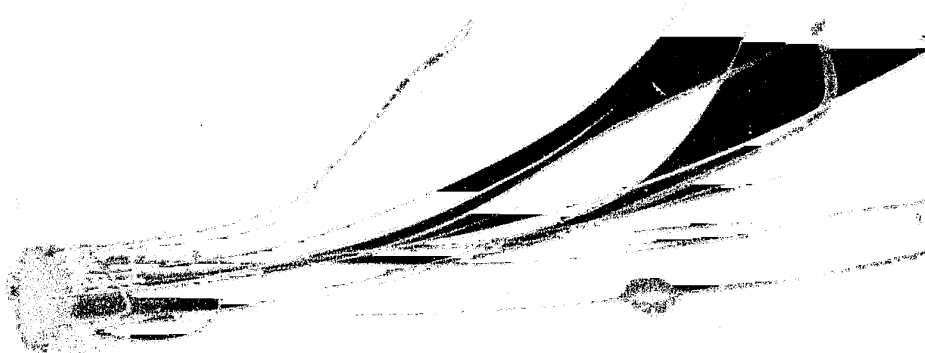




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Director

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Lead Poisoning A Firearms Safety Hazard

By
AMELIA NEWBERRY MARTINEZ

Photo by C.R. Jackson
Missouri State Highway Patrol



tions to control all unnecessary exposure to this toxic element. For firearms range personnel, knowing the hazards of lead is a primary responsibility; taking the necessary precautions to minimize exposure is a duty.

Effects of Lead on the Body

Approximately 6 percent of all lead ingested or inhaled is deposited in the blood or soft body tissues, such as the kidneys, brain, or other vital organs. The remaining 94 percent is deposited in bone. Because the body mistakes lead for calcium, it presumes that, once deposited, the lead needs to be stored.

The body does, however, break down lead so that it can be removed. The time required for this process is measured by the term "half-life," which means the amount of time the body needs to excrete one-half of the lead dose.

Lead in the bloodstream and in soft body tissue has a half-life of approximately 30-40 days and is excreted through urine, bile, sweat, hair, and nails. However, lead deposited in bone has a half-life of approximately 20 years. That is, one-half of the lead dosage absorbed by the body through only one exposure and deposited in the bone would still be present after 20 years.

Health Concerns

For decades, the presence of lead in the environment has been widespread, beginning with smelting factories and continuing with the manufacture of glazed pottery, batteries, and leaded gasoline. Only recently has it been acknowledged as a serious threat to

The U.S. Environmental Protection Agency (EPA) classifies lead as a highly toxic heavy metal with no beneficial biological use in the body.¹ When a person inhales or ingests lead, it is absorbed into the bloodstream. Once in the body, it becomes very difficult to remove. Continual exposure results in the accumulation of

lead in the body, and measurable amounts of lead indicate cumulative exposure over a lifetime.

The EPA has determined that lead poses a serious health hazard to everyone. Unfortunately, individuals working with and around firearms often overlook the harmful effects of lead. Therefore, firearms range personnel must take precau-



Special Agent Martinez is a firearms instructor at the FBI Academy in Quantico, Virginia.

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public health that warranted government control.

In 1971, the EPA began enforcing the Lead Based Paint Poisoning Prevention Act, which restricts the amount of lead used in paints. Seven years later, the agency set the National Ambient Air Quality Standards, which served as the primary mechanism to reduce lead in gasoline. However, even with these standards and other controls, the residue of lead in food, water, and dirt can elevate the lead level in a person's blood.

Firearms and Exposure to Lead

The exposure to lead on the firing line occurs as soon as the shooter pulls the trigger and the hammer falls. This action causes the primer of the cartridge in the chamber to explode, which ignites the main powder charge. At this point, a breathable cloud of lead particles is expelled into the air, with lead dust spraying the shooter's hands.

Lead particles also shear off as the bullet travels through the barrel.

When the bullet leaves the barrel, a second cloud of contaminants, in the form of the muzzle blast, bursts into the air. Then, as the bullet strikes the impact area, another contaminated cloud rises.

