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» KALAWATI FROM KUNWAR

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Living in the Shadow of Death: Arsenic Contaminated Drinking Water

Next time you complain about too many Bedehis and their SUV's, think about Dr. Linda Smith and her untiring efforts to help the Nepali people.

Beneath the shadow of the highest mountains in the world lies an underground ocean flowing south into the river Ganga. Like the oceans covering our planet, groundwater is abundant in this part of Nepal called the Terai. The physiographical area is called the Indo-Gangetic plain extending from Pakistan to Bangladesh. Twenty-four hundred years ago Buddha was born in this land, the ruins of his father's palace in Kapilvastu still mark the footprints of his spiritual journey, one that brings peace to millions of followers. Tharu Kings reigned in the land for hundreds of years, and Tharu Maithali art still decorates mud houses throughout most of the districts. The Tharu as they are known, were resistant to the malaria found in the ancient jungles of the Terai. They were physically strong and lived into their nineties until twenty years ago. As most agricul-

tural people their lives are tied to the soil, the seasons and the water. For half a century water was carried from rivers and hand dug wells in brass and clay jugs to nearby villages.

The Discovery

Two decades ago no one knew of the vast water resources lying below the rice paddies of the now deforested Terai. In an effort to provide both increased water quality and quantity, aid agencies promoted the installation of shallow tube wells all around South Asia. Unfortunately, the notion of arsenic contamination was unknown in South Asia at the time, although a few tests were conducted, in nineteen seventy six, on dug wells, tube wells, and fresh water springs in Chandigarh, Punjab, Patiala, Haranya and Himachal Pradesh in northern India by Dr. B.V. Sarda. By the early nineteen-eighties, Dr. R.C. Saha of the School of Tropical Medicine (STM) in Kolkata recognized arsenicosis patients coming from villages in West Bengal. These patients displayed the tell-tale signs of arsenic poisoning: lesions and ulcers on their hands, feet, head, chest, and skin discoloration on the chest, back and legs, malignancy of the hyperkeratotic spots and cancers. Within ten years WHO declared the arsenic problem in South Asia as the worst natural disaster or man-made correctly the worst development disaster in recorded history. Today over two hundred fifty million people living in the Indo-Gangetic plain drink arsenic contaminated water. In Nepal over two and a half million Terai villagers are drinking their way to death by consuming arsenic contaminated tube well water.

Walk with me as I describe Nepal's most arsenic contaminated village, Kurwar in Nawalparasi. My first visit to Kurwar

was in two thousand and two with students and a professor from Tribhuvan University. The village is two kilometers east of Parasi with over one hundred and thirteen households. Two main small dirt roads divide the village, one road to the left is Sansi Kurwar and to the right is Thala Kurwar. The houses are mostly Tharu style, mud and stone walls with thatch roofs, clay stove in one corner, dirt floors swept clean with branches and a tube well outside most houses. The under side of the thatch roof acts as a filing cabinet for toothbrushes, important papers, and arsenic testing cards.

A spirit of heaviness hung in the air as we walked through the village, sunny noise children with fingers in their mouths, bodies covered in dirt quietly watched us, women in red saris walked slowly to the field, and old men and women lying on beds in the sun moaned from pain. One young girl whose eyes were crossed complained of frequent seizures, a year later we took her to Patan Hospital and discovered she suffers from a diastolic resection of her right brain lobe. An older, emaciated man sat on some stone near the house of a woman, Seema, with whom I had become friends. As I came closer his yellow skin became apparent. His hands were covered with lesions, thickened palm skin and meiosis. Two months later he died. Mr. Chaudary is the first recorded arsenic death in Nepal. Another man came up to me and asked me to examine his chest—scattered white-spots (melanosis) and black wart-like nodules (hyperkeratosis) covered his chest and back; his first wife also displayed the same marks on her legs. Within an hour thirty people were asking for examinations, all of them with similar skin symptoms.





