

HEALTH & ENVIRONMENT

NEWSLETTER FROM THE CENTRE FOR SCIENCE AND ENVIRONMENT



www.cseindia.org/html/eyou/healthnews/index_healthnews.htm

EDITORIAL ▶

In my last column, I talked about attempts by the firecracker industry to dilute or destroy noise regulations on crackers. The more one thinks about this, one realises that this is not unusual. In fact, it could be argued that this is only to be expected. The manufacturers of firecrackers have an interest in pollution and noise. They are in the business of making a product, which if unregulated for emissions or toxicity, will be more profitable for them. In other words, they are in the business of making money through a dirty and polluted environment.

Nothing new in this. Or very dramatic. But it is important, when you consider, the number of such interest groups that operate, indeed flourish in our country. And, more importantly, when you consider how weak opposition to them is. These groups have a direct interest in ensuring that public health related regulations are weakened – from tobacco industry to the car industry. What we need is equally strong – countervailing – pressures from the protectors of public health concerns. It is this asymmetry that leads to the problems we see before us.

Take the issue of pesticides. We have had a close encounter with this equally noxious but definitely more powerful industry grouping. It is roughly two years to this date, a medical doctor living in Padre village in Kerala wrote to us about the unusually high incidences of deformity cases and increasing

▶▶ page 2

LEAD STORY ▶



REUTERS

DECLINING SPERM COUNT

Urge overkill

The average man will be infertile within a century

Endocrine disruptors cause an effect using more than one mechanism to disrupt normal sperm development and reproduction

Increasing evidence shows plastics, fumes, pesticides and metals in food and water cause impaired semen quality

I N S I D E	
LEAD STORY	1
Urge overkill	
PATH BREAKING RESEARCH ...	6
RECENT STUDIES	7
BRIEFS	8
BOOK REVIEW	9
CAMPAIGNS	10
LETTERS	11

The process of human conception is almost absurdly inefficient and depends completely on chance. During copulation, a man expels tens of millions of sperm, with considerable force, into his partner's vaginal canal. Despite the head start, most of the tiny, tadpole-shaped, self-driven cells never come close to a woman's egg. They float deep inside a convoluted fallopian tube and hope that a chance encounter with

the egg — a one in billion chance — would occur. And if one sperm does finally complete the journey, it may or may not have the energy left for fertilisation. With these desperate odds, a man clearly needs every last sperm he's got to ensure conception. Any fewer than 20 million or so per millilitre (ml) of semen — 40 million to 120 million in a typical ejaculation — and his chances of siring a child begin to plummet. This

numbers of cancer deaths in his village. My colleagues collected samples and our laboratory for environmental monitoring tested and found exceptionally high residues of organochlorine pesticide – endosulfan – in human blood, water and food.

The pesticide lobby then launched a virulent disinformation campaign with twin aims; to discredit the CSE study and to prove that endosulfan is safe and harmless. Since the mid 1970s, the Plantation Corporation of Kerala (PCK) had sprayed endosulfan from the air in its cashew plantations, located in densely populated Kerala highlands. But industry's view was that the "endosulfan issue has been exaggerated". A counter scientific study – done by the Fredrick Institute of Plant Protection and Toxicology, commissioned by government, was released by the pesticide association. Not surprisingly the extracts of the report said, "results of residues of blood samples from the subject showed no residues". The government was happy to listen and the use of endosulfan continued. Then because of the intervention of the National Human Rights Commission, an eminent medical professional took on the work to study impacts. A team lead by H N Saiyed of the National Institute of Occupational Health, collected samples from the villages and found that after one year of spraying in the area, human blood and water contained residues of endosulfan. They found high congenital abnormalities, neurological problems and abnormalities in the reproductive systems – much in excess of the control populations studied. They concluded that the causative agent could be endosulfan.

But even with this powerful knowledge on its side, action has been delayed. Why? Because the state government now argues that under the law, only the Central Insecticides Board can ban the pesticide. After months of pussy footing around, the Board has set up a committee to consider the evidence. The committee is stacked against the environment with industry members leading the numbers. It is no surprise that its report is still nowhere to be seen. It will work overtime, I am sure to convolute and bury the incriminating evidence. After all, public health is not on their agenda.

— Sunita Narain, Director
sunita@cseindia.org

is why clinicians the world-over are so concerned about a trend they are noticing over the past few years. Study after study reveals that sperm counts in men the world over seems to be dropping precipitously. "Somehow, this chance encounter never goes amiss in populous countries. We are prolific breeders. But something is going wrong", says M L Shah, fertility expert based in Baroda, Gujarat, whose private practice has grown five folds in providing childless couples with a child, in the last ten years. "Most of the problem lies with men — specially over stressed executives. Chemical exposures at work could also have a significant role in infertility. Unfortunately we have no data". The January 1997 edition of the *British Medical Journal* reported that researchers in Edinburgh, Scotland, found that men born after 1970 had a sperm count 25 per cent lower than those born before 1959—an average decline of 2.1 per cent a year.¹ A 1995 study of Parisians also found a 2.1 per cent annual decline over the past 20 years.² And in the most comprehensive analysis of all, covering nearly 15,000 men from 21 countries, Danish scientists discovered an alarming plunge of nearly 50 per cent in average sperm counts over the past half-century. In 1976 in the town of Seveso in Italy an industrial accident released dioxin into the local population. Since then the fertility rates in the population had fallen, birth defects had increased manifold, and more girls were being born in the population than in other parts of Italy. None of these studies are without their critics, and a handful of others show either no decline or some localised increase. Not only do sperm counts seem to be dropping, but the quality of sperm — the percentage of healthy, vigorous cells versus malformed, sluggish ones — appears to be in serious decline as well. Doctors have also noted an increase in the incidence of testicular cancer and undescended testicles. Together, these factors add up to a significant drop in male fertility. "In the 1960s," says Mohan Khartare of In-vitro Fertility Research Foundation, Nagpur, "only about 5–10 per cent of the men who came for consultation had a fertility problem. Today that number is up to 50 per cent. This is a cause of

grave concern. But an even graver concern is that there is no one finding out the cause of it."

Just what these causes might be is still largely a mystery. Stress, smoking and drug use are all known to be involved. So is the fact that men are having children later in life, when sperm counts naturally fall off, as well as the increase in sexually transmitted diseases. Even the shift in underwear fashion from boxers to briefs has been offered as an explanation (see box: *Infertility risk factors*).