When shooters inhale these clouds of contaminants, lead particles go directly into their lungs and are quickly absorbed into the bloodstream. The blood then transfers the lead to soft body tissue and bone. Heat from smoking, sweating, or physical activity accelerates this process.

Lead can also settle on the skin and hair, and in turn, be absorbed through the pores of the skin. If lead particles reach the mouth, they can be ingested into the digestive system.

Exposure increases at cleanup time, because handling empty casings can result in lead being transferred to the skin. The cleaning process also removes much of the remaining lead in the barrel and transfers it to the cleaner's hands. Oils and solvents used to clean and

lubricate weapons cause the natural oils in the skin to evaporate, leaving dry skin and open pores through which the lead can pass.

Symptoms of Lead Poisoning

The numerous symptoms of lead poisoning mimic various diseases, often making diagnosis difficult. Most commonly, individuals experience abdominal pain, fatigue, nausea, subtle mood changes, headaches, constipation, irritability, and depression. Muscle pain, muscle weakness, weight loss, impotence, convulsions, anemia, and renal failure may also occur with increased lead levels in the body.

Testing for Lead

Testing for lead can be performed in several ways. The blood lead level (BLL) test detects recent exposure to lead but does not provide information regarding long-term or past exposure. The BLL measures the quantity of lead in micrograms per deciliter of blood, written as ug/100 dL, that is, micrograms of lead per 100 deciliters of blood.²

The Occupational Safety and Health Administration (OSHA) standards state that the median blood levels for adults should be about 15 ug/100 dL; children and pregnant women should have blood levels below 10 ug/100 dL. For reproductive health, the blood level should stay below 30 ug/100 dL.³ OSHA recommends removal from the workplace of any employee whose BLL measures 40 ug/100 dL or higher.

The zinc protoporphyrin (ZPP) test can be performed in conjunction with the BLL to determine longer exposure. Lead interferes with the

absorption of iron into the blood, which is needed to transport oxygen, thereby allowing zinc to replace the iron. The ZPP measures the amount of zinc in the blood, which remains elevated longer than the BLL. The normal range for the ZPP is 0-100 ug/100 dL. An elevated ZPP indicates concentration in the bone marrow.

The only effective test used for bone lead levels is the disodium edetate (EDTA) chelating agent test. EDTA, a solution administered intravenously, bonds with the lead in bone and clears it from body compartments so that it is excreted through the urine. EDTA both tests and treats an individual, but medical personnel use it only in extreme cases of lead poisoning because of potentially harmful side effects.

Special Risks

In males, high levels of lead can decrease the sex drive and cause sterility. Lead can also alter the structure of sperm cells, thereby causing birth defects.

Pregnant women are vulnerable to rapid absorption of lead, along with calcium, from the blood into the bone. This mobilization occurs due to hormonal changes caused by pregnancy. In pregnant women, lead passes unimpeded through the placenta to the fetus, potentially causing miscarriages of the fetus and birth defects.

Children are more vulnerable to lead toxicity than adults. Children exposed to lead may manifest slow learning, mental drifts, slight retar-

dation in development, hypertension, and behavioral problems, while excessive blood lead levels can seriously and irreversibly damage a child's brain and nervous system. Because the symptoms mirror those of various childhood diseases, many doctors do not test for lead.

Precautions on the Range

Precautions can be taken both on and off the range to protect shooters, instructors, and their families from lead poisoning. Administrative controls and good hygiene are two necessary tools. In addition, all shooters and instructors should practice the following "do's and don'ts" of range safety.



Don't smoke on the range. Smoking any type of tobacco products on the range should be prohibited to prevent acceleration of inhaled lead into the blood stream and ingestion of lead transferred from hands to the cigarette, cigar, etc.

Don't eat on the range. Lead dust on hands and face can be ingested through contact with food.

Airborne lead expelled from the weapon can also contaminate food.

Don't collect fired brass in baseball caps. Many shooters use their baseball caps to collect spent brass; this contaminates the cap with lead particles. When the cap is placed back on the head, the lead is deposited into the hair and absorbed into the skin. Providing boxes for the brass prevents this practice.

