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LEAD STORY

WATER AND HEALTH

Arsenic invasion

RUHANI KAUR / CSE

Arsenic poisoning through drinking water has for a long time been associated with West Bengal. However, researchers today are of the opinion that the phenomena could be more widespread. Latest reports from Ballia in Uttar Pradesh indicate that millions more might be at risk of arsenic poisoning

Sixty-one year old Dinanath Singh of Ekawana Rajpur village in Ballia district, Uttar Pradesh, suffers from skin cancer. His left foot has a lacerating wound from which blood and pus continuously ooze. His body is covered with black and white spots (lesions). Two fingers of his left hand had to be amputated after they had developed ulcers. His blood report showed 34.40 parts per billion (ppb) of arsenic, as against the reference limit of mere one to four ppb. "Presence of such high levels of arsenic in blood is an indication of chronic exposure," remarked Neena Khanna, a professor in the dermatology department of All India Institute of Medical Sciences, New Delhi, where Dinanath sought medical advice.

Almost every house in the village has the same nightmare to relate. All the 100-odd villagers suffer from skin lesions (known as melanosis — the first stage of arsenicosis (arsenic poisoning)). In some, skin of the palms and feet has turned rough, dry and thick (keratosis) and few others suffer from breathlessness. And that's not all. Arsenic seems to have pervaded far and wide, with several villages in the neighbourhood also reeling under similar alarming health consequences.

Dinanath was well aware of the cause of his disease. Senior dermatologist at Banaras Hindu University hospital — an apex postgraduate medical research institute in eastern Uttar Pradesh, where he went for treatment before coming to Delhi — had suspected that the water he drank might be contaminated with arsenic. Thus, he believed that either the hand pump water or the well water in his village was laced with arsenic. According to the villagers, the hand pumps were installed in the early 1970s, after which they started suffering from skin diseases. But nobody connected the two for a long time. It was only after *Down To Earth* (*DTE*) did an exclusive story on the arsenic-affected regions of the Ballia district that the severity of the problem came to light (see *More arsenic*, *DTE,* Vol 13, No 8).

Safe drinking water: a myth?

In India, up until now, the problem has been recognised only in West Bengal and one district of Bihar. But arsenic is no longer restricted to just these areas. Steady reports on the menace of this contaminant are trickling in from several hitherto unaffected areas of the states of Assam, Uttar Pradesh, Chattisgarh and Jharkhand and some of the neighbouring countries too (see Table: *Crisis chronology*).

INSIDE

Crisis chronology

Chronology of arsenic detection in groundwater

1976	Punjab
1983	West Bengal
1991	Bangladesh
1999	Pakistan
2001	Nepal
2002	Bihar
2003	Uttar Pradesh and Jharkhand
2004	Assam

Source: Dipankar Chakraborti undated, *http://www.soesju.org/arsenic/arsenicContents.htm?f=facilities.htm,* School of Environmental Studies, Jadavpur University, Kolkata, accessed on November 19, 2004.

The permissible limit of arsenic in drinking water — as given in the World Health Organization (WHO) guideline and followed by Bureau of Indian Standard — is 0.01 milligramme per litre (10 ppb).[1,2] Water samples tested in the arsenic-affected villages of Ballia district and surrounding regions had arsenic levels ranging from 47 to 129 ppb — about five to 13 times the permissible limit! Even the hair samples of the residents were found to contain arsenic in very high concentrations — 2,480-6,310 ppb, as against 80-250 ppb in normal healthy hair.

Unarguably, West Bengal is the most affected state in the country. It is estimated that approximately 8.7 million people residing in nine districts of the state are exposed to arsenic at levels above the permissible limit.[3] About 4.9 per cent of the water samples tested by United Nations Children's Fund (UNICEF), in 2003-2004, in these districts recorded arsenic concentration above 10 ppb. Assam has turned out to be another blip in the arsenic radar. Arsenic concentration in about 42 per cent of the water samples tested in 56 villages of the state exceeded 10 ppb, as revealed by Jadavpur University, West Bengal, in 2004. Moreover, about 19.1 and 2.1 per cent of the samples recorded concentrations exceeding 50 and 300 ppb, respectively. In yet another study conducted by Jadavpur University in 2004, 83 per cent of the samples tested in 17 villages of Shahibganj district of Jharkhand reported arsenic levels above 10 ppb. Approximately, 21.8 per cent of the screened villagers manifested skin lesions. It is being feared that about 150,000 square kilometres (km) of West Bengal and Bangladesh are arsenic contaminated and a population of 66 million people residing in this area is continually exposed to the risk of arsenic poisoning. Dipankar Chakraborti, professor of environmental sciences at Jadavpur University, estimates that by 2010, about 450 million people living in the Ganga-Meghna-Brahmaputra basin — encompassing the states of Uttar Pradesh, Bihar, West Bengal, Jharkhand, Assam and Bangladesh — will be at risk of contracting arsenic-related diseases.[4,5]

About 8.7 million people residing in nine districts of West Bengal are exposed to arsenic levels above the permissible limit

Where does arsenic come from?

