Ashok Gadgil on safe drinking water

What happened in northeastern India in the summer of '92 and how did it affect the direction you took with your career?

There was an outbreak of a mutant strain of cholera in Bengal, which became known as "Bengal cholera." Because the surface protein on this mutant strain was slightly different than what's common, all the cholera vaccines were ineffective in protecting populations from this particular strain. So thousands of people contracted cholera within weeks. In one month alone, as the epidemic spread, some 10,000 people died from this cholera epidemic, in a single state in India. Soon after, this particular strain spread from India to Bangladesh and also turned up in Thailand. That's when I decided to do something about it. I had to do something about it because I had been thinking about ultraviolet (UV) disinfection for quite some time as a potential way to disinfect drinking water inexpensively for poor communities in poor countries.

What is the scale of the global drinking water problem right now?

About two billion people, roughly one third of the global population, need to go outside their home to fetch water for daily use. Of those, 1.2 billion people don't have access to safe drinking water; they are forced to rely on biologically contaminated water, in most cases. This leads to a large number of diseases and death, particularly for children below age five. Young children have low resistance to dehydration, which is the resultant condition of diarrheal diseases.

With all the advances in public health, technology and medicine today, why is it that still 20% of our world's population is without access to safe drinking

water?

Right, it is 20% if you exclude the residents of large metropolitan areas like Jakarta, Bombay, Cairo, and Mexico City; if you include them, then the number rises to about 30%. We already have the science and technology to address this problem. It is not anymore a scientifically inaccessible domain, intellectually. It's something that we can do. It just hasn't been done, for a variety of reasons, including inadequate investment in water infrastructure. There is also the mindset that in the developing countries we'll just follow the model of what's been done in the industrial countries, which is to pipe pressurized safe water 24-7 to everybody – and that requires a level of investment and a level of water availability that's often just not supportable. There is also the problem of governance. In many developing countries, the political will to provide safe drinking water dissipates as soon as the politically most vocal and powerful segments of society have access to safe drinking water. Sadly, those who are relatively voiceless and politically weak are left to fend for themselves.

Is water a fundamental human right or is it a commodity?

This is a societal question and the views are sharply divided. Initially, the overall opinion of global policy-makers was that water should be considered a right. However, it appeared after some twenty years of experience that even if they considered it a fundamental human right, investment and aid kept on getting funnelled only into supplying water to those who had political access or political voice in the developing world. It also led to huge incompetence and inefficiency in the supply management of water systems in the developing countries. This was because of enormously bloated bureaucracies with no performance metrics and no accountability. About three years ago there was, after much pushing and debate, a sea change in the way this problem is viewed, at least from the industrial countries. Now the viewpoint, led by the World Bank, is that water should be treated as a commodity, and full cost should be recovered for its supply, which would then, one hopes, amount to some kind of financial accountability in terms of supply costs, and presumably lead to improved efficiency.

How could a strategy based on public-private partnerships work?

This type of strategy draws on the best of both the private sector and the non-government organizations' grassroots outreach efforts. Relying on government alone has not been successful. We have not been able to get safe drinking water to people who need it badly, with a horrendous toll: about 400 children die from diarrheal diseases per hour in the developing countries, every one of the deaths preventable. The public-private partnership vision is not easy to implement, but when it works it works beautifully. You have elements of the private sector – the flexibility, the dynamism, the entrepreneurial spirit, and the ability to rapidly expand services and go out and do something – coupled with the sense of public purpose to do what's considered essential.

Where and how many of your UV Waterworks units are distributed around the world?

Over 300 units are functioning daily throughout the developing countries. There is a handful in the U.S. but most of them are in the developing countries; and most of those, say 200 out of 300, are in Mexico and in the Philippines. The rest are scattered throughout Asia, Africa, and Central America, all the way from South Africa to some in Nicaragua and Honduras. There are also some in India, Nepal and Bangladesh.

What do these units do to pathogenic bacteria and viruses?

The light that's used in the UV Waterworks is known as C-band, the short wavelength end of the UV spectrum. UV light causes adjacent base pair in the DNA helix to fuse together, so that when the DNA tries to replicate, or the organism tries to replicate, it cannot unzip the DNA, and it dies. UV disinfectors, based on this principal, have been around for a long time. To produce the UV light, one essentially passes an electric arc through mercury plasma, which causes the mercury atoms to excite and de-excite. The lamp in the UV Waterworks units is made of quartz, so the UV light can pass through. Normal glass will block it. As well, the UV lamp doesn't have a layer of phosphor on the inside of the glass tube so that you don't get visible light; you just get UV light coming right out. This is a very efficient process.

In terms of energy use, sixty watts of electrical power, which is comparable to the power used in one ordinary table lamp, is enough to disinfect water at the rate of one ton per hour, or fifteen litres per minute, which is approximately two and a half times the water flow in a standard bathtub faucet. This much water is enough to meet the drinking water needs of a community of two thousand people.

What is your next big project?

I am currently working on trying to figure out a way to remove arsenic from drinking water in Bangladesh. The arsenic crisis in Bangladesh is rightly described as the largest case of mass poisoning in the history of mankind. Forty-six million people are forced to choose between arsenic-laced groundwater or biologically contaminated surface water. Given that choice, either slow death by arsenic poisoning or immediate extreme sickness with surface water pathogens, they inevitably and consistently choose the arsenic laced groundwater. For the arsenic removal process, the goals are similar to UV Waterworks. In terms of cost, it must be affordable; it must be cheaper than what's being tried today in Bangladesh. It must be highly effective. It must have very large margins of safety. And it must be very easy to use. We have some good, exciting preliminary results in hand that suggest that we might be able to meet all these goals.

Ashok Gadgil is an environmental physicist.