We asked about the arsenic tests on their tube wells. "Yes, we have arsenic", they replied. They gave us their costs: six hundred and fifty ppb (parts per billion), five hundred ppb, three hundred ppb, seven hundred ppb, and so on. The WHO-cave limit for arsenic is less than ten ppb. Nepal's guideline is fifty ppb. My heart felt heavy with grief. Yes, we discovered the thief who stole their health: arsenic. These villagers were ghosts of a once strong people, physically and mentally crippled by a lack of nature and development.

Only one solution: Arsenic Removal

There is really only one solution to the arsenic problem, arsenic free water. Household filters like the Arsenic Guard Filter (AGF), three Kafi's, two Garghane have been used in Nepal with varying success. One problem with the AGF/Kanchan filter is that the iron matrix, that does arsenic out of the water, need to be replaced every year, adding five dollars to the cost, in addition to yearly maintenance costs. The other vulnerable parts are the pipe sets protruding from the bucket. These are easily broken in a village setting and have a tendency to leak. Microbial contamination is only partially (less than eighty-six percent) removed. After closing the filter a ten-day period is required to build up the microbial film that kills many bacteria. The best filter in Nepal three years ago was the AMF filter. It was a simpler version of the SODI filter in Bangladesh, based on sand and iron for arsenic

removal. AMF students took the simplified filter to Nepal where it was field tested by INHSA and INHMD. Unfortunately the heat of the SODI filter, a proprietary compressed iron matrix (CM), was replaced with iron nails. As mentioned earlier, three years ago we didn't know the nails would last only one year in the higher arsenic villages. Now, after two years of maintenance records, the real cost of AMF filters almost

doubles each year, so that the one thousand five hundred rupees original cost is seven thousand three hundred and thirty rupees after five years.

Two concerns regarding our villages prompted us to examine other arsenic removal options: arsenicosis symptoms reappeared in our high arsenic villagers, indicating ineffective arsenic removal after a year, and increasing maintenance costs of the AMF filter. In spring two thousand and seven, I visited two NGOs in Bangladesh working in high arsenic villages, MSUK and ASAR. Each group provides very different arsenic mitigation options. ASAR field areas are in Sylhet, where they've introduced rain-water harvesting in schools and a bacterial removal system built into the local clay stove called a Chuli. The system uses local pond water eliminating the use of arsenic groundwater. Their test site outside Ghaka is full of creative, inexpensive water projects. One idea they shared with us is the use of heated high iron sand to remove arsenic, our lab is testing processed Nepali sand with eight hundred ppb arsenic water. So far the results are promising. We're also thinking of using the Chuli system in Nepal where local ponds are available throughout the year.

The second NGO, MSUK, developed the SODI filter which removes one hundred percent of the bacteria and reduces six thousand ppb arsenic to less than eight

ppb. Over sixty thousand filters have been distributed in Bangladesh, all delivered from their factory in Bastia. As mentioned earlier, the case of the filter is the compressed iron matrix (CM) developed through ten years of research. The SODI filter won the National Academy of Engineering two thousand and seven Garginger Challenge for the best household arsenic removal filter. Several aspects of the filter are very appealing to us: the filter and material longevity is more than eleven years; arsenic and bacterial removal are close to one hundred percent; twenty-three metals as well as other elements are removed; charcoal in the lower section removes any bad taste; maintenance is very low, and village acceptance is high. The original cost is two thousand seven hundred rupees. Over five years the maximum increase is one hundred and twenty rupees. Even this estimate is high since it allows for a new top each year and it's unlikely that a top would break every year.

Six months ago, a dear friend from Kusmar, Kalawati, age forty-five died from lung cancer. Her neighbors Seema and Mr. Chaudary drank from the same tube well, eight hundred and seventy-six ppb arsenic. Even though Kalawati used a filter for three years, the seventeen years of drinking highly contaminated arsenic water condemned her to death. How many more people from this village in the next will die from years of drinking arsenic poisoned water? We don't know. Deaths are not recorded in Nepal. But we can help the next generation to drink safe water from childhood, water that brings life not death. The next time you fill a glass with water or offer a drink to a child, remember that two and one half million people, fathers, mothers, and children drink the water of death in Nepal.

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