

*Report*

## Threat of Mercury Poisoning Rises With Gold Mining Boom

*With high gold prices fueling a global gold rush, millions of people in the developing world are turning to small-scale gold mining. In many countries, including Colombia, miners are putting themselves and those who live nearby at risk by using highly toxic mercury in the refining process.*

**BY SHEFA SIEGEL**

One rainy evening in the gold mining city of Segovia in northeastern Colombia, José Leonardo Atehortua was working late at the refinery — or *entable* — where miners bring their ores to be processed. Atehortua entered the cramped, concrete room and began his labor — roasting balls of amalgam composed of equal parts gold and mercury, an ancient process used to separate one of the world's most valuable elements from one of the most toxic.

The next thing Atehortua remembers it was morning. He wanted to rise to his feet, to say something, but when he tried to speak saliva poured uncontrollably over his lips and down his chin. He had tunnel vision. He was unable to move his eyes. His limbs were stiff as a plank. He was lying on a cot in the *entable* surrounded by men saying “*José está azogado*” — Jose is mercuried.

The mercury poisoning of Atehortua reflects a growing threat in Colombia and other parts of the world as small-scale gold mining expands in response to rising gold prices. Gold and mercury are interdependent commodities. When the price of gold increases — as it has since 2002 — so does mercury pollution. The source of this pollution is a little known but widely practiced variety of small-scale gold mining, found throughout rural districts of the developing world.

To separate precious gold from common stones, small-scale miners cart their ore to town, where it is mixed with mercury in cylindrical mills filled

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with steel balls that grind the ore into a fine flour. Mercury and gold bind as one, until, sundered by fire, the more volatile mercury is vaporized from the elemental union. The result, in backwater towns like Segovia, can be the exposure of large numbers of people to high levels of mercury vapor, which, in extreme cases like Atehortua's, can lead to life-threatening mercury poisoning.

The small-scale mining sector, much of it illegal and unregulated, is expanding worldwide faster than at anytime in history and, with it, the health threats posed by mercury. This global gold rush began in Brazil in the late 1970s, before sweeping every mineralized country in South America, Asia, and Africa, with an estimated 15 to 20 million prospectors now active in more than 60 countries.

Today's small-scale mining industry is motivated less by adventure than survival. Poverty-driven miners rely on inexpensive, outdated, polluting technologies and chemicals — chief among them mercury — with heavy costs for human health and the environment.

Nowhere is this problem of mercury contamination more urgent than in Colombia. Gold mining is Colombia's fastest growing industry, with 200,000 small-scale miners producing more than 50 percent of the country's gold. This growth has turned Colombia into the world's leading per-capita emitter of mercury, especially in states such as Antioquia, where Segovia is located.

Ground-level concentrations of mercury gas in gold-processing hamlets like Segovia are so high, experts fear the outbreak of an environmental health crisis worse than any caused by mercury since Minamata, Japan, where releases of mercury from a factory in the mid-20th century killed more than 1,700 people. Last year, scientists working for the United Nations Global Mercury Project recorded levels of mercury

gas in Segovia's center — near public schools and crowded markets — 1,000 times higher than World Health Organization limits.

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As Atehortua was being transported to a local clinic, he recalled how nausea and headache had punished him with such intensity the previous night that he had stopped his work to lie down. Unable to be treated at the clinic, Atehortua was sent to the state capital, Medellín, where his blood could be filtered with activated carbon. There the doctors told him to dictate a will. “You are going to die,” they said.

(Atehortua later told his story to Kris Lane, a professor of Latin American history at the College of William & Mary, who interviewed Atehortua in 2008 and 2009 as part of his research for his book on Colombian mining, *The Colour of Paradise*. Lane relayed Atehortua's story to me.)