Another hypothesis states that a wide range of reproduction-related ills may be caused by chemical pollutants in the environment, including dichlorodiphenyltrichloroethane (DDT), polychlorinatedbiphenyls (PCBs), and a number of other synthetic substances. The idea is that exposure to even traces of these chemicals in the womb can interfere with proper development of the reproductive system, leading to

Infertility risk factors

■ Cigarette smoke

Sperm counts of smokers' are on an average 13-17 per cent lower than non-smokers

■ Pesticides

Exposure to pesticides results in reduced sperm count and an increase in abnormally shaped sperms

■ Air pollution

Men living in industrial and polluted towns have 6 times more abnormal sperm than men living in clean areas

■ Chemicals

Sperm count drops in men exposed to chemicals like DDT, PCB's, dioxins and some petroleum by-products

■ Food additives

Food additive like monosodium glutamate (MSG) cause infertility in animals

■ Anaesthesia

Animals exposed to the anaesthesia — enflurane show 50 per cent higher sperm damage rate than those not exposed to enflurane

■ Occupational exposure

Men who work in aircraft industry, textile dyes, plastic industries, welding or handle paint, chemical solvents or even antibiotics are more at risk of having abnormal sperms.

serious consequences years or decades later. Male infertility is just one part of the problem, these pollutants may also be responsible for a rise in breast and other cancers in humans, along with aberrant mating behaviour and genital malformations in animals (minuscule penises among pesticide-contaminated Florida alligators, for example). Chemical manufacturers dismiss these speculations, arguing that nobody has come close to showing a cause-and-effect relationship. In fact, the evidence for a chemical-infertility link does remain largely circumstantial.

What scientists do know is that water, air and soil all over the world are tainted with small amounts of many of these chemicals. They know that once the pollutants get inside the body, they can bind with receptors that normally recognise oestrogen and other natural hormones. They know that these hormones are crucial to the development of a normal reproductive system. And they know that at least in laboratory tests on animals — vanishingly small amounts of industrial chemicals, delivered at just the crucial stage of foetal development, can “feminise” a male embryo, producing smaller testicles, low sperm output and a miniaturised or missing penis. But until 1992 scientists didn't know of any convincing evidence that men were experiencing reproductive problems on a large scale. Then came the groundbreaking report by a Danish endocrinologist, Niels Skakkebaek of the National University Hospital in Copenhagen. Skakkebaek and his colleagues did what is called a meta-analysis: they combined the results of 61 separate studies of sperm count and quality over the past 50 years in men around the world, and found that the average sperm count had fallen from about 113 million per ml in 1938 to 66 million in 1990.³ After Skakkebaek's paper appeared it immediately became apparent that environment is sending a very strong signal that something was seriously wrong. But not everyone accepts the link between environmental oestrogens and reproductive ills. Some researchers have questioned study methods and find them to be speculative. Other researchers have shown that sperm counts in Finland and France have remained the same. What scientists on both sides of the debate can do, is step

up the pace of research. If sperm counts are dropping, even in only part of the world, it would be prudent to figure out why. And if they turn out to be declining everywhere, better to know sooner than later. Extrapolating from Skakkebaek's admittedly controversial data, it's conceivable that the average man will be infertile within a century. Even if things are only half as grim, it would be bad news indeed for the human race.

No comebacks

Chemicals mimic human hormones (called endocrine disruptor) or disrupt their functioning. Endocrine disruptors can cause an effect using more than one mechanism for example, DDT acts by bypassing receptors to stimulate a complex mixture of cell signalling proteins leading to cell growth and division. DDT also acts as an antagonist at androgen receptors. These influence growth and development of many organs and regulate reproductive processes. Oestrogen is predominantly a female sex hormone but does play a secondary role in the male. When the ratio of oestrogen to testosterone in the male is too high, feminisation occurs. The reverse too occurs though rarely. Oestradiol is the most abundant and potent of the oestrogen hormones in women of reproductive age. Often these hormones interplay changing the probability of safe conception, or a healthy baby. Chemicals that cause this damage can also persist to impair the growth of the foetus or poison the womb, permanently (see box: *Sperm speak*).

Specific organs and glands in the endocrine system are known to be damaged by chemical toxicants. Several chemicals and drugs can be toxic to the cells of the pancreas that produce insulin. Exposure to the rodenticide Vacor (N-3-pyridylmethyl-N'-p-nitrophenyl urea) can interfere with the secretion and function of pancreatic hormones, resulting in diabetes mellitus and hyperglycemia. Polyhydroxyphenols and the therapeutic drug lithium can disrupt thyroid gland function and cause hypothyroidism and goitre. Endocrine and reproductive dysfunction has been reported in men exposed to inorganic lead. Chronic exposure to lead can cause direct testicular toxicity,

followed by hypothalamic or pituitary gland disturbances. Studies have linked exposure of a developing embryo with:

- abnormal blood hormone levels
- reduced fertility
- altered sexual behaviour
- modified immune system
- masculinisation of males and feminisation of males
- cryptorchidism (undescended testicles)
- cancers of the male and female reproductive tracts
- malformed fallopian tubes, uterus and cervix
- altered bone density and structure

The adverse effects of environmental oestrogen interaction with the endocrine system are often illustrated by the consequences of the prescription of the synthetic oestrogen diethylstilbestrol (DES). This was given to pregnant women (between 1945 to 1970) to prevent miscarriage. Daughters of mothers taking DES during pregnancy were associated with congenital malformations of the genitalia and cervical cancer. In the sons of these mothers, DES was recognised to have led to a substantial increase in the incidence of cryptorchidism (undescended testicles) and hypospadias (deformation of the urethra of the penis). DES exposure was also linked with an increase in testicular cancer and a decrease in semen quality.

In the past 30-50 years there has been an increasing incidence of reproductive disorders: hormone related cancers (testicular cancer), abnormalities in reproduction development (cryptorchidism, small penis size and hypospadias) and impairment of semen quality (low ejaculate volume, low sperm count, increased numbers of abnormal sperm and decreased numbers of motile sperm). These disorders all arise during foetal development and may have a common aetiology. The striking similarities of these observations to the DES experience endorse the hypothesis that the increase in these disorders might reflect environmental exposure to endocrine disrupting chemicals.

(I am) half the man I used to be

Workers in chemical factories, petrol pumps, plastic units, dyeing industries, mining and smelting are greatest risk

Sperm speak

Endocrine toxicity is defined as adverse effects on the structure and /or functioning of the endocrine system that result from exposure to chemical substances. The endocrine system is composed of many organs and glands that secrete hormones directly into the bloodstream, including the pituitary, hypothalamus, thyroid, adrenals, pancreas, thymus, ovaries, and testes. Once synthesised, hormones are conveyed to a target tissue, where they function as chemical messengers that transmit information between cells. Hormone levels and interactions control normal physiological processes, maintaining the body's homeostasis.

