Surprise find in toxic tests

No known contaminants turn up, but trees show high tungsten levels in an area hit by cancer fears.

By Chris Bowman -- Bee Staff Writer
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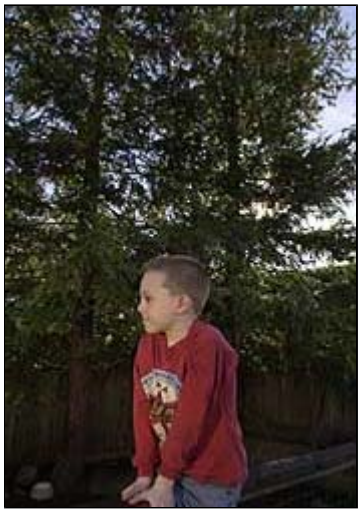
Laboratory testing in a south Sacramento County neighborhood haunted by fears of a leukemia cluster found no trace of cancer-causing contaminants in the tap water but did find unexpectedly high levels of tungsten in area trees.



Leukemia patient Keith Boney, 6, sits in his Auberry Drive back yard, where tests on a redwood tree showed tungsten levels had more than quadrupled over the past decade.

Sacramento Bee/Anne Chadwick Williams

Tungsten, a metal, recently has drawn the attention of federal researchers investigating childhood leukemia in Fallon, Nev., though the element's link to cancer, if any, is unknown.

The Sacramento Bee commissioned the environmental tests in the Calvine-Florin neighborhood last fall after state health officials declined to investigate on-site.

Growing numbers of

residents suspected the
area just north of Elk Grove had a leukemia cluster -- an unusually high incidence not likely due to chance. Families organized as the Concerned Residents Initiative pressed the state Department of Health Services to find out if something in their water, soil or air was making people sick.

The Bee collected tap water samples from six residences in mid-December. It selected homes based on where worried residents thought the water might be contaminated. Four are occupied by leukemia patients, and two are hooked to old, individually owned wells that are shallower and, generally, more vulnerable to pollution than municipal wells.

Four government-certified analytical laboratories screened for different types of contaminants within a group of 140 pesticides, industrial chemicals and toxic metals.

They found nothing of known health concern. They detected only bits of naturally occurring metals and radiation and chemical byproducts of chlorination -- all at levels well below government safety limits.

The tungsten find in the trees is potentially significant in light of an ongoing federal leukemia-cluster probe in Fallon, 60 miles southeast of Reno.

Tungsten, a naturally occurring metal used in hardening tools and military ammunition, has never been tied to cancer and is not a regulated environmental contaminant.

But the U.S. Centers for Disease Control and Prevention grew concerned last year upon finding extraordinarily high levels of the element in Fallon residents and in their drinking water. The finding possibly reflected an exposure to something unique in the environment.

The agency recently expanded its testing to other Nevada communities for comparison and ordered testing of the metal's effects on humans.

In addition, two University of Arizona scientists working independent of the CDC have reported that trees appear to be absorbing tungsten much more so than other natural elements in the Fallon area and in Sierra Vista, Ariz., which also has a confirmed childhood leukemia cluster.

Curiously, the metal shows up at higher levels in Calvine-Florin trees than in the pines growing atop the tungsten mines near Sierra Vista.

"I can't think of what would cause that. It is interesting," said Ralph Seiler, a U.S. Geological Survey hydrologist involved in the Fallon cancer-cluster probe.

The Arizona scientists extracted samples from the trunks of several Calvine-Florin trees last October at the invitation of Dee Lewis, a resident leading a grass-roots investigation of the area's cancer incidence.

"It interested me that they were trying new ways of identifying environmental pollutants that may be linked to leukemia," Lewis said.

Lewis chose the sample trees based on where she thought toxic exposure might

have occurred, including yards of houses where families have had leukemia patients. The Bee paid for the tests, which checked for tungsten and 11 other metals in the wood of nine trees.

Results from tree-ring analyses of different species consistently show tungsten in the most recent trunk growth at significantly higher levels than in the older wood. The other metals tests showed no consistent change in concentration over time.

The research pair were struck by the same pattern in the trees of Fallon and Sierra Vista.

The trend suggests that the trees -- and, perhaps, the residents -- have been exposed in recent years to increasing amounts of tungsten either in the natural environment or from industry.

"This is a big clue that tungsten is involved in leukemia and possibly other cancers," said Mark Witten, a toxicologist at the University of Arizona College of Medicine. Witten is conducting the wood sampling with tree-ring expert Paul Sheppard.