Arsenic occurs naturally in the Earth's crust. Scientists are of the view that arsenic originates in the Himalayan headwaters of the Ganga and Brahmaputra rivers. For the past many centuries, these rivers have been depositing arsenic-laden sediments across the Gangetic plains and the Padma-Meghna-Brahmaputra basin. It is the human intervention in the form of groundwater abuse that has accelerated the leaching of arsenic into our drinking water sources. Two theories have been put forth explaining

How arsenic enters groundwater?

Theories explaining how arsenic leaches into the groundwater

Oxidation theory

Researchers believe that the oxidation (gaining oxygen) of iron releases arsenic into the sediments. It is present in pyrites — iron-containing rocks — that are deposited in the aquifer sediments. When the iron is exposed to oxygen, its capacity to adsorb arsenic reduces and the toxic chemicals start leaching into the aquifers. Dipankar Chakraborti, professor of environmental sciences at Jadavpur University, concurs that it is the heavy groundwater withdrawal that facilitates the entry of oxygen into the aquifer, leading to the oxidation of arsenic-rich iron sulphide that ultimately leads to the leaching of arsenic into water. In fact, between 1970 and 1990, groundwater irrigation in West Bengal increased by a staggering 575 per cent. Similar patterns were observed in Bihar, Uttar Pradesh and Punjab, and neighbouring Bangladesh, pointing to the indiscriminate use of groundwater in these regions. Quite predictably, these are the regions that record a high prevalence of arsenic-related diseases.

Reduction theory

According to the reduction (loss of oxygen) theory, arsenic is adsorbed by iron oxides that are a part of fine-grained sediments. These sediments are rapidly 'reducing' because the organic-rich matter (microbes in the sediments) constantly consumes oxygen. This reduction of the sediments triggers a series of geochemical reactions that lead to the release of arsenic into the groundwater. A 2004 paper in the British journal *Nature* reports that anaerobic metal-reducing bacteria can also play a key role in the mobilisation of arsenic in the sediments. "The iron oxides scavenge arsenic from soil solution and river water, building up a store of adsorbed (trapped) arsenic", reports the British Geological Survey that has conducted various studies on the arsenic problem of Bangladesh.

Further, to explain arsenic contamination in deep aquifers, organic carbon reduction theory has been propounded — dissolved carbon in the waters of some regions reacts with iron hydroxides rich in arsenic, thus discharging arsenic into the groundwater.

Source: P Ravenscroft *et al* 2001, *Arsenic exposure and health effects*, Elsevier Science Ltd. Oxford, pp 53-78.

this phenomenon — oxidation and reduction theories (see Box*: How arsenic enters groundwater?*).

What happens when exposed to arsenic?

Arsenicosis symptoms usually take six months to years — from the time of exposure — to develop, depending on the exposure level (the concentration of arsenic in water and food and its consumption by the population) and the nutritional status of the community and individuals (see Box: *Early symptoms*).

Prolonged exposure to arsenic may result in malignancy of skin, liver, kidney, lungs and bladder. According to WHO, cancer risk (lifetime risk of dying from cancer) from exposure to more than 0.05 milligramme arsenic per litre per day is 13/1,000.[6]

Arsenic in food

Arsenic has not only infiltrated our drinking water sources, but also started impregnating our food chain with a vengeance. In 2003, Andrew Meharg, a bio-geochemist at the University of Aberdeen in Scotland, and his team conducted a study in Bangladesh to examine the arsenic assault on food chain. Soils in the regions conspicuous with large number of irrigation pumps supplying arsenic-tainted water contained high levels of arsenic.[7] A study conducted by Bangladesh University of Engineering and Technology, Dhaka, has highlighted the fact that arsenic concentration in the soil, particularly in the top layer, increases in direct proportion to the increase of arsenic in irrigation water. School of Environmental Studies (SOES) in Kolkata has come up with a calculation that every year, 6.4 tonnes of arsenic is deposited on the agricultural fields of Deganga Block of North 24-Parganas in West Bengal owing to the irrigation from the existing 3,200 irrigation tube-wells. Food crops grown on this arsenic-laden soil imbibe arsenic in dangerous proportion. Rice samples tested in the contaminated regions have been reported to contain arsenic at unsafe levels. The recommended daily safe levels of dietary intake of arsenic (milligramme) for adults range between 0.171 and 0.189 and for children between 0.092 and 0.101. It is not only the raw food items that are spiked with high concentration of arsenic. Studies show that cooking doesn't rid arsenic from our food, as cooked food has also been reported to be high on arsenic (see Table: *Arsenic diet*). Various studies conducted in West Bengal reveal the presence of arsenic in perilously high levels in potato skin, vegetable leaves, arum leaf, papaya, rice, wheat, cumin, turmeric powder, cereals, bakery food and spices.

According to Chakraborti, underground vegetables (roots, tubers and bulbs) contain relatively higher concentration of arsenic. Adverse health implications due to arsenic have been reported in animals as well. Presence of arsenic in rice straw — widely used as fodder — can adversely affect cattle and, subsequently, human beings via the plant-animal-human pathway. Elevated concentration of arsenic has been detected in the hair and urine of cows and buffaloes in the arsenic-

Early symptoms

According to the World Health Organization, intake of one milligramme of inorganic arsenic per day may give rise to skin lesions within a few years.[1] The early symptoms of arsenicosis — arsenic poisoning — are manifested in the form of dark patches (melanosis) along with white patches (leukomelanosis) on the skin (extremities), corn like lesions on palms and soles (keratosis), increasing weakness and numbness of limbs (neurological manifestation) and breathing problems (respiratory manifestation).