Because the endocrine system is complex, a toxicant may interfere at any of a number of points along a hormone's pathway of production, regulation, and action. Some chemicals may injure the glands that synthesise and secrete hormones, while others disrupt hormonal actions at the target organ. Compounds that are toxic to the endocrine system may cause diseases such as hypothyroidism, diabetes mellitus, hypoglycemia, reproductive disorders, and cancer. A wide variety of toxic substances can disrupt the function of the endocrine system. For example, chemicals that resemble the hormone oestrogen can bind to oestrogen receptors

located throughout the body and either mimic the natural hormone or inhibit its actions. Exposure to endocrine-disrupting chemicals such as PCBs and DDT have caused a host of toxic effects in wildlife, including impaired reproduction and development. Other endocrine toxicants, such as persistent organochlorine pesticides (POPs) and dioxins, are being studied for their possible role in promoting hormone — induced cancers (such as breast cancer) and in lowering sperm counts and male fertility.

Chemical cocktail

Chemical group	Per cent
*Organic Compounds	78
<i>of which insecticides and pesticides</i>	31
*Cleaning agents	12
<i>of which volatile compounds</i>	54
*Metals and metallic compounds	7
<i>of which inorganic metallic compounds</i>	12
*Others	3

Source: Based on data from US- Environmental Protection Agency, (EPA), World Wide Fund for Nature (WWF) and Environment Defense Fund (EDF), available at <http://www.scorecard.org/ranking>, as viewed on November 10, 2002.

of mutating their sperms from risks at work. Infections and other behaviour and individual risks also cause temporary or permanent harm. But increasingly new chemicals once considered safe are proving to be affecting human hormones. Recently some papers have shown that increased air pollution, specially particulate and volatile organic compounds can reduce successful fusion of the egg and the sperm — an arduous event made even more improbable, considering air pollution is the bane of most cities.⁴

In some cases, some recovery of sperm activity and function is possible, if the exposure source is removed.⁵ This is possible in some cases of users of anabolic steroids (like testosterone and dihydroepiandrosterone sulfate), systemic fever illness (spinal abscess, chicken pox), neurological drugs and sedatives (like carbamazepine and GABA-B). This also means that discrete exposure to drugs and other environmental gonadotoxins can have real and profound effects on sperm production. This study recommended that emphasis must be made during physical examination and needs to have a good medical history in the evaluation of male infertility. Possibly the biggest

perpetrator are a class of compounds called dioxins. They are commonly produced during the process of plastic production and more importantly in unsafe food packaging and burning of plastic wastes.⁶ Dioxins inhibit enzymatic action and reduces transcription in sperm, which predisposes some men to greater risk of abnormalities of the sperm as a result of exposure to hydrocarbons and dioxins. Artificial food additives and packaging contaminants can also be extremely toxic to the sperm. A study compared the oestrogenic potency of the synthetic oestrogen Zeranol, (used as a growth promoter in meat production) and five related compounds, 17 β -oestradiol, diethylstilboestrol (DES), genistein, and Bisphenol-A (a plastic additive). Zeranol, 17 β -oestradiol and DES were about equally potent, genistein was four to six orders of magnitude less potent than 17 β -oestradiol but an order of magnitude more potent than Bisphenol-A. Most of these chemicals act as genetic modulators. The very high potency of Zeranol compared with other potential endocrine disruptors suggests that Zeranol intake from beef products could have greater impact on consumers than the

amounts of the known or suspected endocrine disruptors that have been found in food.⁷ Metals like lead and cadmium also affect genetic transcription and translation — a step important in the reproduction of genetic information within rapidly produced sperms in the gonads. Lead for example degenerates transcription processes in immature sperms in human testis that leads to infertility.⁸ Aluminium concentrations in the spermatozoa and seminal plasma can lead to permanent or irreversible sterility. In a study of 27 employees of two industrial companies, a refinery and a polyolefin factory found that high concentration of aluminium in spermatozoa was correlated with decreased sperm motility.⁹

Effect of pesticides and other biocides on sperm and chromosomes has not been extensively researched. Almost all studies indicate that occupational exposure to pesticides induces genetic changes in human sperm. One Finnish study found that some pesticides individually change the genetic constitutions irreversibly.^{10,11} Almost half of 700 Danish army recruits have been found to have sperm counts low enough to make it hard for them to father children. French

military personnel found that heat and nuclear exposure have been responsible in decrease in sperm counts. Pesticides can also adversely affect male reproductive function.¹² Damage caused by environmental toxins during critical periods of growth have been found to be irreversible.

Precocious puberty

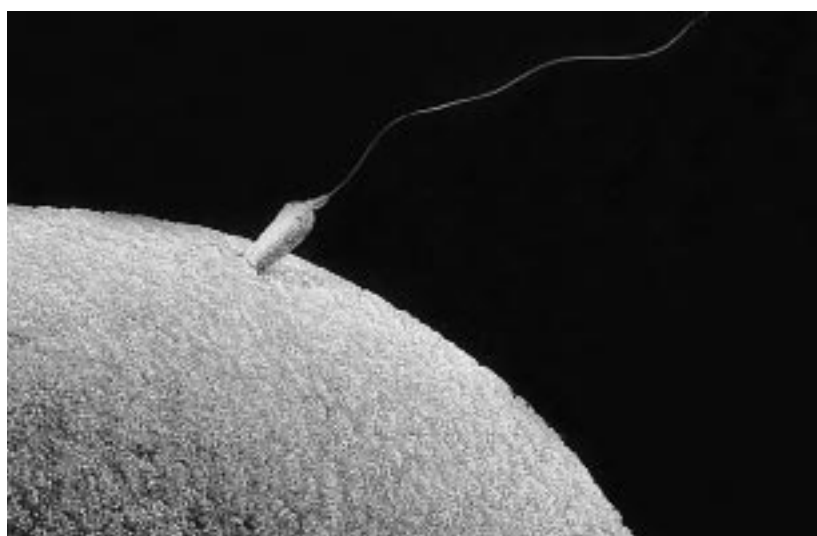
So what is the probability of reversing toxic-induced male sterility? Considering the diversity of chemicals and the different ways in which they work it is difficult to make an assessment. Many forms of sterility and fertility problems are irreversible. It depends on the time and duration of exposure, intensity (dosage) of exposure and extent of damage. Men alone are not affected. Girls too have been experiencing changes in reaching puberty.