In the ensuing weeks, Atehortua's molars fell out; he was besieged by ringing in his ears, loss of hearing and appetite, impaired vision and

**Segovia and four nearby cities release as much as 100 tons of mercury each year into the air and soil.**

balance, and damaged kidneys — ailments common to acute mercury vapor intoxication. But somehow kidney dialysis worked, and, slowly, movement returned to his arms and legs. Four months later, Atehortua returned to the *entable*, famous among Segovia's miners as the *azogado* who had miraculously recovered from paralysis.

“Unfortunately, people in Segovia say about José Atehortua, ‘Too bad for him, but great story,’ rather than ‘Watch out or this could happen to you,’” says Lane.

It is unclear what made the night of Atehortua's poisoning different from other nights. One theory is that the unusually late shift occurred in the *entable* just as the air temperature was dropping and the day's accumulated mercury vapor was precipitating from the ceiling. What is clear is the attack on Atehortua's nervous

system ought to have sounded alarms about an imminent threat to the urban residents of Antioquia's mining regions.

“There is no other case in the world like this where an urban population of 150,000 people is exposed to such high levels of mercury vapor,” says Marcello Veiga, a professor of geochemistry and mining engineering at the University of British Columbia and former director of the United Nations Global Mercury Project. “The *entables* must move from the cities.”

Ordinarily, gold processing occurs in rural districts or industrial zones, away from densely-populated areas. But in Colombia, where security forces are preoccupied battling violence from all directions, the risks of working in the bush are too extreme to operate unprotected. (While I was there last fall, bandits robbed and murdered four brothers at their mine.) So gold refiners seek the security of city centers. In Segovia and four nearby cities, an estimated 350 *entables* release 50 to 100 metric tons of mercury each year into the air and soil of northeast Antioquia.

Yet cases where mercury-afflicted miners return to work in heavily contaminated areas remain common because of the Colombian Health Ministry's practice of testing urine rather than blood; only blood tests can gauge how much mercury may have reached a person's brain. “When the level of mercury in urine is normal,” Veiga says, “the patient can return to the same polluted work environment, without any evaluation of how much mercury has accumulated in the brain.”

Meanwhile, evidence is accumulating that more chronic varieties of the acute symptoms endured by Atehortua are affecting the most vulnerable segment of the population. In neurological tests administered to 196 children in Segovia, aged 7 to 13, 96 percent failed at least one measure of intoxication, whose indicators include attention, memory, language, and executive functions. These data are included in a UN health report, published in January, which describes the mercury situation in Antioquia as “dramatic.”

“It is no exaggeration,” the report concludes, “that in Segovia and Remedios” — the

towns are adjacent — “the proportion of the population exposed to a high risk of mercury intoxication approaches 100 percent.”

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After the birth of industrial-scale mining in the late 19th century, small-scale mining receded to the corners of crumbling, impoverished states, offering a refuge for the global poor — “drought-driven work” — during periods of privation and crop failure. Unlike industrial mining operations, small-scale mines never abandoned mercury. Cheap, abundant, and easy to use, mercury used in gold mining causes 30 percent of global mercury pollution, eclipsing all sources except mercury gas emitted from coal-fired power plants. But because of a widespread perception that small-scale mining was no longer a global force, serious efforts to document these toxic emissions only began in the last decade.

In Colombia, two modest technical adjustments — adding mercury after, rather than during, the grinding of ores, and capturing its vapor in ovens — could eliminate nearly all mercury emissions from *entables*. But most miners and processors lack the resources to change, while the country’s culture of conflict means there are no easy solutions.

Operating *entables* inside municipal limits has been illegal in Colombia since 1995, when a federal decree gave mayors a ten-year window to relocate refineries. Ten years turned into 15. The federal government pointed to the state agencies, the state to the mayors, the mayors to the miners, all to no effect. The mayors did not want to lose their votes. They also did not want to lose their lives.

