Biomedicine

Gun buffs risk loading lungs with lead

The more blatant health effects of handguns have become painfully apparent in many U.S. cities. But as street killings take their toll, a new study indicates that a subtler sort of danger threatens law-abiding handgun hobbyists using indoor firing ranges: high blood levels of lead after inhalation of firearm-generated dust.

Bullets fly from guns with a bang following the ignition of "primer" material containing lead styphnate. That explosion, and the microscopic shearing of lead bullets as they travel down gun barrels, sends lead particles into the air and into shooters' lungs. A report in the August AMERICAN JOURNAL OF PUBLIC HEALTH – the first to follow blood lead levels in indoor-range enthusiasts over time – documents a significant risk of lead poisoning.

Sarah E. Valway of the Indian Health Service in Albuquerque, N.M., worked with Colorado health officials to measure lead exposure in 17 members of a law enforcement trainee class before, during and after a three-month period of firearm instruction at a state-owned indoor firing range.

The researchers found mean air lead levels 40 times the safety standard of 50 micrograms per cubic meter set by the Occupational Safety and Health Administration (OSHA), despite the installation of a new ventilation system early in the study. And those levels are low compared with levels at most of the ranges Colorado health officials have examined, says study coauthor John W. Martyny of the Tri-County Health Department in Englewood.

No trainee had elevated blood lead levels before the training. But 15 of the 17 ended their training with levels deemed "elevated" by OSHA standards, and eight had levels above 1.93 micromoles per liter (μmol/l), the threshold at which OSHA requires active medical monitoring. During the training period's peak month, when participants spent about an hour in the firing range every four days, four trainees had levels above 2.9 μmol/l, the point at which OSHA requires removing individuals from the source of exposure. Valway says the exposures during that period are probably typical for regular users of indoor ranges. Six weeks after training ended, blood tests measuring the body's total lead burden showed continued evidence of lead poisoning in five trainees.

The health effects from such exposures remain unclear, Valway says. The most obvious symptom detected among participants was a chronic metallic taste reported by three trainees. But shooters at other ranges have exhibited neurological symptoms such as hand twitching, she says. And other studies indicate family members may risk high lead exposures from handgun users who bring home lead dust on their clothes.

The researchers say their concern is not for the occasional handgun user. Their findings may, however, apply to many of the nation's 800,000 competitive pistol shooters and to employees of indoor ranges, who get cumulative doses of lead from repeated exposures. The revamped ventilation system helped somewhat in reducing lead exposure, they found. But comparative studies showed that far more benefit comes from switching to "jacketed" ammunition – bullets coated with copper or nylon. (Most rifles already use such jacketed ammo.)

Although jacketed bullets cost about twice as much as lead ones, Martyny says they may prove cost effective compared with ventilation retrofit expenses and liability risks to range operators. The researchers failed to find a single private firing range willing to permit them to test users' lead levels.

OSHA estimates 16,000 to 18,000 indoor firing ranges operate in the United States. Approximately 50 new ranges open each year to serve the users of the nation's 70 million privately owned handguns.

Chemistry

Utah pours megabucks into cold fusion

A Utah state panel voted Aug. 8 to release $4.5 million of the public funds appropriated at a special April session of the state legislature as "seed money" for a National Cold Fusion Institute at Research Park, which is affiliated with the University of Utah in Salt Lake City. The panel decided to unleash the money despite a "no" vote and an abstention from the only two scientists on the nine-member panel, called the Fusion-Energy Advisory Council. Last month, a federal advisory panel concluded that the evidence for cold fusion was unconvincing and recommended against increasing federal funds for cold fusion studies or for establishing special research centers (SN: 7/29/89, p.78).

In late March, B. Stanley Pons of the University of Utah and Martin Fleischmann of the University of Southampton in England claimed they had found a route to energy-releasing nuclear fusion reactions at room temperature by squeezing hydrogen nuclei together in electrolytic cells (SN: 4/1/89, p.196). Since then, hundreds of researchers around the world have failed to verify the claim, though a few have reported experiments yielding unusual levels of heat, neutrons or tritium – all possible, but not definite, indicators that hydrogen nuclei had fused.

"The feds can do their own thing," says Francine Giani, press secretary for Utah Gov. Norman H. Bangerter. She says Bangerter remains confident that Pons and Fleischmann have discovered something, perhaps room-temperature fusion. Although Brigham Young University in Provo, Utah, will receive none of the newly released state monies, that university announced Aug. 7 it had established its own Center for Cold Nuclear Fusion Studies. Brigham Young researcher Steven E. Jones and his colleagues reported independent evidence in March for minuscule levels of cold fusion occurring in experiments somewhat similar to those of Pons and Fleischmann.

Superconductors made for satellite-talk

As the skies get more crowded with electromagnetic signals of the kilo- and megahertz frequencies, satellite communications researchers want to ease the crunch by building circuitry that operates at much faster, gigahertz frequencies – billions of cycles per second.

Scientists at NASA's Lewis Research Center in Cleveland have used the superconducting material yttrium-barium-copper sulfate to make a simple experimental circuit, which operates in the 33- to 37-gigahertz frequency range. That's fast enough to transmit the contents of roughly 50 multi-volume encyclopedias in a second. The researchers made the device by blasting a small piece of the superconducting material with a laser to produce an atomic vapor of precisely the correct composition, which was then deposited onto a nearby lanthanum aluminate support chip, explains research team leader Kul B. Bhasin. They then used chemical etching and photolithography techniques to produce a simple and precise pattern consisting of a circle – which can resonate at the superhigh frequencies – and a few lines about 75 microns wide that nearly touch the circle.

Doing geometry constructions with DNA

DNA may be good for more than carrying genetic information, suggests a report in the Aug. 2 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY. As part of a project to create all-purpose molecular scaffolding for designing new catalysts, chemists Nadrian C. Seeman, Neville R. Kallenbach and Jung-Huei Chen of New York University assembled DNA segments into a closed, four-sided structure, or quadrilateral. They now aim to build more complicated, three-dimensional structures out of DNA components and hook proteins or other catalytic chemical groups to the resulting framework.