A retrospective study of 145 girl patients in Belgium during a 9-year period for treatment of precocious puberty, 28 per cent appeared to be foreign children (39 girls, one boy) who immigrated 4 to 5 years earlier from 22 developing countries, without any link to a particular ethnic or country background. These children were either adopted or newly settled in Belgium. This led to the hypothesis that the mechanism of precocious puberty might involve previous exposure to oestrogenic endocrine disruptors-DDT. Dichlorodiphenylethylene (DDE), a derivative of DDT was 1.20 and 1.04 nanogramme/ml in foreign adopted and non-adopted girls with precocious puberty, while the Belgian native girls did not show any detectable concentrations. A possible relationship between transient exposure to endocrine disruptors and sexual precocity is suggested.¹³ An unpublished research paper by H N Saiyed, director of National Institute of Occupational Health (NIOH), Ahmedabad, shows that schoolgirls whose school is situated close to a lead smelter in Kolkata matured sexually quicker than other girls in the city.¹⁴ Lead is mostly accumulated in the bones but also targets soft organs causing particular damage to the brain and nervous system, kidneys, liver, reproductive system and the cardiovascular system.

Key issues

In Japan, in the last few years there has been a public frenzy after exaggerated reporting by the media on the effects of endocrine disruptors. In response the government initiated a large research programme accompanied by a large research budget, building new laboratories and providing funds for national research. Concern amongst the US public and pressure from environmental groups has prompted the government to undertake a similarly significant research stance. The research budget for endocrine

Aniruddha Malpani of the Malpani Infertility Clinic, Mumbai says, "We really don't have population based data on semen analyses, sperm counts and motility in India, so it's not possible to provide statistics. These are based on experience with semen analyses at large laboratories which perform lots of semen analyses daily, but these patients are not representative of the population at large." He attributes the decline in sperm count to effect of stress, effect of smoking and effect of phytoestrogens and dioxins, a group of strong endocrine disruptors. Malpani



SCIENCE PHOTO LIBRARY

disruptors in 1999 was in excess of \$26 million in the US.¹⁵

The primary focus of research in Europe is on occupational risk factors as opposed to the US and Japanese focus on environmental risk factors. Hard data shows that in the last 25 years the incidence of testicular cancer has increased three fold as well as major increases in hypospadias, cryptorchidism and male infertility. This has caused a significant reaction amongst the European community to investigate and to work together on the endocrine disruptor problem; the main aim being to justify policy reviews and hence improve health standards. Few studies in developing countries have been done. Most of the studies are observations and anecdotal evidences focussing on sperm quality or sperm quantity.^{16,17} In India, no authoritative studies have been done comparing trends in sperm count or quality.

also laments that, "There is very little hard evidence in this field in India, and population-based studies are very difficult and expensive to carry out. Since infertility has never been a priority for the government, no one has really looked at this field. With no regulations existing for the setting up of infertility clinics, there is really no way of even determining whether the doctors who head these clinics are qualified or not. Getting the true picture will hence be a difficult task."

Manju Jilla, gynaecologist at the Jilla Hospital, Aurangabad opines, "Around 30 per cent of the cases that come to my hospital have the problem of male infertility. History of the patients states that patients who have those problems are either working in the industrial areas, pesticide industries, or doing drilling work."

The seriousness of the endocrine disruptor issue necessitates further

research. There is a need to:

- develop rapid and reliable assay systems to identify the oestrogenic effects of chemicals currently used and chemicals that will be developed
- determine the related health effects of endocrine disruptor chemicals
- determine concentrations and periods of exposure that cause adverse effects
- develop universal analytical techniques for chemical identification and health related epidemiological studies so that fair comparisons can be made
- understand all the confounding factors of how these chemicals effect humans and other species - this may help identify who is most at risk
- understand the geographical factors involved
- determine how synergistic combinations of endocrine disruptors and other chemicals act

This research will help governments to decide what can be done and form policies to restrict the use of certain chemicals in industry, agriculture the home and other areas. Recent prominence and public awareness of the environment has prompted governments to initiate and accelerate research into these chemicals.

Tinkering randomly with the chemicals, that can disrupt human growth and survival of future progeny, is dangerous and unwise. Meantime, while various chemical companies and others are making a good living tinkering and arguing among themselves, 46,000 American, 32,000 European, 11,000 Indian, 16,000 Chinese, 72 Inuit, and many many more women the world over will die of breast cancer this year and another 400,000 will undergo surgery, radiation treatment or chemotherapy for the disease. The 250 plus confirmed hormone-mimicking chemicals are still being pumped and dumped into the environment in tonnes each year. We allow this to happen because we (as a society) assume chemicals are innocent until proven guilty. Isn't it time we turned that assumption on its head, requiring corporate polluters to demonstrate the absence of harm from their products before they are released? Why do we

tolerate these chemical trespasses into our most intimate property, our bodies? The present regulatory system where greater harm is caused before we can even begin to restrict the output of dangerous chemicals, seems — to put it bluntly — so unworthy of great nations as to be called uncivilised.

References

1. J Pajarinen *et al* 1997, Incidence of disorders of spermatogenesis in middle aged Finnish men 1981-91: two necropsy studies, in *The British Medical Journal*, The BMJ Publishing House, London, Vol 314, No 13.
2. J Auger *et al* 1995, Decline in semen quality among fertile men in Paris during the past 20 years, in *The New England Journal of Medicine*, Massachusetts Medical Society, Boston, Vol 332, No 5, pp 281-285.
3. A Giwercman *et al* 1993, The human testis organ at risk?, in *International Journal of Andrology*, American Society of Andrology, Schaumburg, Vol 15, pp 373-375.
4. K C Worriow *et al* 2001, A retrospective analysis: the examination of a potential relationship between particulate (P) and volatile organic compound (VOC) levels in a class 100 IVF laboratory clean-room (CR) and specific parameters of embryogenesis and rates of implantation (IR), in *Fertility & Sterility*, American Society for Reproductive Medicine, USA.
5. S Cayan *et al* 2001, Spermatogenic recovery after discrete periods of unusual gonadotoxin exposure, in *Fertility and Sterility*, American Society for Reproductive Medicine, USA, Vol 76, No 3, p 154.
6. O A Khorram *et al* 2001, Expression of aryl hydrocarbon receptor (AHR) and aryl hydrocarbon receptor nuclear translocator (ARNT) messenger ribonucleic acid in human spermatozoa, in *Fertility and Sterility*, American Society for Reproductive Medicine, USA, Vol 76, No 3, Supp 1, pp 259-260.
7. Henrik Leffers *et al* 2001, Oestrogenic potencies of zeranone, oestradiol, diethylstilboestrol, bisphenol-A and genistein: implications for exposure assessment of potential endocrine disrupters, in *Human Reproduction*, Oxford University Press, Oxford, Vol 16, No 5, pp 1037-1045.
8. S H Benoff *et al* 2001, Environmental Lead (Pb2) exposures modulate testicular RNA expression, in *Fertility and Sterility*, American Society for Reproductive Medicine, USA, Vol 76, No 3, Supp 1, September, p 260.
9. O Hovatta *et al*, Aluminium, lead and cadmium concentrations in seminal plasma and spermatozoa, and semen quality in Finnish men, in *Human Reproduction*, Oxford University Press, Oxford, Vol 13, pp 115-119.
10. K Härkönen *et al* 1999, Aneuploidy in sperm and exposure to fungicides and lifestyle factors, ASCLEPIOS, A European Concerted Action on Occupational Hazards to Male Reproductive Capability, in *Environmental Molecular Mutagen*, Vol 34, pp 39-46.
11. J Lähdele *et al* 1997, Incidence of aneuploid spermatozoa among infertile men studied by multicolor fluorescence in situ hybridization. *American Journal of Medical Genetics*, John Wiley and Sons, Utah, Vol 71, pp 115-121.
12. E Tielemans *et al* 1999, Pesticide exposure and decreased fertilisation rates in vitro, in *The Lancet*, The Lancet Publishing House, New York, Vol 354, August 7.
13. M Krstevska-Konstantinova 2001, Sexual precocity after immigration from developing countries to Belgium: evidence of previous exposure to organochlorine pesticides, in *Human Reproduction*, Oxford University Press, Oxford, Vol 16, No 5, May 16, pp 1020-1026.
14. H N Saiyed 2002, Effects of lead exposure on sexual maturity rate (SMR) in girls, presentation at MoEF-CII conference on Environmental Health, November 20-21, New Delhi.
15. USEPA, Annual Budget and Expenditure 2001, Vol 1, Research and Outreach programs, Washington DC.
16. E Chou 1999, Workplace and declining sperm count, in *Occupational Health and Industrial Medicine*, January, Vol 12, No 1, p 73.
17. H Fisch *et al* 1996, Worldwide variations in sperm count, in *Urology*, Vol 48, No 6, December, pp 909-911.

