Environment

Country kids: No letup from lead

Traditional wisdom holds that children living in the country enjoy healthier lives and suffer less from environmental hazards than their city cousins. Not necessarily, cautions a report in the July PEDIATRICS. Dale A. Newton, a pediatrician at East Carolina University School of Medicine in Greenville, N.C., and his coauthors found that children living in rural areas of the state had elevated lead concentrations that matched or exceeded those of their urban counterparts.

Indeed, one does not readily associate the image of pristine air and streams with lead poisoning. But the air and streams aren't the problem, says Newton. "Lead poisoning is associated with poverty and old housing," he says. "A compounding issue is nutrition. Children who eat a high-fat diet that's low in calcium and low in iron also absorb more lead."

The study looked at 20,720 North Carolina children age 6 months to 6 years between November 1992 and April 1993. The study's sample derived from children routinely screened for low-income programs and thus was not random.

In 1991, the Centers for Disease Control and Prevention (CDC) in Atlanta changed its guidelines for acceptable concentrations of lead in the blood. Prior to that time, it did not recommend medical intervention for concentrations less than 25 micrograms of lead per deciliter of blood. Responding to mounting evidence of lead toxicity at lower concentrations, CDC set 10 micrograms per deciliter as a dangerous amount.

The new study found that 20.2 percent of the children had readings between 10 and 15 micrograms; more black children than white ones exhibited concentrations of 15 micrograms per deciliter; and boys showed a slightly increased risk over girls. Thomas L. Schlenker of the Salt Lake City-County Health Department says, "This is a fairly substantial study. . . . Most of the work on lead poisoning has concentrated on urban areas. . . . It's important to note that rural areas shouldn't be ignored."

Air over Los Angeles: Piece by piece

Approaching Los Angeles from the sea, one is amazed at the shell of smog, ubiquitous and grim, surrounding the city. Los Angeles is unlucky in locale, says Lynn M. Hildemann of Stanford University. "They've got this ring of mountains that tends to hold air, and the way their prevailing winds work, pollution takes a long time to blow away."

Hildemann is part of a research team headed by Glen R. Cass of the California Institute of Technology in Pasadena that has been analyzing the air of the angels for 12 years. Their sixth study of sources of fine particulates (less than 2 micrometers in diameter) in the air focuses on cigarette smoke. It appears in the July ENVIRONMENTAL SCIENCE & TECHNOLOGY.

The team worked to identify a tracer for cigarette smoke, as they had done earlier for other pollutants (SN: 7/27/91, p.60).

They found between 100 and 200 different chemicals in cigarette smoke, says Hildemann. From these, the team had to find a tracer that was unique to cigarette smoke, remained primarily in the particulate phase (not in the gas phase, which immediately disqualified nicotine), and wouldn't degrade quickly in the atmosphere.

Eventually, the group settled on isoalkanes and anteisoalkanes (C_{29}-C_{34}) found in the surface waxes of tobacco leaves in such a form that they are distinguishable from other plant leaf waxes in the Los Angeles area.

Using the surface-wax tracer, the researchers determined that cigarette smoke contributes from 1.0 to 1.3 percent of the fine particle mass in the Los Angeles atmosphere.

"That they've identified these ambient air samples is incredible," says Douglas W. Dockery of the Harvard School of Public Health in Boston, "They're doing some really precise analysis here. Just extraordinary."

Physics

Trapping stripped uranium ions

A uranium atom stripped of all but one of its 92 electrons represents an extreme example of the simplest possible atomic system. Consisting of just one electron bound to a highly charged, heavy nucleus, such a hydrogenlike ion serves as a testing ground for theories of atomic structure.

For the first time, researchers have now managed to produce, trap, and bring to rest both hydrogenlike and bare uranium ions. Ross E. Marrs and his coworkers at the Lawrence Livermore National Laboratory in Livermore, Calif., describe their achievement in the June 27 PHYSICAL REVIEW LETTERS.

The researchers used an electron-beam ion trap to create and capture uranium ions (SN: 11/20/93, p.324). By probing the trap's contents, they determined that the trap contained about 500 hydrogenlike and 10 fully stripped uranium ions. The ratio of bare to hydrogenlike ions provided a measure of the rate at which collisions between electrons and uranium ions can strip additional electrons from the ions.

The experimentally observed rates failed to match theoretical predictions. "Our measurements suggest that the theoretical [rates] are too low," the researchers conclude.

Cascades from a dripping faucet

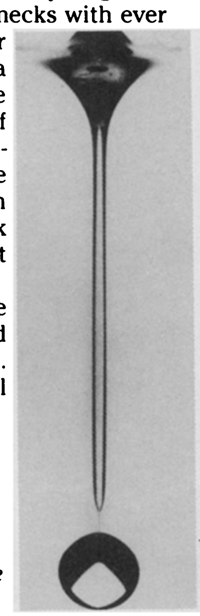
When water drips from a faucet, it initially bulges into an elongated, hanging drop. As it enlarges and sags, the drop develops a long, narrow neck. Finally, the drop breaks off, leaving behind a quivering chain of smaller, hanging droplets.

From the creation of spray at the seashore to the splitting of atomic nuclei and the dividing of biological cells, the rupture of an object into two or more pieces is a ubiquitous phenomenon. Observing how a liquid drips from a nozzle may provide insights into what happens in more complicated situations when something splits, says physicist Sidney R. Nagel of the University of Chicago.

Using computer simulations and experiments involving high-speed photography, Nagel and his Chicago colleagues Michael P. Brenner and Xiangdong Shi studied how the thickness, or viscosity, of a liquid affects the shapes of the drops dripping from a nozzle. By raising the proportion of glycerol mixed with water, they could make their liquids increasingly syrupy. The resulting droplet shapes changed dramatically for liquids with higher viscosities.

The researchers observed that near the breakup point, viscous drops – unlike water droplets – develop very long, thin necks, which then spawn a series of smaller necks with ever narrower diameters (see photo). Computer simulations indicate that this stretching of a droplet into a cascade of necks can continue indefinitely as long as there is some kind of disturbance present, whether a slight air current, tiny temperature fluctuation, or pressure variation in the nozzle. In the absence of such environmental "noise," only a single, long neck would form. Nagel and his coworkers report their findings in the July 8 SCIENCE.

The researchers are now looking into the role played by noise. "We really want to understand the effect of noise on the drop," Nagel says. "How much noise do we need? Can we control the noise and do something to the drop?"



Shi et al./SCIENCE

Photograph of a drop of a glycerol-water mixture during the initial stages of breakup as the droplet separates from the nozzle by a long neck. A narrower secondary neck is also visible just above the main drop.