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Source: ATM. Farid *et al* 2003, A study of arsenic contaminated irrigation water and its carried over effect[s] on vegetable[s], Fate of Arsenic in the Environment, Proceedings of the BUET-UNU International Symposium, February 5-6, Dhaka, Bangladesh, *mimeo*.

Arsenic diet

Arsenic levels (in milligramme per kilogramme (mg/kg)) in food items

Tuber	150
Tomato	20.1
Cabbage	7.2
Bean	5.1
Leafy vegetables	4.5
Cauliflower	2.7
Papaya	1.1
Vegetable curry	0.81
Rice	0.35
Spinach	0.33
Fish curry	0.27

Note: Maximum permissible limit — 0.2 mg/kg.

Source: Andrew Meharg 2004, *Arsenic in rice – understanding a new disaster for South East Asia*, in *Trends in Plant Science,* Vol 20, No 20, pp 1-3.

affected villages. Local ice creams and cold drinks have also been found to be laced with arsenic.

Nutrition has a say

Nutrition plays a decisive role in the prevention or the onset of arsenic-related ailments. Low dietary intake of protein and micronutrients (calcium, selenium, vitamins) increases vulnerability to arsenic-related diseases. The reason could be that nutrition deficiency might result in slow elimination of arsenic from the body. Studies confirm that people with poor nutrition develop skin manifestations after drinking water containing arsenic at concentration 0.3 milligramme per litre. On the other hand, a healthy diet offsets any such adverse impact. People with good nutrition were found to be in good health even after drinking water containing arsenic at concentration 0.4 milligramme per litre.

Strategies to combat arsenic

We must recognise that managing arsenic is more about effective water management strategies and less about technologies to remove the toxin. The problem of arsenic poisoning abounds because people residing in regions blessed with abundant surface water increasingly depend on groundwater, especially for drinking purposes. This dependency can be checked only by making available other safe drinking water options.

In neighbouring Bangladesh, for instance, mitigation efforts include cleaning traditional ponds used to rear fish. As most of the arsenic-affected regions receive abundant rainfall, rainwater harvesting could be a feasible proposition in these areas. Collecting rainwater directly from the rooftops, or channelling the rain into shallow bodies or even dug wells for household use is another viable alternative. But it is essential to combine all these strategies with good sanitation practices.

Arsenic has not only infiltrated our drinking water sources, but also started impregnating our food chain with a vengeance

RUHANI KAUR / CSE

Management and surveillance

Arsenicosis can be successfully managed by surveillance and careful case management. The primary objectives of the surveillance are to identify the disease in individuals within a community, to monitor the trend of the disease and to follow up patients for clinical management. Surveillance is essentially the responsibility of health department, public health engineering department and state water and sanitation department.

Medicos can also play an important role in arsenicosis surveillance by diagnosing the case clinically and looking for similar kind of symptoms in patient's family or locality. Generally, the practitioners are ill-equipped to diagnose and treat this disease, as it doesn't feature as a priority disease in the medical curriculum. In order to rationalise the detection, management and reporting of cases, WHO recommends two major diagnostic criteria: presence of pigmentation and keratotic skin lesions, and evidence of exposure to arsenic by assessing arsenic concentration in hair and nail (see Box: *Five-point programme*).

The water and other biological samples (nail and hair of clinically diagnosed patients) should be sent to the right authorities — like SOES, Jadavpur University, Kolkata — for further examination. If the history on arsenic concentration is unclear, an elevated concentration of arsenic in hair (>0.8 milligramme per kilogramme (kg)) or nail clippings (>1.3 milligrammes per kg) may serve as a presumptive evidence of chronic exposure. Any unhealed ulcer (suspected malignancy) in soles, palms or any other part of the body ought to be diagnosed keeping the possibility of chronic arsenicosis open.

There is no specific treatment for arsenicosis. Nevertheless, there are some conflicting opinions on using chelating agents (Dimercaprol, D-penicillamine) to eliminate arsenic from the body. But the results are not very encouraging (as these medications can lead to some adverse side effects) and thus need further evaluation. Moreover, these drugs are exclusive and expensive. In West Bengal, the most prevalent practice for treating keratotic lesions is the application of 5-10 per cent salicylic acid and 10-20 per cent urea-based ointment.

How effective are field kits?

To overcome the problem of long-distance transporting of water from far-off arsenic-affected areas to high-tech laboratories, portable, reliable, sensitive and user-friendly field kits were introduced. These offer instant results on

Five-point programme

World Health Organization recommendations to manage arsenicosis

1. Stop drinking arsenic-contaminated water
2. Administration of specific drugs or nutrients (eating more of locally available fresh vegetable and fruits) to hasten recovery or arrest further progression
3. Symptomatic management
4. Prevention of latent effects (for example, malignancy) through medical surveillance
5. Counselling and educating the affected persons and family members

Source: WHO 2004. *A field guide for detection, management and surveillance of arsenicosis*, WHO, New Delhi, pp 13-25.

