

ENVIRONMENTAL SCIENCES

Solutions are a must

But they may take time to resolve the arsenic crisis

WITH the menace of arsenic contamination in groundwater continuing unabated in Bangladesh and India, reuse of surface waterbodies has been proposed as a way out. These waterbodies were abandoned in the past because of bacterial contamination owing to poor sanitation practices. Instead of cleaning them up, the officials had propagated the use of tubewells because of which the arsenic contamination is said to have spurred (see: 'More arsenic', p26).

As per a new study by epidemiologists from the Australian National University, the use of surface water-



Testing water for arsenic is a must

bodies will eventually result in less disease burden (arsenic toxicity due to exposure). But initially it will cause a considerable increase in diarrhoeal diseases due to the bacterial contamination of water.

To quantify the disease burden resulting from both arsenic exposure and use of surface waterbodies, the researchers used published information to estimate mortality rates and disability-adjusted life years (DALYS). The DALYS reflect how much a person's expectancy of healthy life is reduced by premature death as well as by disability caused by the disease.

The researchers found that arsenic-related disease currently results in 9,136 deaths per year and 174,174 DALYS annually in those exposed to arsenic concentrations above 50 parts per billion (ppb) — five times higher than the permissible limit of 10 ppb.

The researchers found that intervention measures were over-all beneficial in reducing disease burden in most scenarios examined, but they simultaneously increased water-related infectious diseases. This significantly reduced their potential benefits.

According to them, a minimum reduction in arsenic-related DALYS of 77 per cent was necessary before intervention achieved any reduction in net disease burden. This is assuming two facts: interventions were provided to those exposed to 50 ppb, and they would result in a 20 per cent increase in water-related infectious diseases in those without access to adequate sanitation.

As per the researchers, the intervention policy must be based on exposure levels — it appears to be justified for populations exposed to high levels of arsenic. Moreover, interventions should not only aim at reducing arsenic menace but even minimising the risk of water-related infections. ■

TECHNOLOGY

Clean power

Scientists produce electricity from compressed gas

SCIENTISTS at the Bangalore-based Indian Institute of Science (IISc) have found that a jet of gas can generate current if passed over materials like semiconductors. Physicists Ajay Sood and Shankar Ghosh made the discovery by using just a bottle of compressed gas and equipment made at very low cost. The findings, appearing in the *Physical Review Letters* (Vol 93, No 8, August 20, 2004), have drawn considerable peer attention.

The scientists passed the compressed gases (oxygen, nitrogen and argon) at velocities ranging from a few kilometres per hour to 350 kilometres per hour over various materials — semiconductors like silicon and germanium, carbon nanotubes, graphite and metals like copper.

Each time they got a measurable current, which falls in the microampere range. The scientists found that the voltage increases with the speed of the gas flow. As per the scientists, though even the maximum current generated was miniscule, it is still a breakthrough as there is no need to burn any fuel to generate it.

The current is generated without using any polluting fuels

The duo along with N Kumar of the Raman Research Institute, Bangalore, had in 2003 demonstrated that the flow of liquids over carbon nanotubes generates a voltage in the tubes. "Having done that we asked ourselves if a similar effect will be produced by passing gases instead of liquids. We found that an equally striking effect exists for gas as well but for entirely different reason," Sood told *Down To Earth*. According to him, the reasons are linked with an interesting interplay of two well-known physical principles — first, the pressure differences in the gas flow and second, the flow leading to temperature differences across the base material (Bernoulli's principle), which in turn produces the measured voltage (Seebeck effect).

Sood and Ghosh report that the effect they observed is not restricted to the few materials they studied. Any material with high Seebeck coefficient, such as selenium, tellurium, gallium arsenide and electrically conducting polymers can also produce similar or better results.

One immediate application of the technique is in sensors used for measuring gas flow in equipments of various industries. Currently a gadget called anemometer is used. It works by measuring the changes in heat transfer in the system, and hence a slight change in temperature, pressure and composition of the gas can give erroneous reading.

According to the scientists, the magnitude of current generated can be easily scaled up by connecting millions of these 'nanogenerators' in the same way numerous photovoltaic cells are connected to generate power from the sunlight. ■