Witten, who specializes in the effects of environmental pollution on children, goes further than other scientists in pointing to a possible link between tungsten and cancer. Few studies have even looked at the possibility, let alone developed any evidence.

Carol Rubin, the CDC's lead investigator in Fallon, said only that the high levels of tungsten found in the water and urine of Fallon residents "is certainly something of note. ... We are taking steps to find out more."

State health officials in California and Nevada said they are intrigued by the results of The Bee's pilot tree-ring tests and think they merit further study. They cautioned against drawing any conclusions about links between tungsten and leukemia.

"It's interesting to look at tungsten, but (Calvine-Florin) is not like Fallon because at this point we don't think there's an excess number of leukemias there (Calvine-Florin)," said Raymond Neutra, California chief of environmental and occupational disease control.

The Bee's findings already are generating questions in the Sacramento County neighborhood.

"I find it very interesting that one of the highest levels of tungsten increases is happening in my back yard," said Randy Boney, who lives on Auberry Drive, off Calvine Road.

Tests of Randy Boney's backyard redwood tree showed tungsten levels had more than quadrupled in the past 11 years.

The specimen showing the biggest change -- 446 percent in 12 years -- came from a redwood between Union House Creek and a 1960s industrial center at Elsie Avenue and Cottonwood Lane.

Changes in tungsten concentrations in the other seven trees tested ranged from a 42 percent decrease in 10 years to a 232 percent increase in 15 years.

Boney's 6-year-old son is one of at least six people -- four of them children -- who have been diagnosed with leukemia since moving to the 15-year-old Auberry Drive tract, according to The Bee's interviews with cancer patients and family members.

"I want to see if there is any (environmental) link there," Boney said.

State cancer investigators maintain that the rise in leukemia and lymphoma cases in the area is in line with what would be expected for the population, given the area's rapid growth.

They point out that environmental conditions, such as exposure to radiation, pesticides and industrial solvents, account for a small percentage of cancer cases in society.

State and local environmental officials nonetheless reviewed files of area businesses with hazardous materials and found no apparent source of pollution that might account for any increase in cancer incidence.

Some residents remain concerned because the health officials drew conclusions without investigating on-site.

Witten and Sheppard plan to expand their field work in Calvine-Florin.

A much broader tree sampling and expanded experimentation is needed to determine whether the tungsten pattern observed in the trees of Calvine-Florin is unique, said Sheppard, a specialist at the University of Arizona's renowned Laboratory of Tree-Ring Research.

The key question, Sheppard said, is whether the stark jump in tungsten observed between older and newer wood truly indicates that the metal is becoming more available to trees and people, through groundwater, soil or air.

Another possibility, tree scientists said, is that trees by nature move the tungsten absorbed through roots or leaves outward in the trunk, thus concentrating the metal in the younger wood. Studies of other heavy metals have shown that they can move through trees in this way, and that their distribution in tree rings do not necessarily reflect the history of pollution events.

Sheppard and Witten are planning experiments to find out whether this is the case for tungsten.

Beyond the Sacramento County neighborhood, the tree tests have been limited to Fallon (seven trees) and Sierra Vista, Ariz. (four trees), communities with confirmed childhood leukemia clusters.

On average, the changes in tungsten levels seen between the older and newer wood have been comparable in the three communities: Calvine-Florin, 155 percent; Sierra Vista, 156 percent; Fallon, 118 percent, according to Sheppard.

"What are the odds of having three hot areas of childhood leukemia ... and three hot areas of tungsten?" Witten asked. "I think we're on to something."

All involved say more study is needed, especially in learning the health histories in other communities exposed to tungsten.

"It is no doubt an interesting find, but one needs to find answers to these basic questions before making too much out of this," said Randall Todd, the Nevada state epidemiologist who is involved in the Fallon cancer investigation.

Until now, environmental agencies have had no reason to track manufacturers' releases of the metal into the environment. The element is not considered a hazardous material, air pollutant or drinking water contaminant, so agencies haven't systematically tracked it.

The sources of tungsten are more apparent in the desert communities.

Fallon has a tungsten smelting plant 20 miles north of town and is downstream of former tungsten mines in the Carson River drainage. Sierra Vista, 70 miles southeast of Tucson, Ariz., has several inactive tungsten mines in the nearby Huachuca Mountains.

In Calvine-Florin, The Bee could not confirm whether any nearby industrial activity past or present processed significant amounts of the metal.

As for natural sources, the closest tungsten mine or deposit is more than 200 miles away, in Bishop, geologists said. Minuscule traces of the element, however, can be found in the soil just about anywhere on Earth.

The discovery of tungsten as a potential cancer-causing agent came as a result of scientists attempting new approaches to unraveling the mystery of cancer "clusters" -- unusual groupings not likely due to chance.

