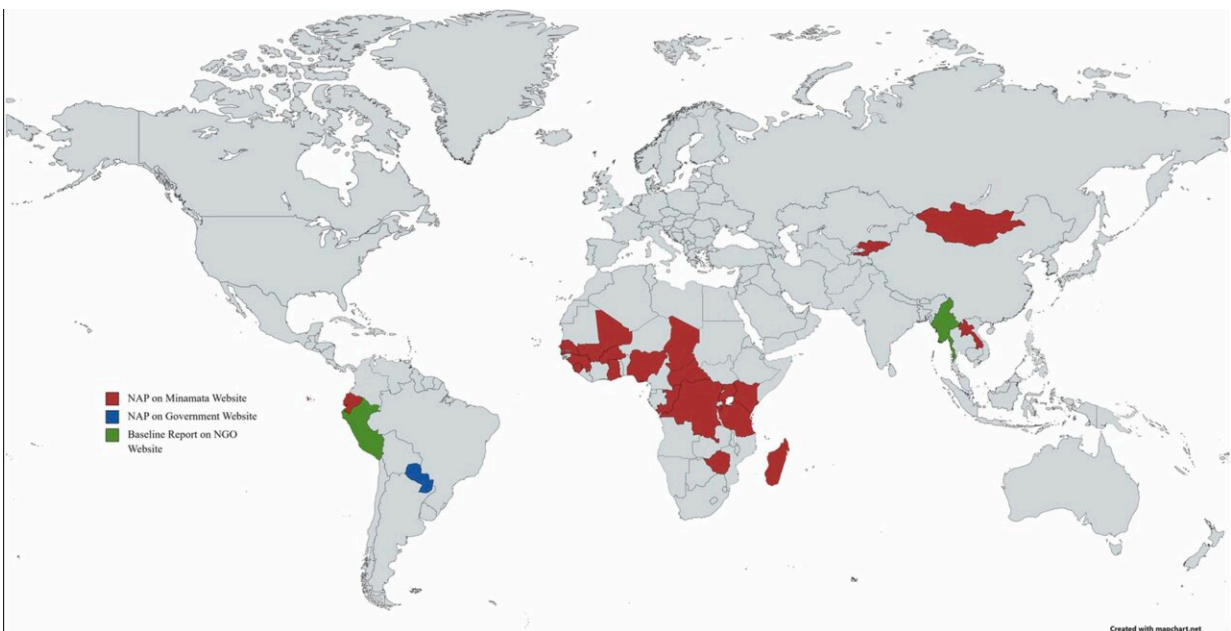


Study: Mercury emission estimates rarely provide enough data to assess success in eliminating harmful mining practices

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Map of countries with published NAPs on Minamata Convention's official website (red), national government websites (blue), and NGO (Non-Governmental Organization) websites (green). Credit: *Environmental Science & Policy* (2023). DOI: 10.1016/j.envsci.2022.12.002

A global treaty called the Minamata Convention requires gold-mining countries to regularly report the amount of toxic mercury that miners are using to find and extract gold, designed to help nations gauge success

toward at least minimizing a practice that produces the world's largest amount of manmade mercury pollution.

But a study of baseline mercury emission estimates reported by 25 countries—many in developing African, South American and Asian nations—found that these estimates rarely provide enough information to tell whether changes in the rate from one year to the next were the result of actual change or data uncertainty.

Key variables—like how the country determines the amount of its gold production—can result in vastly different baseline estimates. Yet, countries often don't report this range of possible estimates.

Millions are at risk

About 15 million artisanal and small-scale gold miners around the world risk their lives every day facing hazardous working conditions that include constant exposure to mercury—a potent neurotoxin. Mercury vapors cause debilitating effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. Mercury is particularly harmful for children and pregnant women, whose developing fetuses are especially susceptible to the neurotoxic effects.

An estimated 4 to 5 million of 15 million artisanal miners are women or children.