Poisoned by



Global evidence suggests that pesticides harm human health. Despite many of them being restricted for use or banned, and stringent regulations being set by many countries, recent studies show that even very minute levels of persistent organic pollutants (POPs) — chemicals that persist in the environment and build up in the food chain — of which pesticide comprise a significant proportion, harm human health. Levels, which were once assumed to be safe, are now being debated. This is because PCBs that affect human brain are nearly one millionth less than levels previously thought to be as safe. Because of their ability to be persistent in the environment for many years and to bioaccumulate in fatty tissues, they today pose serious health concerns. Debating on the existing ban and regulations that are in place today for POPs, G M Solomon and others from the California based advocacy group, Natural Resources Defense Council, call for eliminating worldwide, all chemicals that are persistent, lipophilic (fat-binding) and bioaccumulative.¹ At present, POPs residues like DDT and its metabolite, DDE are present in virtually all categories of foods. K Schafer and S Kegley from the Pesticide Action Network, California, USA found that it is common to find five or more pesticides residues in food and they criticise the lack of stringent analyses and regulation by regulating agencies like the US-Food and Drug Administration. They look at the political implications of the Stockholm Convention and the reasons for the persistence of these pesticides in markets.²

L G Hansen of the college of veterinary medicine, University of Illinois, Urbana, USA, puts forth the view that though the Stockholm Convention has had an accelerating effect on the global decline of POP manufacture and use, reservoirs from previous misuse are much larger

pesticides



than current manufacture and efforts now should be more directed at containing these reservoirs.³

In India some scattered research has shown the detrimental effects of pesticides on health. Pradeep Bhatnagar and his colleagues from the environmental toxicology unit of Sawai Man Singh (SMS) College, Jaipur have established links between pesticides and hypothyroidism. Women coming from the semi urban areas have been found to have higher pesticides

residues as they may be indirectly exposed to them through the ingestion of contaminated food and water, especially meat and poultry products. The concentration of pesticides in non-vegetarians was much higher than the vegetarians and women in the lower age group had higher levels of pesticides. Women are able to dispose of pesticides accumulation due to lactation and menstruation suggesting that women in the upper age group thus have more chances of losing these pesticides. Dieldrin, one of the most common pesticides was high in women with hypothyroidism.⁴ A second study by the same group shows the presence of high amounts of organochlorine pesticides in breast cancer patients irrespective of age, diet, and geographic distribution. Levels of pesticides like DDT and its metabolites, dieldrin, heptachlor and hexachlorocyclohexane (HCH) were compared with normal women who did not suffer from any major diseases like cancer, diabetes or hypertension.⁵

These studies clearly state the urgency needed to ban many pesticides and the need to have a coherent action plan for phasing out POPs. Or else, let's prepare for the whole world to be slowly poisoned.

References:

1. G M Solomon and A M Huddle 2002, Low levels of persistent organic pollutants raise concerns for future generations, in *Journal of Epidemiology and Community Health*, BMJ publishing house, London, Vol 56, pp 826-827.
2. K S Schafer and S E Kegley 2002, Persistent toxic chemicals in the US food supply, in *Journal of Epidemiology and Community Health*, BMJ publishing house, London, Vol 56, pp 813-817.
3. L G Hansen 2002, Persistent organic pollutants in food supplies, in *Journal of Epidemiology and Community Health*, BMJ publishing house, London, Vol 56, pp 820-821.
4. P Bhatnagar et al 2002, Burden of organochlorine pesticides in blood and its effect on thyroid hormones in women, in *The Science of Total Environment*, Elsevier, Vol 295, pp 207-215.
5. P Bhatnagar et al 2002, Breast cancer incidence and exposure to pesticides among women originating from Jaipur, in *Environmental International*, Elsevier, Vol 28, No 5, pp 331-336.

Recent studies on sperm decline

Regional differences

Differences between sperm counts of men living in several European countries were studied by Margus Punjab et al. Within the Baltic region, differences in semen quality and levels of reproductive hormones has been noticed. Estonian soldiers were found to have the lowest level of testosterone and oestradiol.

International Journal of Andrology 2002, Vol 25, pp 243-252

Gradient quality

Niels Jørgensen and his colleagues at the department of growth and reproduction, Copenhagen, Denmark, report that the high incidence of testicular cancer to be found in Denmark and Norway may have environmental risk factors attached. Differences in semen quality have been noticed in the 968 young men of Nordic-Baltic area with regard to certain parameters.

Human Reproduction 2002, Vol 17, No 8, pp 2199-2208

Reduced fecundity

The low sperm count noticed among younger Danish men has made the Danish Ministries of Health and Environment to launch a surveillance programme, in which they are considering to study the impact that social changes cause in the decline in fertility rates. More than 30 per cent of 19-year-old men have been found to have sperm counts in the subfertile range, which may also be contributing to the recent decline noticed in fertility rates among teenagers in Denmark.

