipe samples from underneath the carpet for lead analysis. Subsequent dust wipe analysis results indicated a lead concentration in excess of 9,000 μ g/ft² on the floor beneath the carpet. This level is 225 times the HUD allowable level of 40 μ g/ft² for residential floors. This was the highest level of lead dust concentration inside the range and the most probable lead exposure source.

Additional testing revealed that lead-contaminated dust had been tracked throughout portions of the facility outside the range. High concentrations were found in the track to the women's bathroom (1960 μ g/ft²), the floor under the women's bathroom sink (1230 μ g/ft²), an area under a rug outside of the firing range (790 μ g/ft²), and the floor under the sink in the men's bathroom (193 μ g/ft²). Analysis of dust wipe samples from other locations inside the range, such as the area between the shooting deck and the slug backstop, contained low lead levels.

Blood Lead Test Results

Blood samples for lead analysis were collected from twenty-four persons, including the range officers, all students enrolled in the program, and their parents and siblings. The samples were submitted to a CLIA (Clinical Laboratory Improvement Act) certified laboratory for blood-lead analysis using the graphite furnace atomic absorption spectrophotometry method.

Blood-lead levels of all seven student team members ranged from a low of 21 μ g/dL to a high of 31 μ g/dL; the average BLL was 24 μ g/dL. All parents and siblings of the team had

blood-lead levels <10 μ g/dL. No specific medical treatment is indicated for the students or the range officers at this time. Chelation therapy is normally not considered in this age range until blood-lead levels become considerably higher.

Discussion

Improper maintenance, ventilation, and the absence of safe work practices, can contribute to excessive accumulation of lead-contaminated fumes and dust in indoor firing ranges. Many target shooters remain unaware of the potential for lead exposure. Most commonly, exposures result from lead-contaminated fumes and dust caused by the ignition of lead styphnate primers in ammunition and the fragmentation of lead slugs from friction against the gun barrel and impact with the target backstop. Minute particles of lead can remain suspended in the air for up to ten hours. Inhalation and/or ingestion of these particles over a period of time can result in elevated blood-lead levels. High levels of lead can cause high blood pressure, headaches, muscle or joint pain, and damage to the brain, nervous and reproductive systems.

Based on advice from the Section of Epidemiology and results of the lead hazard risk assessment, the school district superintendent closed the range and restricted access to persons properly trained and equipped to perform the lead hazard remediation and renovation work. Approximately four to six weeks after the initial BLL results, follow-up blood lead analysis was performed on four team members. Parents of the remaining team members chose not to participate in follow-up blood-lead testing. Since the team members had no further contact with the firing range, their blood-lead levels were reduced by about one half, as was expected.

Conclusions:

The highly contaminated carpeted shooting deck, combined with an improperly operated ventilation system, was the most probable source of lead exposure. Carpeting in shooting ranges is not recommended because of its tendency to trap and concentrate lead dust.

The Section of Epidemiology recommended that the school firing range facility remain closed until lead levels have been reduced to allowable amounts consistent with HUD guidelines inside the range and adjacent areas. In addition we recommended that the existing ventilation system be evaluated.

Schools with firing ranges and competitive target-shooting programs need to evaluate their programs for any potential lead exposure problems. It is essential that they establish a policy of routine blood-lead monitoring for all team members, range officers and maintenance personnel. Free blood-lead testing is available through the Alaska Lead Poisoning Prevention Program.

For further information, contact the Alaska Lead Poisoning Prevention Program at (907) 269-8044.

*(U.S. Environmental Protection Agency/U.S. Department of Housing and Urban Development)