"To make effective and impactful mercury interventions and policies, you must first make sure you have the baseline emission estimate right," said Kathleen M. Smits, chair of Civil and Environmental Engineering and Solomon Professor for Global Development in SMU's Lyle School of Engineering. "Providing more transparency in their reporting would help with that."

Smits joined civil engineers from the University of Texas at Arlington and the U.S. Air Force Academy in the study recently published in the journal *Environmental Science and Policy*. The work was supported by the National Science Foundation.

The research group analyzed 22 countries' national action plans (NAP), which contained their annual baseline estimates assembled under the Minamata Convention and posted on the organization's website. The team also looked at three additional countries with pertinent information posted to national government or non-governmental websites.

Smits and her co-authors calculated the baseline estimates for Paraguay, if different variables were used. The South American country was selected for analysis in this study, due to the country's transparency of their reporting.

Lacking key data in countries' baseline estimates

Baseline mercury emission estimates seek to determine how many kilograms of [mercury pollution](#) are injected into the atmosphere each year from the practice of artisanal gold mining. To do that, countries calculate how much gold was found by miners—and therefore an approximation of how much mercury was used to get it.

Countries primarily collect that information using interviews with miners, gold and mercury traders and other key players in the gold mining business; ratios that calculate the mercury to gold ratio; previous research, and field visits to known mining locations.

But the study cites key problems with the way those estimates are currently calculated:

- **Not enough data on gold production estimates.** Fifteen

countries, like the Central African Republic and Madagascar, only provide one source for the calculation of the gold production rate, yet as Zimbabwe demonstrates, different data sources can provide vastly different values. In a separate study, Zimbabwe reported that extraction, processing and miners' income information resulted in gold production estimates varying between 11 percent and 55 percent using 2012 mining data and 9 percent to 35 percent using 2018 mining data. The African country's goal for reduced mercury emissions is a smaller percentage than range of uncertainty the study found for gold production.

- **Countries aren't unified in how they select important metrics.** The mercury to gold ratio (Hg:Au) is used to estimate the amount of mercury used to produce a given amount of gold. A different ratio can result in different reasonable estimates for how much mercury was emitted. In the study, five different ways were listed as a ratio for Hg:Au, and a few countries cited more than one in their national action plan. Similarly, different countries used different techniques to come up with the national estimate of mercury emitted, some based on a small sample of mines and some without verifying the data with other sources.

Smits said countries must do a better job of accounting for these variables if they want to draft more meaningful mercury reduction targets in their national action plans.

"If you just take a look at the baseline mercury emission estimate process, it is clear that the NAP program will not achieve its goal of reducing mercury emissions if they continue with the current approach," Smits said, whose team spent six years working alongside miners in gold-mining countries for the study.

Why do miners use toxic mercury to get gold?

Artisanal and small-scale miners—the term for individual miners, families or small groups with minimal or no mechanization to do the work—sift through rocks in rivers and dump beads of mercury over the sediment, which clings to gold. They then light a match, using the flame to separate the mercury from the gold, a process that shoots toxic vapors into the air.

It's a cheap method of mining gold, but mercury can leak toxins into the air and pollute water systems.

The hazardous gold mining process accounts for roughly 40 percent of all man-made mercury emissions, making it the largest source for this type of pollution, the United Nations (U.N.) says.

In 2013, the U.N. created the [global treaty](#) called the Minamata Convention to try to phase out artisanal and small-scale gold mining, as well as other mercury emission contributors. This treaty currently has 139 countries committing to its goal.

"To join its treaty, countries that regularly engage in artisanal [gold](#) mining are required to report baseline mercury emission estimates on a regular basis and offer a national action plan for how they will eventually reduce their country's footprint for [mercury](#)," says Monifa Thomas-Nguyen

More information: Michelle Schwartz et al, Quantifying mercury use in artisanal and small-scale gold mining for the Minamata Convention on Mercury's national action plans: Approaches and policy implications, *Environmental Science & Policy* (2023). [DOI: 10.1016/j.envsci.2022.12.002](#)

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