The CDC had all but abandoned cancer cluster investigations years ago because the expensive investigations yielded far more questions than answers.

The disease pattern in Fallon, which began to take shape in 2001, first appeared more compelling and promising than clusters examined in years past, the CDC's Rubin said.

Surrounded by rangeland suitably vast and unpopulated for the Navy's "top gun" pilot school, the Fallon area sticks out like none other on the national landscape of cancer clusters.

From 1997 through 2001, leukemia has sickened 13 children and killed three others in the Fallon area. A population so small -- about 8,000 -- would be expected to have no more than one new case of childhood leukemia every three years, according to the National Cancer Institute.

"There were so many cases diagnosed in such a short period in such a well-defined geographic area that there was reason to go further," Rubin said.

The CDC also saw in Fallon an opportunity to put to test new methods able to

detect the slightest traces of environmental contaminants in the blood and urine.

The scientists ran tests to check for dozens of known or suspected cancer-causing pesticides, industrial chemicals and metals. But they went on to test for other substances not known to be toxic, simply because they now had the instruments and techniques to do it, Rubin said.

"Tungsten was part of that panel," she said. "It was not a priority in the beginning."

That changed last August when the CDC received results of the urine tests.

The agency had a new database that allowed them to discern immediately that the levels were excessive. A recently completed survey of substances Americans absorb in their bodies showed that the average level of tungsten found in 205 Fallon residents tested was more than 13 times the national average.

At about the same time, the Arizona scientists stumbled into tungsten in testing the trees of Fallon and Sierra Vista.

They had asked the Battelle Marine Sciences Laboratory near Seattle to test for a broad selection of metals, without specifying them.

"So they ran it from antimony to zinc," Witten said. "Tungsten just happened to be one they included. It was just the luck of the draw."

Then, in October, the Geological Survey said it found varying levels of tungsten in the tap water collected from dozens of Fallon homes, suggesting the well water was the source of the high levels detected in the residents.

Earlier this month, the CDC team concluded that the measurements on tungsten were the most surprising and promising find in more than 18 months of environmental and medical testing.

"The tungsten is significant not only because the levels in residents were high compared with the national norm but also because it wasn't on anybody's radar screen," said Todd, the Nevada epidemiologist.

The CDC has advised Fallon residents to drink bottled water or install reverse-osmosis filters on their taps because of the tungsten as well as high levels of naturally occurring arsenic and uranium in the town's well water.

Last week, the agency began taking the next step: collecting water and urine samples in two geologically similar Nevada towns in an effort to determine whether Fallon's tungsten levels are unusually high or just part of the geology in the mineral-rich state. Results from Lovelock and Pahrump are expected this summer.

In addition, the National Institutes of Health is beginning research to determine potential links between tungsten compounds and cancer.

Witten believes he is on his way toward establishing such a link.

Results from his recent laboratory experiments repeatedly show leukemia cells from a diseased girl growing at a vastly higher rate when exposed to tungsten at levels found in the Fallon trees, Witten said. He plans to submit his findings for review by peers and publication in a scientific journal.

Alexandra Miller, an East Coast researcher, unaware of Witten's work and the CDC findings in Fallon, also has developed evidence recently of tungsten's toxicity.

In one of the few studies on human exposure to tungsten, published in January 2001, Miller showed that healthy human bone cells grown in the lab transformed to cancerous cells when exposed to tungsten alloys of the type used in military ammunition.

Exposure to the metals also damaged genetic material and altered chromosomes, said Miller, a scientist with the Armed Forces Radiobiology Research Institute in Bethesda, Md.

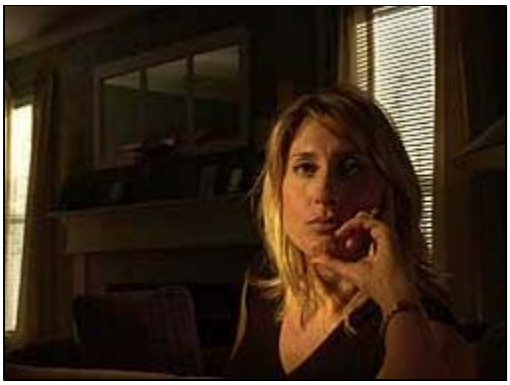
"It looks like tungsten was the culprit," she said.

Graphic: Pollution testing in Calvine-Florin (32k PDF)

Adobe Acrobat needed to view graphic

About the Writer

The Bee's Chris Bowman can be reached at (916) 321-1069 or **cbowman@sacbee.com**.



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