Human Reproduction 2002, Vol 17, No 6, pp 1437-1440

Ozone affects sperm

Changes in the ambient air quality may account for the declining sperm quality noticed the world over. Evaluating more than 14,000 sperms, Rebecca Sokol, professor of medicine and obstetrics and gynaecology at the University of Southern California's

Keck School of Medicine found that ozone could adversely affect a man's sperm, reducing their numbers, as well as their crucial ability to move or "swim." As the levels of ozone in the ambient air increases, the sperm concentration goes down. Ozone, once inhaled gets rapidly metabolised, triggering an inflammatory reaction, which could adversely affect the sperm.

Reuters Health 2002, April 19

Rural links

Shanna Swan, epidemiologist at the university of Missouri, Columbia, USA has found that men living in rural Missouri had lower sperm counts than men living in New York, Minneapolis and Los Angeles. Many agricultural chemicals are used in Missouri, which are known to enter the drinking water sources. Certain chemicals can act as endocrine disruptors, changing the way hormones work in the body. They include pesticides such as DDT and industrial chemicals like PCBs. Such "gender bending" chemicals may be responsible for causing genital abnormalities in animals such as frogs and alligators.

Reuters Health 2002, November 13

Solvent exposures

Painters, printers, decorators and other men exposed to organic solvents in their jobs are twice as likely to suffer from low sperm counts and infertility, says Nicholas Cherry at the department of public health sciences, at the university of Alberta, USA. 1200 manual workers attending Canadian fertility clinics between 1972 and 1991 were studied. Men exposed to moderate levels of the compounds had twice the risk of having low numbers of sperm or slow-moving sperm. The risk was found to increase with higher exposures. Organic compounds have also been shown to cause damage to the nervous system and skin.

Journal of Occupational and Environmental Medicine 2002, Vol 44, No 11, November

AMIT SHANKER / CSE



Insure your teeth

Pepsodent, the toothpaste marketed by Hindustan Lever has launched a Dental Insurance (DI) Policy along with collaboration with New India Assurance. The focus behind the insurance scheme is to promote good oral hygiene as per the goals of the National Oral Health Policy.

According to the National Oral Health Policy 85 per cent of Indian children and nearly 90 per cent of adult Indian population suffer from common dental problems like caries and periodontitis.

But would regular usage of a particular brand bring about a decline in dental problems? Dental problems are more associated with poor dental hygiene and really have not much to do with using a particular brand. Or is it the sluggish market growth which has not seen much change over the last two years?

Under this scheme, Pepsodent will be offering its customers insurance cover against expenses of up to Rs 1,000 for the extraction of a permanent tooth/teeth on account of caries and periodontitis. Covering a period of one year, the insurance comes into effect six months after the Pepsodent Dental Insurance Certificate is issued to the customer. The dental insurance form is available with different variants of the toothpaste and the form has to be submitted along with the dental bills to the New Delhi office of Pepsodent.

Pepsodent has hired the services of a delhi based backend service provider (SP) who would be verifying the claims sent in by the customers. The SP would be further sending in the genuine forms to New India Assurance for reimbursement of the expenses, which would take place within 30 days. However whether the core idea remains gum protection and better oral hygiene or just a smart move to market Pepsodent's strategy will be watched closely.

Delhiites' health

A three-year project has been initiated by the Central Pollution Control Board and the Chittrajan National Cancer Institute, Kolkata to study the damage that pollution is doing to the health of Delhiites. Results from blood and sputum samples will be correlated with pollution levels data of that particular area. Health camps in various parts of the city are to be held wherein the samples will be collected. Pollution is known to affect the alveolar macrophage (AM) count in the blood. A similar study done in Kolkata has shown that people staying in polluted areas had almost seven times the mean AM value than that of rural people. The mean AM count in rural areas is 3.4 AM per high power field. The study besides looking into the occupational and residential exposures of the people and the travel route that they take is also paying attention to the socio-economic background of the respondents.

Still active

The United Nations Environment Programme (UNEP) has found three sites in Bosnia-Herzegovina that were targeted with weapons containing depleted uranium (DU) during the mid-1990s to be still radioactive enough to pose a risk to human health. A by-product



of nuclear power, depleted uranium has been used in heavy tank armour, anti-tank munitions, missiles and projectiles. According to the World Health Organization (WHO), DU has 60 per cent of the radioactivity of natural uranium and "significant chemical toxicity." More than 10,000 rounds of DU ammunition

were fired during the air strikes in 1994 and 1995. Around 200 environmental samples - including 47 surface soil samples, three full soil profiles, three penetrators, one full DU bullet, 24 air samples, 42 water samples, and samples of lichen, bark, moss, mushroom and vegetables were taken and analysed for radioactivity and toxicity at laboratories in Switzerland, Italy and the United Kingdom. Two of the sites - the Hadzici tank repair facility and the Han Pijesak barracks — have not been cleaned of radioactive materials and dust although people are working in these facilities. The UNEP recommends the decontamination of buildings in these three sites as the first precautionary step to avoid unnecessary health implications.

Fat, fatter, fatter

Studies conducted in affluent schools of Delhi point out to an increase trend in obesity in school going children. Sitaram Bhartia Institute of Science and Research studied 750 children in the age group of 10 years and found that 22 per cent were overweight. The prevalence of obesity has been found to be more common in boys; perhaps girls at that growing age are more obsessed with image building rather than food. Refractive error was also on the increase with 35 per cent of the children having a subnormal visual acuity of 6/9 or less. A high incidence of dental caries was also found with nearly 40 per cent of the school children having dental problems like caries and gum infections related to poor oral hygiene. The study points out to the increased consumption of sugary and junk foods as one of the major contributory factors to the rise in obesity. Umesh Kapil, additional professor, department of gastroenterology and human nutrition at the All India Institute of Medical Sciences (AIIMS), New Delhi, who conducted a similar study says, "Changing lifestyle patterns has made fast food a necessity of our lives. This has however to be balanced with exercise, which is sadly lacking in today's children." Growing sedentary lifestyle, coupled with overprotective parents, more disposable income, and nuclear families with both parents working — all contribute to the increase in obesity amongst growing children.



CSE

Operation clean up

Finally after nearly 18 years of the Bhopal tragedy, the toxic waste still lying at the Union Carbide site is to be cleaned up. The Defence Research and Development Organisation (DRDO) will undertake the clean up and already Rs 50 crore has been allotted towards the clean up operations. The toxic waste still around is causing severe contamination of the soil and water table. Vegetables grown in the area have been found to have high levels of pesticides due to the contaminated water. In this operation, Union Carbide's machinery would be decommissioned and the solar evaporation tank and land would be "secured." With plans to construct a reservoir, a pump house and lay pipelines, the state government is also increasing the supply of safe drinking water to Bhopal's 36 affected wards.