Fielding kits

Information on various field kits available to test arsenic in water

Agency	Cost	Range (ppb)	Availability	Places they have been used
Hach	Rs 7,678. Kit comes with reagents and accessories to perform 100 tests	0-500 ppb	National Metallurgical Laboratory, UNICEF, Bengal Engineering College, Punjab University	Chennai, Kolkata, Delhi
NCL	Kit — Rs 4,800, testing — 100 tests	5-10 ppb	Not widely marketed	In parts of Jharkhand and Patna, Bihar, primarily by UNICEF.
Development Alternatives	Kit — Rs 2,500, testing — 50 samples for Rs 600 or Rs 12 per sample	10-400 ppb	NGOs and school groups	Widely used by NGOs in parts of Jharkhand, Orissa and Rajnandgaon in Chattisgarh
NEERI	Kit — Rs 3,000, testing — Rs 3 per sample	10-1,000 ppb	Developed on behalf of WHO and ready to be marketed	Currently not in operation

Notes: UNICEF: United Nations Children's Fund; WHO: World Health Organization, NGO: Non-governmental Organisation, NCL: National Chemical Laboratory, NEERI: National Environmental Engineering Research Institute; ppb: parts per billion

Sources: 1. Hach undated, Hach EZ arsenic test kit, HACH Company, Colorado, USA, p 3.
2. O G B Nambiar 2004, Scientist, Chemincorp, Pune, October 14, *personal communication.*
3. Manoj Kumar 2004, Scientist, Tara Environment Monitoring Facility, Development Alternatives, New Delhi, October 7, *personal communication*.
4. S P Pande 2004, Head, R&D Planning and Business Development Division, NEERI, October 11, *personal communication*.

the site itself and thus can be used in remote areas where laboratory facilities are not available.[8] UNICEF was the first agency to use these kits for testing arsenic in the well water in mid-1997. This encouraged a number of field kit manufacturers to jump into the fray (see Table*: Fielding kits*). Majority of the kits are based on colorimetric reactions in which inorganic arsenic is reduced to arsine gas. The Industrial Toxicology Research Centre, Lucknow, is also in the process of bringing out a field kit**.**[9] It would be based on voltametric technology — the effect of electrical conductivity on charged particles in water.

But many drawbacks are attached to these kits, which overshadow their merits. Arsenic concentration is measured in ppb, which requires a high degree of accuracy and reliability in the instrument. No kit has been able to achieve that level of efficiency till now.[10] They give false positive results (arsenic detected even in its absence) and false negative results (presence of arsenic not detected), of which the latter has more serious implications. The kits are largely based on various chemical reactions, the results of which are tallied with colour compare charts, which can lead to confounding results.[11] In addition, direct sunlight alters the colour of the strips used for colour comparison.[12] The kits generate harmful arsine gas (a mixture of arsenic and hydrogen) along with hydrogen gas. Both are toxic and destroy red blood cells and cause kidney damage.[13] With a wide range of kits available in the market, an evaluation procedure for them becomes imperative but does not exist. "We have no plans of undertaking an evaluation of the kits," says U C Srivastav, head, chemicals department, Bureau of Indian Standards, New Delhi.[14] Therefore, there is no strict protocol underlying as to which particular method is best or which particular kit ought to be recommended.

Treating water

Various processes to remove arsenic from water

Process	Advantages	Disadvantages
Co-precipitation Aluminium and ferric salts are added to precipitate arsenic in raw water. These precipitates are removed after they settle down.	• Can be used at household and community level • Chemicals easily available • Low capital cost	• Problem of toxic sludge disposal • Requires trained operators • Medium removal of trivalent arsenic
Adsorption Chemicals such as activated alumina, iron-coated sand, ion-exchange resins are used to adsorb arsenic.	• Commercially available • High arsenic removal efficiency • Sludge disposal is a problem	• Needs regular replenishment of chemicals • pH needs to be monitored regularly • Poor after-sale service in villages
Membrane technologies Raw water is passed through a membrane that filters out arsenic. Some common technologies are reverse osmosis and electrodialysis.	• High arsenic removal efficiency • Low space requirement	• High initial investment • High operation and maintenance cost • Requires pre-treatment of water

Source: CPCB 2002, *Arsenic contamination in groundwater and its control*, CPCB, Delhi, p 19.

LEAD STORY

Low-cost options for treating water

With the availability of a number of low-cost methods, the arsenic level in water can be reduced considerably so as to make it fit for consumption. Once an area is identified as arsenic affected, one of these methods can be deployed for removing arsenic from water (see Table: *Treating water*).

Prevention is better than cure

With no specific medical treatment currently available to cure arsenic related diseases, arsenic mitigation strategy is more about prevention than cure. Identifying arsenic-affected areas and using low-cost options for treating arsenic-laden water, coupled with judicious use of groundwater for both drinking and irrigating purposes, can go a long way in checking the spread of arsenic.