Do be aware that face, arms, and hands are covered with lead. Shooters and instructors should wash thoroughly with cold water and plenty of soap. Cold water is preferred because warm water enhances the absorption of lead by opening the pores of the skin. If no water is available, shooters should consider carrying a box of wet handwipes or a bottle of cool water and a washcloth for this purpose.

Do be aware that hair and clothes are still contaminated. Shooters and firearms instructors should wear an outer garment, such as a jumpsuit or coveralls, or change clothes before going home. Contaminated clothes should not be cleaned by blowing, shaking, or other means that dispense lead into the

air. To prevent cross-contamination, range clothes should be washed separately from the family's regular laundry. Families with infants should be particularly careful, since infants are most vulnerable to lead contamination. Changing to clean clothing before leaving the range prevents recontamination of the hands and any contamination of the family vehicle.

Do change shoes before entering residence. Shoes can also transport lead into the home. Shoes should be left at the door to prevent tracking lead onto floors and carpets. As an alternative, disposable shoe coverlets can be used while firing and cleaning, then discarded when leaving the range. Ordinary vacuuming does not remove lead from the home, but redistributes it by blowing it into the air to be inhaled and/or resettled onto the carpet.

Do avoid physical contact with family members until after a shower, shampoo, and change of clothes. Lead can be transferred by casual contact. Family and friends should not be hugged or kissed until after a shower and a change of clothes. Any physical contact should be avoided while the shooter is still in range clothing.

Do participate in lead safety training programs. Shooters and instructors should attend all training programs provided by the department or agency to ensure awareness of the hazards of lead.

Indoor Ranges

Most indoor ranges have a greater lead dust problem than outdoor ranges. However, range personnel can institute several controls to lower the amount of lead dust in these facilities.

The choice of ammunition is one such control. Nonjacketed ammunition produces the most lead dust and fumes; jacketed ammunition, the least. Shotgun shells produce more airborne lead dust than any handgun round. Currently, many ammunition manufacturers are trying to develop lead-free ammunition.

Indoor ranges should not be carpeted, since lead dust settles and contaminates the rugs. A high-efficiency particulate (HEPA) vacuum, which has a 3-stage particulate air filter, is the best air vacuum to use for lead.

Because water cannot be treated for lead contamination, personnel should use water sparingly to remove lead when cleaning ranges. If water is used for lead removal, minimizing the amount of water used will result in less pollution. Range maintenance employees should wear disposable coveralls and air purifying masks while cleaning and/or repairing indoor ranges.

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Recommendations

Departments should conform to OSHA's lead standards, which became law in 1978. The air supply to ranges should be monitored for lead, and employees should be informed of the results. Medical monitoring, such as BLL testing of employees, should be conducted and funded by the department or agency. In addition, air purifying masks should be provided to employees who request them.

Washrooms and/or showers should be provided to ensure proper

cleanup, and eating areas must be separate from lead-contaminated areas. A lead abatement training program should be instituted for all employees who may be exposed to lead.

Departments should place warning signs on the range and weapon cleaning areas that read: *“Warning, lead work area—poison, no smoking or eating.”* In the gun cleaning area, an additional sign should be placed stating: *“Wash hands with cold soapy water.”*

Conclusion

During the early years of firearms training, neither eye protection nor ear protection was provided or encouraged on the range. Today, most departments now require both types of protection on the line.

Currently, another health hazard—lead poisoning—threatens the physical well-being of shooters and instructors in firearms ranges. However, through administrative controls and education, departments can reduce the on-the-job exposure of employees and their families to lead.

Firearms training helps to keep officers safe while performing their duties. Now the time has come for departments to ensure officer safety from a serious health hazard during this training! ♦

Endnotes

¹ U. S. Environmental Protection Agency, Strategy for Reducing Lead Exposures, February 21, 1991.

² One microgram is one millionth of a gram, and one deciliter equals 100 milliliters.

³ Occupational Safety and Health Administration Standards: Occupational exposure to lead. chap. XVII, title 29, U. S. Department of Labor, sect. 1910.1025.