Malnourished in Gaza

Recent surveys done by CARE International UK assessing the nutritional status of young children in the West Bank and the Gaza strip reveal that almost 13 per cent of children under the age of five year suffer from short-term malnutrition, and almost 18 per cent have long-term malnutrition. Lack of iron in the daily diet resulted in about 20 per cent of children being anaemic. It is the Israeli policies of curfews and closures that have affected the food availability as a result of which many households have less food to eat. Children are the worst sufferers of this. CARE International and Johns Hopkins University Emergency Medical Assistance Project carried out surveys in different households, medical clinics and markets along with collaboration of the Al Quds University in Jerusalem and US Agency for International Development (USAID). The survey pointed out that more than half of the children ate food having fewer calories and half of them did not get enough vitamin A. Iron and zinc deficiency was found in almost 80 per cent of the children. To deal with the current problems of wasting, stunting, anaemia and micronutrient deficiencies, the Palestinian Ministry of Health has declared a nutritional emergency.

Polluted heart

Evidence upon evidence shows rising air pollution levels affect the heart. Recent study published in the Indian Heart Journal shows that around 54,000 to 2,00,000 deaths take place each year due to bad air. Says Anoop Misra, of the department of medicine at the All India Institute of Medical Sciences (AIIMS), New Delhi, "High levels

of pollution which are characteristic of any city today are associated with arteriosclerosis, which translates into the deposition of fat in blood vessels. This leads to heart disease, increased cardiovascular morbidity and mortality." This is concurred by Upendra Kaul, director of the interventional cardiology unit at AIIMS. Suspended particulate matter (SPM) is known to rise to upto 811 microgrammes per cubic meter post Diwali. Rising pollution levels can result in a youngsters suffering from heart attack at least 10 years earlier than his or her parents. Stressful lifestyle, lack of sleep and exercise combined with alcohol and substance abuse aggravates the situation. Today even 18 year olds are prone to contract heart disease because of the genetic make-up and smoking and prevalence of diabetes. A recent study of 26 European cities- A Health Impact Assessment of Air Pollution (APHEIS) finds that reducing particulate alone



AMIT SHANKER / CSE

could prevent 12,000 premature deaths in a year in cities across Europe. The report estimates that 2,653 premature deaths could be prevented annually if long-term exposure to PM₁₀ concentrations were reduced to 40 µg/m, the cut-off value set by the European Commission for 2005.

B O O K R E V I E W

SHITTING PRETTY- HOW TO STAY CLEAN AND HEALTHY WHILE TRAVELING

Jane Wilson-Howarth 2000-pp 150. Travellers' Tales, San Francisco, California.



A hilarious account of the experiences that travellers, especially women have when it comes to natural activities like eating, bathing and going to the bathroom. A perfect handbook for travellers, it is filled with practical knowledge on how to eat and drink safely in a foreign country. At the same time, it touches the heart with its witty and dry humour, interspread with amusing anecdotes from fellow travellers. The book is laced with common sense tips and techniques on how to avoid diarrhoea, parasites and other diseases like malaria, hepatitis and typhoid. On openly dealing with a topic that is normally shunned in discussions, Jane Wilson-Howarth provokes the traveller to be adventurous and unashamed when it comes to "loo" matters. Throughout its racy style, the book emphasises on the big role that culture plays when it comes to something as simple as wanting to use the bathroom.

Known faces



AMIT SHANKER / CSE

Women who help out with your medical ailments. Women who assist you with prescription details. These are the women behind "Vikas Mahila Sangam" (VMS), a non-governmental organisation (NGO) which works with the objective of helping the patients visiting Lal Bhadur Shastri Hospital, Khichdipur, East Delhi. The organisation was approached by the then chairman of the hospital to aid the doctors and the

staff with the administration and smooth functioning of the hospital. With the patients being illiterate and rude and the hospital being overcrowded and understaffed, understanding prescription details became a big issue for the patients. This is where the women of VMS stepped in. Retired, senior females from the neighbourhood of Mayur Vihar, they began by streamlining the prescription lines. These women were trained by the doctors on how to decipher medical prescriptions and how to guide the patients as to where to go to the concerned doctor in the hospital.

The women have been trained in identifying a critically ill patient and rushing him to the concerned doctor at the earliest. They have an excellent teamwork with the doctors and the staff. A separate ante-natal registration counter is handled by the organisation wherein counselling on breast-feeding, immunisation, and usage of oral rehydration salts is given to the pregnant females. Personal hygiene counselling is an

important part of the whole education process. Emphasis is given on prevention of water-borne diseases. The registration counter also serves as a counselling centre for couples wherein family planning counselling is an integral part of the process. The women of VMS are now the "known" faces of the hospital, and in the decade of their services to the hospital, they have never taken a day off.

Registered in 1997, the ngo has been the driving force behind the smooth relations between the patients and the doctors of the hospital. It is now a part of all the health camps held by the hospital.

What began initially in 1991 as an extended form of a kitty party has now taken shape into a full fledged non-governmental organisation. VMS also holds balwadi and health awareness camps in the slums of Khichdipur.

For further information, please contact:
Shakuntala Srivastava
403/Pocket E, Mayur Vihar Phase-II,
New Delhi 110 096
Ph: 011-2770274

Breathe easy

In 1998, a group of prominent chest physicians of New Delhi got together to launch the Better Breathers Club of India (BBCI). The group was concerned over the alarming rise in asthma cases in the city. It also noted that environmental triggers were known, identifiable and with proper education and awareness, most of these triggers would be avoided and asthma prevented. The presence of just one speciality hospital in the capital to deal with the disease also made the doctors aware of the need for such a campaign.

Set up in the lines of the National Heart, Lung and Blood Institute (NHLBI), Bethesda, Maryland, USA, the main objective of the BBCI is to educate the public and children at large about the environmental triggers linked to asthma and the preventive measures that can be taken up against this disease. The physicians of BBCI have been invited by GlaxoSmithKline

(GSK) India to set up an advisory board to launch the National Initiative against Asthma (NINA). NINA would be focusing on organising regular patient and professional education programmes.

The main objective of BBCI, is to create awareness about asthma. Ensuring proper diagnosis of asthma at the earliest and treatment of other respiratory diseases is also an important element of BBCI. BBCI has launched School Asthma Awareness National Seminar (SAANS) to monitor and determine the prevalence of asthma in the National Capital Territory of Delhi. Through its information dissemination programme, SAANS aims to make children more active, bring about a decrease in school absenteeism, improve night time asthma symptoms and restrict the side effects of asthma medications.