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BREAK THROUGH

Clear vision

Trachoma causes blindness

Latest research reveals that it is possible to control the spread of trachoma — a disease that results in blindness — by adopting sustainable sanitation measures. Trachoma — a conjunctival infection — is caused by *Chlamydia trachomatis* and is responsible for 15 per cent of all blindness worldwide. Trachoma epidemics are associated with vastly increasing number of eye-seeking flies (*Muska sorbens*) that breed in faeces. Paul Emerson, researcher at the School of Biological and Biomedical Sciences, Durham, the UK, and his team targeted these flies for their study. The underlying idea was to prove that trachoma could be controlled by a sanitation drive. They carried out the study in 1999-2001 in high trachoma-endemic areas of Gambia, Africa. They conducted cluster-randomised control trials in three groups, each comprising seven clusters. Two of the groups were divided on the basis of two different intervention strategies — using insecticide (permethrin) spray and pit latrines (non-ventilated) — and one group was treated as control (no intervention). After six months, the clusters were compared on the basis of trachoma screening, and the number of eye-seeking flies from the eyes of the volunteer children younger than five years was calculated. Insecticide spray reduced the fly population by 88 per cent and led to a 56 per cent reduction in the incidence of trachoma. On the other hand, pit latrine reduced both fly population and trachoma incidence by mere 30 per cent.

The fact that the result was in favour of insecticide spray has a wider positive implication in the context of developing countries. But the sanitation drive has other collateral benefits that are not evident with insecticide spray. Pit latrine is economically viable, can be constructed in remote villages with locally available tools and is culturally acceptable. It needs very little water. Further, this latrine can control all kinds of waterborne diseases. The study mentioned active community participation in the sanitation drive, which gave a sense of ownership to the beneficiaries. Permethrin, on the other hand, can cause neurological damage, breast cancer, hormonal changes and childhood cancers in addition to ecological damage (for instance, it adversely affects fish, honey bee and waterborne arthropods). Moreover, regular insecticide operation is expensive and needs trained manpower and proper planning, which is difficult to implement in developing countries. There are reports of permethrin resistance in eye-seeking flies and also in *Aedes aegypti* (vector for dengue fever), which may cause further devastation to the community.

About six million people in Asia and Africa currently suffer from irreversible blindness due to trachoma. In India alone, an estimated 865,000 people have turned blind due to trachoma

According to recent estimates, about six million people in Asia and Africa currently suffer from irreversible blindness due to trachoma. In India alone, an estimated 865,000 people have turned blind due to trachoma. It is mostly prevalent in the poor (particularly children) living in unhygienic condition. The current strategy of trachoma control comprises mass antibiotic eye ointment treatment, surgical correction of eyelid deformity caused by infection, insecticide spray to control fly and personal hygiene. But since these measures are expensive, donor dependent, manpower oriented and also hazardous, only a sustainable sanitation programme can save the eyesight of hundreds of people every year in India and other developing countries.

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PRODUCT WATCH

Pesti cola: everything is official about it now

In a landmark judgement of October 8, 2004, the High Court of Rajasthan directed the two soft drink majors in India, PepsiCo and Coca-Cola, to specify ingredients of their products along with the pesticide levels on their labels. The court said that consumers have a fundamental right to know the entire content of the carbonated beverages. It had taken cognisance of a public interest litigation filed by a Jaipur-based social worker, Santosh Mittal, in which he had asked the manufacturers to make a "complete and full disclosure of composition" and content of their products so that consumers could make an informed choice in selection, purchase and consumption. The Cola companies argued in the court that the Prevention of Food Adulteration Rules do not envisage total exclusion of pesticides from beverages and soft drinks and that the disclosure would create panic in the market, affecting their business. But the court stood firm, declaring, "Commercial interests are subservient to the fundamental rights. The manufacturers cannot be allowed to keep the contents of the carbonated beverages and soft drinks under a veil of secrecy."

This judgement got a further fillip when the Supreme Court (SC), on December 6, 2004, supported the ruling of the Rajasthan Court. It further stated that the soft drink majors have to display on their bottle a warning that the soft drink might contain pesticide residues. The Cola giants are now mulling over the language of the warning that would state that the contents of the water used confirm to packaged water standards.

This fracas had ensued following the detection of harmful levels of pesticides by New Delhi-based Centre for Science and Environment, in August 2003, in soft drinks manufactured by the Cola companies in India.

BRIEFS

Hello...anyone listening?

Be careful the next time you say hello in your mobile phone. You might be exposing yourself to the risk of cancer or brain cell damage or Alzheimer's disease. Studies world over, especially in the US (where hardly any cell phone company is based), have revealed that radiation from mobile phones and their towers might result in a number of serious ailments. Henry Lai, an expert in non-ionising radiation at the University of Washington, USA, has disclosed that even low-level microwave radiation splits the deoxyribonucleic acid (DNA) molecules in the brain cells, which may lead to Alzheimer's disease and cancer. Conventionally, radiations are considered damaging to cells only if they are strong enough to disintegrate them.

Cell phone manufacturers maintain that radiations of their products are too weak to produce these effects (see Box: *Tower of menace*). A sneak preview of a US study, conducted in 1999, on 469 people with brain cancer and 422 controls, showed that cell phones can double the risk of a type of brain tumour. Surprisingly, when the study was eventually published (*The Journal of the American Medical Association*, Vol 294), it denied any such link! The companies can publicly pooh pooh the concerns, but some of their discreet activities do betray their worry. For example, a 1998 Nokia patent for a shield layer states: "…a continuous localised exposure to radio frequency irradiation has been suggested to weaken myelin sheets of cells and to eventually lead to an impairment of hearing capability … irradiation may stimulate extra growth among supportive cells in the nerve system, which in the worst case, it has

Tower of menace

Mumbai civil court orders dismantling of a radiation-emitting cell phone tower

In an unprecedented move, a Mumbai civil court in India recently ordered a cellular phone service provider to dismantle one of its networking antennae operating in a residential apartment. It was being feared that the tower was causing risk because of its radiations. In September 2001, Bharti Cellular Limited, one of the industry's top service providers, approached the governing body of a 20-storeyed residential building located in Cuffe Parade, South Mumbai with the proposal to install two-feet high single stick antennae on the roof of the building. But in March 2002, it converted the building into a hub station for the entire South Mumbai, without even informing the residents.

