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A man pumps water contaminated with arsenic from a well near his house in Prek Russey village in Kandal province last week. © Heng Chivoan

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## Silent killer taking toll

Wed, 19 March 2014 Laignee Barron  
Kandal province

Villagers emerge from the shade of their homes and gingerly roll up their sleeves, turning their palms upwards to reveal skin braided with dark lesions, ulcers and decaying tissue. They point to houses up and down the street where people have died of symptoms like theirs.

Arsenic, an invisible, odourless poison, has haunted this village in Kandal's Koh Thom district. Most have been diagnosed with arsenic poisoning, and many have lost children or parents to it.

"The children are scared of my disease," says Chhang Vern, 40. He unbuttons his shirt to show hyper-pigmentation covering his chest, stomach and back, and extending down his arms and legs. His children turn away as he lifts his feet and points to blackened, oozing sores.

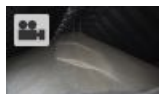
Hundreds of thousands of Cambodians are at risk of inadvertent, mass poisoning in the same manner, experts say.

Over the past 15 years, extremely high levels of arsenic have been detected in food and well water in 10 provinces, with the highest concentrations found in Kandal, Kampong Cham and Prey Veng. Once ingested, the cancer-causing toxin can take years to do its lethal work, and experts predict Cambodia has yet to experience the full extent of the poison's dire health consequences.

The arsenic, a naturally occurring toxin, comes from polluted groundwater dredged up by hand-operated pumps called tube wells, according to Stanford University soil biochemist Scott Fender.

Starting in the 1980s, a UNICEF-led safe-water program pioneered Cambodia's vast network of community tube wells, installing pumps as an easy and inexpensive alternative to bacteria-infested surface water. An independent report commissioned by UNICEF in 2006, however, found that such tube wells installed in arsenic-affected areas were contaminated.

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"Arsenic is a silent killer; it has no taste and no smell. You can only know if it's there by testing for it," Sophary Phan, a technical officer at the World Health Organization Cambodia, said.

Arsenic contamination was discovered in Cambodia during a 1999 national water-quality survey. By 2006, the first cases of arsenicosis – arsenic poisoning – were diagnosed.

"Arsenic is one of the most toxic, carcinogenic molecules we know of," said Dr Craig Steinmaus, an epidemiologist at the University of California at Berkeley. "But you don't get exposed one day and get cancer the next. Most of the health effects happen down the line."

But efforts to calculate how many people are or may become sick have revealed a trail of unknown variables: how many wells are contaminated, how many people drink the poison, how often and how much of the food is contaminated.

Based on 2004 census data, UNICEF determined that 2.25 million people live in the 1,607 most at-risk villages, but the number of well-users consuming arsenic falls somewhere below that total, with estimates ranging from 38,000 to more than 1 million people.

"Arsenic poses a very serious problem. Most of the high-risk areas are also high agriculture producers using [polluted] groundwater as irrigation and ... arsenic can contaminate not just water, but food as well," a local researcher who spoke on the condition of anonymity said. "We lack too much data to know how to properly deal with this problem."

And the problem may be getting worse. Studies show that the more water is pumped from a contaminated well, the stronger the arsenic concentration can become. Additionally, due to subterranean water flows, the toxin can leak into clean wells and agricultural fields, and be spread by annual flooding.

Arsenic exposure in Cambodia has already caused more than 500 documented cases of arsenicosis, and led to numerous amputations and fatalities, according to a UNICEF briefing last year.

But, the paper warned: "The effects of current exposures have yet to be fully realised."

#### An arsenic village

Kandal province, home to some of the most densely populated areas in Cambodia, has exhibited the most extreme arsenic pollution in the country.

Thirty-five per cent of more than 15,000 wells sampled in Kandal contained arsenic exceeding the national limit of 0.05 milligrams per litre, and as many as 54 per cent measured above the WHO standard of 0.01 milligrams per litre.

During field testing in 2006, researchers stumbled across Prek Russey village in Kandal's Koh Thom district, where well contamination averaged far beyond previously documented levels and hundreds of arsenicosis patients were found.

"It was the highest concentration of arsenic and number of arsenicosis cases found to date," Resource Development International Cambodia executive director Mark Hall said.

Today, even as NGOs' red paint warning villagers away from the hand pumps has long faded, the scars of arsenic exposure – black dots covering villagers' bodies like hundreds of poison freckles, gangrene and amputated limbs – serve as a constant visual reminder.

In 1995, UNICEF dug the village's first tube well. Following the example, Vern and his father sunk a pump behind their house in Prek Russey village. Vern's family drank the water for five years. And then one day, he went to the doctor for an itchy, red rash.

"The doctor told me I had chicken pox," he said, an initial diagnosis many of the villagers received.

The "chicken pox" affecting Vern, his father, his aunt and his now 18-year-old son, refused to go away. Months later, Vern and his father went to the hospital in excruciating pain. They were told they had advanced arsenicosis, and the spots were the poison trying to force its way out.

"My skin is itchy and it hurts. And my insides feel bad, too," he said, pointing to his lungs and his stomach. "It's difficult to breathe, and every night I cannot sleep."

The symptoms of arsenic poisoning are irreversible and cannot be treated, though vitamins and a high protein intake are thought to help manage the disease, according to Dr DN Guha Mazumder, founder of a prominent arsenic research centre in India.