At a September meeting of 55 public officials in Medellin, Miguel Enrigue Franco Menco, the mayor of Nechí — another gold mining town in Antioquia — issued a sober lament of his state’s mercury crisis. “Responsibility falls on the mayors,” he said. “But behind the gold market

‘The proportion of the population exposed to a high risk of mercury intoxication approaches 100 percent,’ said the UN.

there is violence threatening us, and public officials are turning a blind eye to this problem. We have fear.”

The mayor of Nechí was countered, swiftly and unsentimentally, by a vow from the region’s attorney general, Fanny Enriquez, to imprison any mayor who failed to move the *entables*. “Comply with the law!” she cried into a microphone, drowning protests from miners and mayors.

During my recent trip to Colombia, I had planned to tour *entables* in Segovia, but protests over the arrival of a Canadian mining company made that journey impossible. Trade union leaders were persuading miners that UN efforts to curb mercury emissions were part of a foreign conspiracy to expropriate their mines under environmental pretense.

I went instead to the town of Amalfi, visiting a small mine with modest quarters for sleeping six, a privy, and a kitchen. Under a tin roof were eight ball-mills, lined up next to each other near an opening in the rock face just wide enough for a cart the size of a small sled to be wheeled down into the darkness.

The mine starts as a sharply sloping tunnel descending 50 or 60 meters, before leveling off into the first large opening where dynamite had blasted a space big enough to stand upright. From here the miners had followed quartz veins, expanding underground into a disorienting series of tunnels that dip another 50 meters, leaving you fatigued from ducking beneath low clearings and squeezing between narrow walls.

Carted up from the mine below, the ores are run through a sluice to strain and separate large from small rocks, then combined with mercury in the ball-mills where they are ground for five or six hours. After that, the floured concentrate is panned in a wide-lipped cedar bowl, until what’s left is the gold and mercury amalgam, ready to be burned.

“Of course we know miners who are mercuried,” said Cesar Zapata, the mine’s operator. “We want to change. The problem is we don’t know how, and we don’t have

means. And we don't have means because we are not legal.”

Many miners are aware of the danger posed by mercury. One common practice to keep from inhaling mercury vapor is for miners to hold a large leaf over the roasting amalgam. “The problem,” said Oseas García Rivera, who directs a mercury pollution project administered jointly by the government and UN, “is they take that leaf and go like this” — he pretended

**Development experts view environmental needs as inseparable from questions of poverty and property.**

to throw something into the forest — “so the mercury ends up in the environment anyway.”

Garcia is among an increasingly vocal wing of development practitioners who view environmental needs as inseparable from questions of poverty and property. Only when miners have access to credit and capital, the thinking goes, can they invest sustainably in pollution controls. And without formal mining claims, small-scale gold miners in Colombia and elsewhere have no collateral against which they can borrow.

But mobilizing governments to recognize mineral rights in the small-scale mining economy is a struggle, especially when foreign companies wield influence through investment in large-scale resource extraction.

Among small-scale miners, the perception is they are engaged in a game that is rigged against them. “The companies arrive and the laws are immediately changed to help them, while we have to wait ten years to get titles,” says Roberto Lema Castro, president of a national miners association called Fenamicol.

Such problems present a vexing paradox: Acute environmental health crises such as urban mercury emissions demand immediate intervention, yet sustainable solutions lie in healing deeper social and political afflictions.

“We have too many problems to expect one big solution,” García Rivera says. “But what we can hope for is to get a group of *entables*, five or ten, to try a different way,

and use mercury as an excuse, a tool, to create a progressive process.”

*Alexandra Castano contributed translation and reporting for this article.*

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#### **ABOUT THE AUTHOR**

**Shefa Siegel** directs the U.S. State Department’s technical assistance program with small-scale miners in the Andes. From 2005-2007 he was External Relations Advisor for the United Nations Global Mercury Project. He works at the intersections of environmental politics, economic development, and global health, and teaches ecological thought at Royal Roads University on Vancouver Island. He is a fellow in the politics of mining at the University of British Columbia.

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