Trouble arose when the informed people residing on the building's top floors realised that they were being continuously exposed to the radio frequency waves. On October 18, 2003, an 11th floor resident filed a case in the Bombay city civil court against Bharti and the society's chairperson and secretary. He contended that the radio frequency waves from the tower were affecting his as well as his family members' health.

Following the court order, Deepak Jolly, director, corporate communications, Bharti, asserted: "Telecom is an essential service and we follow the best safety standards. The demand for removing the tower from the building is being made on a very flimsy ground (his allusion is to the health aspect)." But the court stuck its ground and went ahead with its ruling. It is laudable that the court gave primacy to the health issue in its judgement. It categorically stated that the likelihood of health implications, based on scientific evidence, was reason enough for the matter to be taken up. This significant judgement comes at a time when there are no regulations in India to deal with such issues. Laws under the Consumer Protection Act do cover the quality of such products, but do not offer protection against their health hazards.

been suggested, could (lead) to development of malignant tumours…"

On the question whether radio frequency waves are really harmful to health, the World Health Organization says it is difficult to draw a definite conclusion at this stage. All established health impacts of radiation exposure are related only to heating and are called the 'thermal' effect. The International Commission on Non-Ionising Radiation, Munich, Germany, has laid down guidelines pertaining to the safety of radio frequency waves, which set limits based on thermal radiation. Gerald Hyland, researcher at Warwick University, the UK, says that such guidelines afford no safety and protection against the non-thermal radiation. He further states, "This non-ionising electromagnetic pollution of technological origin is particularly insidious, in that it escapes detection by the senses… Yet the nature of the pollution is such that there is literally nowhere to hide."

Cell phone manufacturers can reduce exposure by tweaking the handset design. But this means bigger handsets that might not find favour with consumers. Till more conclusive evidence on the adverse health impacts of cells comes up, the best way out would be to let the consumers make an informed choice. The mobile phone packs ought to carry a warning: Using mobile might be injurious to health or Use at your own risk!

A shot in the arm

On September 28, 2004, California became the second state, after Iowa, in the US to ban the use of mercury — a known neurotoxin — in vaccines. The law stating that children below the age of three and expectant mothers would not be given vaccines containing mercury will come into effect from July 2, 2006. Earlier in May 2004, the state of Iowa had approved a similar bill.

Generally, all vaccines contain a compound thimerosal that is added to increase their shelf life and check the growth of virus and bacteria. This compound is about 40 per cent mercury by weight and has been used as a vaccine preservative since the 1930s. Vaccines containing this chemical have been implicated in the onset of autism — a brain disorder that begins during childhood and affects developmental skills related to communication and creativity. Between 1987 and 1998, there has been a 273 per cent increase in the incidence of autism in California alone. In a study conducted by Columbia University, USA, in June 2004, mice injected with the chemical showed autism-like behaviour.

In 1999, in the wake of concerns on the possible toxicity to children, the US Center for Disease Control and Prevention had recommended that vaccine makers stop using thimerosal. But this suggestion was largely ignored, as vaccines without mercury are twice as expensive as those without it. In developing countries, the vaccines containing mercury still continue to cripple children. In India, for instance, there has been no effort to ban mercury in vaccines. "The situation here is worse than in the US, as the level of thimerosal in the multi-dose vials being sold by multinational companies in India is 10 times more than what is allowed in the West," says a Delhi-based paediatrician. This is alarming, considering that India is a mercury hot spot and adverse fallouts of the careless dumping of this toxin are quite common.

When lifesavers take life

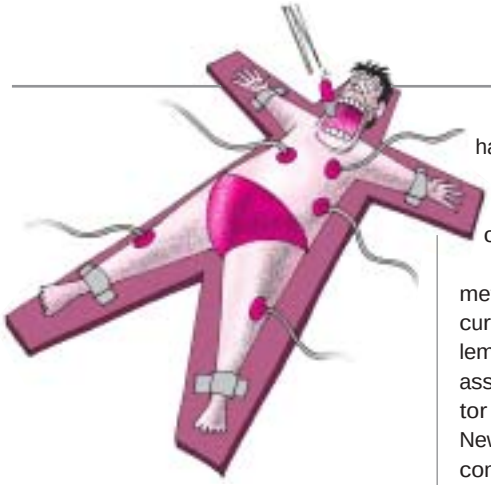
In 2004, Health Care Without Harm — an international coalition of 437 organisations — conducted a research on 48 medical products used in European hospitals. About 39 were found to contain di (2-ethylhexyl) phthalate (DEHP) — a toxin found in the products made up of polyvinyl chloride (PVC). It is commonly used as an additive to soften PVC used to manufacture medical products like blood bags, urine bags and tubes. Since DEHP is not chemically bound to PVC, it leaches from the PVC products, depending on various factors, including storage and usage temperatures. Experiments conducted on animals indicate that

