

# SCIENTIFIC AMERICAN™

Permanent Address: <http://www.scientificamerican.com/article.cfm?id=10-worst-toxic-pollution-problems-slide-show>

## World's 10 Worst Toxic Pollution Problems [Slide Show]

Mercury, lead, chromium and other toxic compounds, used in many industrial processes, rob years of healthy life from millions each year. Simple fixes could go far in solving the issue

By David Biello | Thursday, November 10, 2011 | 11 comments

The price of gold affects more than global finances; it also drives the world's most toxic pollution problem, according to new research from the Blacksmith Institute, an environmental health group based in New York City. Miners in countries from across Africa and Southeast Asia use mercury to separate the precious metal from the surrounding rock and silt. To then separate the resulting amalgam of gold and mercury, heat must be applied to vaporize the mercury. Typically, heating occurs over an open gas flame, releasing the potent neurotoxic element into the atmosphere. What's more, the estimated 10 million to 20 million workers who mine for gold this way will all too often inhale the mercury, putting their health at profound risk.

"Small-scale gold mining contributes to one third of the mercury released into the environment today," says physicist Stephan Robinson of Green Cross Switzerland—Blacksmith's partner in the research and ranking—or nearly as much as coal burning by power plants. "This is continuing to increase because of rising gold prices."

The researchers estimate that more than 3.5 million people suffer from mercury-related health effects as a result of such artisanal gold mining, making it the world's worst toxic pollution problem in terms of number of people affected.

The toxic top 10:

1. Mercury pollution from gold mining (3.5 million people)
2. Lead pollution from industrial parks (nearly 3 million)
3. Pesticides from agriculture (more than 2.2. million)
4. Lead smelting (just under 2 million)
5. Chromium pollution from leather tanning (more than 1.8 million)
6. Mercury residue from other mining (more than 1.5 million)
7. Lead pollution from mining (more than 1.2 million)
8. Lead pollution from improper battery recycling (nearly one million)
9. Arsenic in groundwater (at least 750,000)
10. Pesticide manufacturing and storage (more than 700,000).

Notably, groundwater arsenic is the only naturally occurring pollution problem—and it is in ninth place. Put together, arsenic, chromium, lead, mercury and pesticides are the leading causes of such toxic hot spots largely created by mining, metal smelting, chemical manufacture, agriculture, heavy industry, tanneries and waste disposal, among other activities.

***View a slide show of the world's worst toxic pollution problems***

"We find lead all over the world, we find arsenic all over the world, chromium from tanneries all over the world," says Blacksmith's Bret Ericson, who managed the three-year project. "These are not large-scale, multinational corporations that are responsible for this pollution. Typically, it's low income, small-scale industries who have no emissions controls," often because these outdated industries remain unregulated.

All told, an expanded list that also includes specialized activities such as chemical manufacturers and uranium mining finds that at least 100 million people worldwide suffer health effects or die from such pollution. "We anticipate that number growing as we continue the inventory work," Ericson says.

The list derives from Blacksmith's survey of more than 2,000 toxic sites in 47 different countries in the developing world. The researchers then ranked the sites and problems by "disability life-adjusted year," or DALY, which measures both early death and the impact of pollution-related disease. In essence, one DALY equals "one year of 'healthy' life lost," the researchers wrote in the report released on November 9.

On average, those afflicted by the 10 worst pollution problems lost 12.7 DALYs of life. "It could mean that a person has 6.7 years with a serious disease as well as dying six years earlier than they otherwise would have," Ericson explains. But that ranges from nearly 24 years lost because of lead in industrial wastewater to just under three years lost from hexavalent chromium, the carcinogenic form of the element, from tanneries.

"The chromium process is old, historic and efficient, and any other process is not likely to dominate," says environmental health scientist Jack Caravanos of the City University of New York School of Public Health, who consulted on the report and suggests chromium tanning for leather is not going away. "The goal is to install industrial waste treatment plants that collect the waste, as opposed to just discharging it. We have to live with hexavalent chromium and manage it at the source." Management tactics range from using bone charcoal to soak up the carcinogen and then dispose of it as toxic waste to chemically transforming hexavalent chromium to a more benign form.

In many cases, however, the fixes are even simpler. "We have also seen people working in these mines ill-equipped, who do not wear gloves or very often shoes," Robinson notes. "The mines are located in the middle of villages, and children are playing on the waste rocks and tailings."

The solution for the health impacts of artisanal gold mining is not to shut down the mines. "We're not interested in putting people out of work," Ericson says. It is instead a simple retort—essentially a still, or a sealed chamber, for heating the amalgam with an attached outlet tube for cooling and recapturing the mercury vapor. "They are built by local craftsmen using locally available materials and cost a few dollars," Robinson says. "It allows miners to recycle 99 percent of the mercury and saves their health, but also the health of the global community."

There is one major source of toxic hot spots worldwide that does not appear on this list: oil production and its ancillary industries. "If the data existed, the petrochemical industry would be included as one of the top 10 pollution problems," the researchers wrote in the report, noting that processing one ton of crude oil results in 3.5 to five cubic meters of wastewater and three to five kilograms of sludge and other solid waste. They add that thousands of sites are "contaminated by the petrochemical industry, often in highly populated areas." But, because such sites tend to be neither abandoned nor defunct and are largely immune from regulatory control, the oil industry "falls out of the focus of what we're looking at," Ericson explains. "There's a lot of information on petrochemicals out there."

In the future the Blacksmith Institute and Green Cross Switzerland hope to be able to measure the pollution burden of individual countries. In the meantime the environmental health groups note that the health impacts of pollution rival diseases such as AIDS and tuberculosis but lacks similar systematic global systems to combat it. "The problems we're looking at are on a scale with other types of

public health threats in these countries, like malaria," Ericson notes. "Toxic hot spots are a problem hiding in plain sight."

---

Scientific American is a trademark of Scientific American, Inc.,  
used with permission

© 2011 Scientific American, a Division of Nature America, Inc.

All Rights Reserved.