Vern bought vitamins and painkillers at the hospital, but when he was forced to stop farming, he couldn't afford even such basic measures.

"I cannot stand for a long time, and my hands cannot grip tools anymore. There were people here sicker than me, but most of them have died."

Vern's father had a leg amputated in 2008 due to cancerous lesions. He died three years later and Vern removed their well, wrapping the remaining nozzle in a black cloth.

Vern said his neighbour lost a husband and a brother. Across the street, one of the village's youngest victims, a 13-year-old boy, died after years of suffering from a rotting leg. Two other children diagnosed with arsenicosis died as well.

Vern worries the disease that claimed his father's life will take his, too, but since there isn't anything he can do about his illness, he puts bandages on his sores and goes to feed the cow.



A man from Prek Russey village in Kandal's Koh Thom district last week shows sores caused by arsenicosis on his foot. © Heng Chivoan

#### Cancer risk

Arsenic affects people differently, yet another piece of the puzzle when trying to determine how many lives the poison could eventually claim.

Most of the people in Prek Russey village suffer from heavy arsenic contamination, but in Koh Thom's neighbouring Kien Svay district, no symptoms have yet

been observed, even though tube-well contamination there is 10 times the national standard.

"There are a lot of complicated factors linked to arsenicosis symptoms like living standards, malnutrition, the individual's general health, smoking and whether there are other water sources used," WHO officer Sophary said.

Outward arsenicosis symptoms were at one point thought to take eight to 10 years to appear, but cases discovered in Cambodia have manifested in as little as three years, medical studies show.

"The duration of the patient's arsenic exposure [and] ... the onset of symptoms does not follow a particular time frame," Mazumder said.

Researchers may not be able to pinpoint a timeline, but they do agree that arsenic poses an enormous cancer risk. A study published earlier this year predicted that due to elevated arsenic levels, Kandal residents face a five-in-1000 cancer risk, more than four times the national average.

"Both ... [water and food] are our main concern ... because arsenic can accumulate in the human body via both sources," Suthipong Sthiannopkao, one of the report's researchers, said.

In several at-risk locations, villagers may have stopped drinking from arsenic-laden wells but still water their fields and let their animals drink from them.

"What other option do we have? When we water using the well, the crop

isn't good either, but at least there is still a crop," said Prak Toun, 33, while taking a break from standing on his scaly, arsenicosis sores.

Food samples collected in Cambodia have shown arsenic levels higher than in 17 other countries, and 60 times higher than in Bangladesh, where food arsenic levels have been identified as a health hazard.

"The arsenic contamination in food samples collected from Cambodia, especially from Kandal province, is an alarming public health concern," according to a study published last summer and conducted with support from the UN's International Institute for Global Health.

Arsenic water contamination remains the primary concern, but experts agree that the health risks posed by arsenic ingested through food cannot be ignored.

"Arsenic in food will probably become a greater problem with the increasing groundwater irrigation," retired environmental research scientist Tom Murphy said. "It needs to be addressed before it becomes a big problem ... but there's not enough research being done, no resources to get the data and the Cambodian labs don't have the ability to do the kind of chemical analysis necessary."

No funding, no rescue

Experts say Cambodia's arsenic problem is falling between the cracks because it lacks funding.

"Donors decided that the government needs to take the lead and not rely on external funding, while the government lacks capacity," an aid worker wishing to remain anonymous said.

Director of the Department of Rural Water Supply Mao Saray said the government does not have a budget for arsenic contamination.

The lack of investment is already taking a toll. Last year, Cambodia failed to meet both 2013 goals of its five-year arsenic strategic action plan – that every person exposed to arsenic-contaminated wells have an alternative drinking source and that every person with arsenicosis receive a swift diagnosis.

Saray said the new goal is to provide 75 per cent of people in arsenic-affected areas with a clean water source by 2015. He was unable to identify how much of that target has already been achieved.

Villagers in Prek Russey said they receive no assistance from the government, and many still lack clean water.

Vern and his neighbours buy water at 2,000 riel per cubic metre from a system that RDI helped install. But the water, piped in from a nearby river, still needs to be treated for the bacteria and pesticides that tube wells were designed to avoid in the first place.

"It is expensive for me," Vern said, adding that as he isn't able to help his wife farm anymore, he doesn't have money to both buy and treat his water.

"How about food and the children's school?" he asked.

Saray said all school wells in the affected areas were also tested. Data from the arsenic centres show that 41 per cent of more than 1,000 school wells tested contained arsenic at or above the WHO standard. The Ministry of Education deputy director of school health said the department was not familiar with the findings.

There's no shortage of proposed alternatives for the situation, just a shortage of funding to implement them.

"Rather than treating arsenic, the idea is to source water that is not contaminated. Options include rain water, dug shallow wells and pipe systems, among others," Steven Iddings, a WHO Cambodia officer, said.

UNICEF extrapolated last year that half of the affected population continues to use arsenic-contaminated water for drinking and cooking in the dry season owing to a lack of available alternatives.

"When you have no choice, or other available options, what are you going to do?" said Chansopheaktra Sovann, an environmental science researcher at the Royal University of Phnom Penh. "You're not going to think about the possible effects 10 to 20 years from now, you're going to think with no water, you will die in less than a week."

ADDITIONAL REPORTING BY SEN DAVID AND PHAK SEANGLY

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