BOOK REVIEW

AIDS IN ASIA

THE CHALLENGE AHEAD
Edited by Jai P Narain, SAGE Publication 2004,
New Delhi, pp 395, Rs 295/-

Since 1981, when acquired immunodeficiency syndrome (AIDS) was first reported in the US, the disease has spread widely, affecting almost all the countries world over. India ranks second, after South Africa, in terms of total number of human immunodeficiency virus (HIV)/AIDS cases in the world. This book highlights the menace of the problem in Asia, describing the epidemiological aspects and the response mounted over the past two decades. Various experts have contributed to the book and editor Jai P Narain, regional advisor of World Health Organization, southeast Asian region, has deftly handled each chapter. Apart from the epidemiological issues, the book discusses the vulnerability factors of the disease, its prevention, case surveillance, detection, investigation and management, secondary infection prevention and treatment, social and cultural issues, economic dimensions and current issues in vaccine development. The book has been written in a lucid style and makes for engaging reading. The diagrams and tables are self-explanatory. The issues discussed will be of practical use to National AIDS Control Programmes, health care workers, academicians and NGOs working in the area of HIV/AIDS prevention and care.



exposure to DEHP leads to abnormal sexual development as well as skeletal, cardiovascular, eye and neural tube defects. Besides, the toxic effects of DEHP include damage to the heart, liver, kidneys, lungs and testes of laboratory animals. The US National Toxicology Program and the International Agency for Research on Cancer have classified DEHP as a possible human carcinogen. Its hazards were recognised as early as 1986 when the Consumer Product Safety Commission asked the toy industry to remove it from children's teethers owing to its toxicity and ability to leach through saliva into children's bodies.

While the EU has banned the use of DEHP in cosmetics, personal care products and certain toys, its use in medical products is still rampant. Viable alternatives to vinyl medical products are now available. PVC-free blood platelet containers have hit the market and active research is going on to develop a blood bag substitute.

Trap them!

The Municipal Corporation of Delhi (MCD) has come up with an oviposition trap to deal with the mosquito menace in the city. The trap is a wide-mouthed, pint-sized jar that is partially filled with water. It is usually placed in an area where mosquitoes are likely to spawn. It contains chemicals called pheromones, the 'smell' of which attracts the female mosquitoes to lay eggs inside it. These eggs are then destroyed. By analysing the weekly breeding data of mosquitoes, it is also possible to identify the most vulnerable areas in the city, which, in turn, can lead to effective surveillance. This system of surveillance is currently being followed in the slums.

This trap has been quite successful in checking the mosquito nuisance in Singapore — a hot spot of malaria. It has helped reduce the annual breeding intensity of *Aedes aegypti* — the dengue vector — below two per cent since 1979.

Back home, officials hope this method will help save many lives. "The current measures to check the problems of mosquitoes are not foolproof," asserts M A Ansari, senior deputy director of the Malaria Research Centre, New Delhi. "The traps can help overcome the drawbacks of the present system. Moreover, they are cheap and eco-friendly," claims K N Tewari, municipal health officer at MCD. Effectiveness of these traps remains to be seen. Interestingly, after the introduction of these traps, the total number of malaria cases reported in the city till September 2004 was significantly higher than the corresponding figures for the last two years. This is because the positive impacts of this method would be evident this year onwards.

Banning is the only way out

A review of worldwide research on human reproductive disorders related to organochlorines (OCs) points to an urgent need to ban these harmful chemicals. OCs are compounds that can alter hormonal functions, thereby adversely affecting reproductive organs and the health of newborns. Some of the widely used OCs are dichlorodiphenyl-trichloroethane (DDT), polychlorobiphenyls (PCBs) and dioxins.

The review was undertaken by Gunnar Toft, researcher, Department of Occupational Hazard, and colleagues of Aarhus University Hospital, Denmark, in November 2004. They analysed 408 studies from countries that have banned OCs as well as those that are still using these chemicals. The researchers studied the following effects: male and female infertility, cancer, spontaneous abortions, prenatal mortality, low birth weight, pre-termed delivery, congenital malformations, skewed sex ratio and early puberty. A strong correlation was found between exposure to OCs — especially DDT and PCBs — and all the above-mentioned adverse outcomes.

In another study, researchers from the University Hospital, Sweden, studied the effects of the following OCs: PCBs, hexachlorobenzene, chlordanes and dichlorodiphenyldichloroethyelene (DDE). They found that despite Sweden banning OCs in the 1970s, many babies born in 2003 were suffering from testicular cancers, as their mothers had very high concentration of the chemicals in their body fat. Of the 61 children studied, 44 had testicular cancer, and the OC exposure levels of their mothers ranged between 0.2 and 3,339 nanogramme chemicals per gramme of body fat.

In developing countries that use OCs indiscriminately for various purposes, such as manufacturing paints and pesticides, the exposure is mainly via contaminated foodstuff — vegetables, fruits and milk. A study by researchers from the US-based Harvard School of Public Health shows that the chances of spontaneous abortions in China rose with increasing concentrations of DDE and DDT in the mothers' lipid.