SAANS has been launched in 7 public schools and there are plans to involve government schools. This initiative has already seen the setting up of an "Asthma Cell" in one of the



AMIT SHANKER / CSE

leading schools of New Delhi. Besides the principals and school teachers, local school doctors play an important role in this project. SAANS also comes out with a newsletter devoted to awareness on respiratory diseases and environmental influences.

For further information on BBCI and SAANS contact:
P P Bose,
Chairman, BBCI, I-1611, C R Park,
New Delhi 110 019
Ph: 011-6271672/ 09810159687
e-mail: ppbose@vsnl.net

Readers write in

Thank you for the Health and Environment Newsletter, which made interesting reading. All of us are responsible in one way or the other for the state of our environment and through this newsletter I hope we can participate in solutions to halt the degradation. I wish to pay my respects to Shri Anil Agarwal whose efforts have awakened many. Though he is no more, we must all continue the work he has begun.

Jyoti Shankar
Chartered Accountant
Unit Trust of India, Indore
e-mail: shankarjyoti@hotmail.com

I found your articles on asthma to be excellent reviews, and believe that the H&E newsletter is well-targeted and will make an important contribution. I very much look forward to reading more about environmental health in the forthcoming issues.

davidvansickle@yahoo.com

I am very happy to know an exclusive newsletter on Health an Environment is being published on a bimonthly basis. The need for such a newsletter was felt for a long time. I am sure that issues highlighted in the newsletter will generate interest of both academic community and policy makers.

Dinesh Agarwal
UNFPA
55, Lodi Estate
New Delhi 110 003
e-mail: dinesh.agarwal@unfpa.org.in

The health and environment newsletter will act as a tool for pediatricians in identifying children afflicted with diseases that may have environmental influences.

G R Sethi
Pediatrician
Maulana Azad Medical College
New Delhi

Congratulations to CSE for bringing out highly informative and thought provok-

ing articles in the health and environment newsletter. Keep up the good work to enlighten the readers.

S J Ahluwalia
Opposite Daman Cinema
Nani Daman
Daman 396 210
Ph: 0260-263154

An initiative like the health and environment newsletter is very encouraging and gives an insight into the environmental health issues in India. This shows a remarkable effort on the part of a responsible organisation like CSE.

Mohammed Shahabuddin
National Institute of Health
Rockville Pike, Bethesda,
Maryland, USA
e-mail: mshahabudd@niaid.nih.in

Comprehensive and impressive at the first glance. I find the newsletter very informative and very well researched. Kudos to the organisation. Keep up the good work.

K Gunasekharan
Assistant Director
Vector Control Research Centre
Pondicherry
Ph: 0413-272396
e-mail: k_guna@yahoo.com

JOIN OUR NETWORK!

**Are you in the medical profession?
Do you have news to share with us?
A campaign to talk about?**

CSE's Health and Environment Newsletter invites comments, suggestions and views.

If you are interested in receiving the copy of the newsletter, do write to us. Join our network.

Health and Environment Unit
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi - 110 062. INDIA
Tel: 91-11-2608-1124/3394/6399
Fax: 91-11-2608 5879
e-mail: sarita@cseindia.org, health@cseindia.org

ABOUT OUR READERS

S V Shetty
Lilavati Hospital
A/103, Rahul Apartments
Andheri (West)
Mumbai 400 058
Ph: 022-6316322/ 6233535
e-mail: shettysv@vsnl.com

Working on prevention and control of HIV infection in hospitalised patients, and on infection control and waste management in hospitals and nursing homes.

Digambar Behera
Additional Professor
(Pulmonary medicine)
PGIMER
Chandigarh 160 012
Ph: 0172-745045
e-mail: dbehera@glide.net.in

Studies histopathological changes in the lungs of women and children exposed to domestic cooking fuel and linking respiratory diseases to this exposure.

M Susheela
Professor and Head
Department of cytogenetics
Cancer Institute
32, S P Road
Chennai 600 036
Ph: 044-2350131/ 2350241
e-mail: caninst@md2.vsnl.net.in

Evaluating drugs and products using several international protocols. Studying samples from different types of human malignancies for cytogenetics and molecular genetics.

Manish Desai
Department of Environmental Health
Sciences
University of California and Berkeley
USA
Ph: +01-5106434551
e-mail: desai@socrates.berkeley.edu

Assessing the interventions between malaria and environment in South Africa. Also working on the burden of disease due to indoor air pollution in India and global levels.

Down To Earth ONLINE

Ten years of research, analysis and commentary
...now a mouse click away.

Subscribe to read some of the best articles on
environment, development and sustainability.

Or **subscribe** to the print edition and get
the online edition, absolutely **free!!**

Now, the whole wide world at your fingertips.

Down To Earth ONLINE

read | think | explore | know | interact

www.downtoearth.org.in

SUPPORT US!

CSE's Health and Environment Newsletter is a bi-monthly bulletin, with the objective of bringing into focus the various issues of environmental health. A free publication, the newsletter is targeted at doctors, environmentalists, NGOs and policy makers concerned with the state of our environment.

To enable us to forge closer ties with our readers and to enrich our association, we look forward to your support. Cheques or Demand drafts may be remitted in favour of:

"Centre for Science and Environment"
and sent along with the form duly filled in with the following details.



Name _____
Address _____
Phone _____ e-mail _____ Profession _____

Payment of Rs enclosed vide Cheque No
 Bank draft No dated
 Please charge Rs/US\$..... to my Credit Card Number
 Visa Master card Amex
Card valid till..... Signature..... Date

Payment of US\$.....has been made by Bank transfer to Account No: 320143055
Centre for Science and Environment at American Express Bank Ltd, Hamilton House, Block A,
Connaught Place, New Delhi-110 001 INDIA.

CSE's Health and Environment Newsletter is a bi-monthly publication and is available online and downloadable at
www.cseindia.org/html/eyou/healthnews/index_healthnews.htm

Other stories related to environment and health are available at our website: <http://www.cseindia.org>

This newsletter is funded by the Delegation of the Commission of the European Communities, New Delhi, as part of its support for the Centre's programme on environmental health. Institutional support comes from the Swedish International Development Agency (SIDA) and the Evangelischer Entwicklungsdienst (EED), Germany.

Centre for Science and Environment, 41, Tughlakabad Institutional Area, New Delhi - 100 062. INDIA
Phone: +91-11-2608 3394, 2608 1124 Fax: +91-11-2608 5879

Written by Pranay Lal, Sarita, D B Manisha Designed by Surender Singh Printed by Excellent Printing House, New Delhi