The review indicates that a worldwide ban on all OCs is the only way out. "If developing countries continue using OCs, the impacts would be more pronounced and fatal in the future. A worldwide ban means a less toxic legacy," concludes Toft.

In developing countries that use OCs indiscriminately for manufacturing paints and pesticides, the exposure is via contaminated foodstuff — vegetables, fruits and milk

Health for All

To check the unethical and exploitative medical practices flourishing in India, a movement called the Jan Swasthya Abhiyan (JSA) was launched. Its activities include policy-level interventions for right to health care, primary health care, women's health issues, child health and malnutrition, privatisation of health services, indigenous medicine and folk healing traditions and mental health issues. JSA is the Indian circle of the People's Health Movement (PHM) — a worldwide movement to establish health and equitable development as top priorities. The first People's Health Assembly was organised in Savar, Bangladesh, in December 2000. This initiated the coming together of people's movements and other non-governmental organisations all over the world to reiterate the pledge of "Health for All", taken for the first time long back in 1978. JSA has adopted the 'Right to Health and Health Care' as its key campaign theme. Instances where primary health centres and public hospitals are regularly denying basic health services to people are documented by JSA. Presently, JSA is a coalition of various voluntary organisations and people's movements involved in health care delivery and health policy. This network has numerous constituent organisations. Twenty-one major national networks constitute the National Coordination Committee of JSA, which is the national decision-making body of the coalition.

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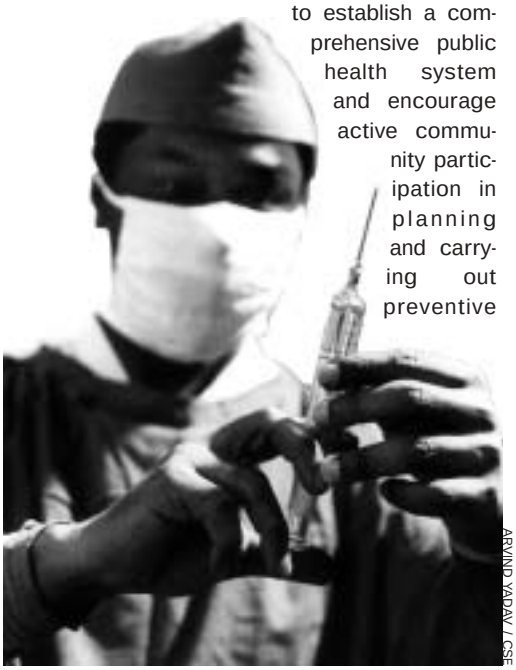
Friendly yours

Pune-based Medico Friend Circle (MFC) is basically a non-governmental organisation comprising health activists who believe in equality and equity of health. It was started in 1974 with an objective to establish a comprehensive public health system and encourage active community participation in planning and carrying out preventive measures. It is actively working towards evolving an objective and rational approach to a health care system that can cater to the needs of a vast majority of the Indian populace. It communicates its experiences and information through its bulletins and other publications.



UN ARVIND YADAV / CSE

During the Bhopal disaster of 1985, the organisation provided technical support to the health activities of voluntary agencies and action groups working with the gas victims. It brought to the fore all the issues related to maternal and child health and took up the cause of the women affected in this catastrophe.

The organisation works on a lot of contemporary public health issues, critically analyses the government's health policy on diseases like human immunodeficiency virus, acquired immunodeficiency syndrome, tuberculosis, and communicates its views in its bulletin and at its annual meeting. It networks with the local and national organisations in advocacy and policy lobbying of the health-related issues.

In February 1985, MFC worked to curb the unethical fertility control practices that were being followed in the family planning programme in India. It became a co-respondent to the government's petition to effect a ban on quinacrine — an anti-malarial drug that was used for sterilising women, but adversely affected them in the process.

MFC is also an active founder member of the All India Drug Action Network (AIDAN). It formed a Rational Drug Policy Cell in 1980 to contribute to the campaign for a rational drug policy through AIDAN. It offers a forum for sharing of experiences, with the aim of realising the goal outlined above and taking up issues of common concern for action.

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Readers write in

The Health and Environment newsletter is being re-launched with a vision to provide an interactive platform for the environmental and medical fraternity to network on the sensitive issues pertaining to environmental health. We request our readers to send in their views, counterviews and suggestions along with their detailed profile and area of expertise to make our network stronger and more efficient.

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GET ENRICHED AND CHANGE THE FUTURE

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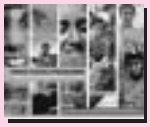
A comprehensive Life Cycle Analysis (LCA) approach for assessing the environmental performance of pulp and paper industry. The report presents an in-depth account of the pulp and paper sector's performance in various phases of life cycle ranging from raw material sourcing to pollution generation and control.
(Pages 344) *PB: Rs 5000 / US $ 125*



Green Schools Programme manual
This manual is designed as a self-learning and assessment tool so that teachers can work with students to audit their use of natural resources and to experiment with environment friendly practices. (Pages 78) *PB: Rs 125 / US $ 10*

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www.cseindia.org/html/healthnews.htm
Other stories related to environment and health are available at our website: **http://www.cseindia.org**
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