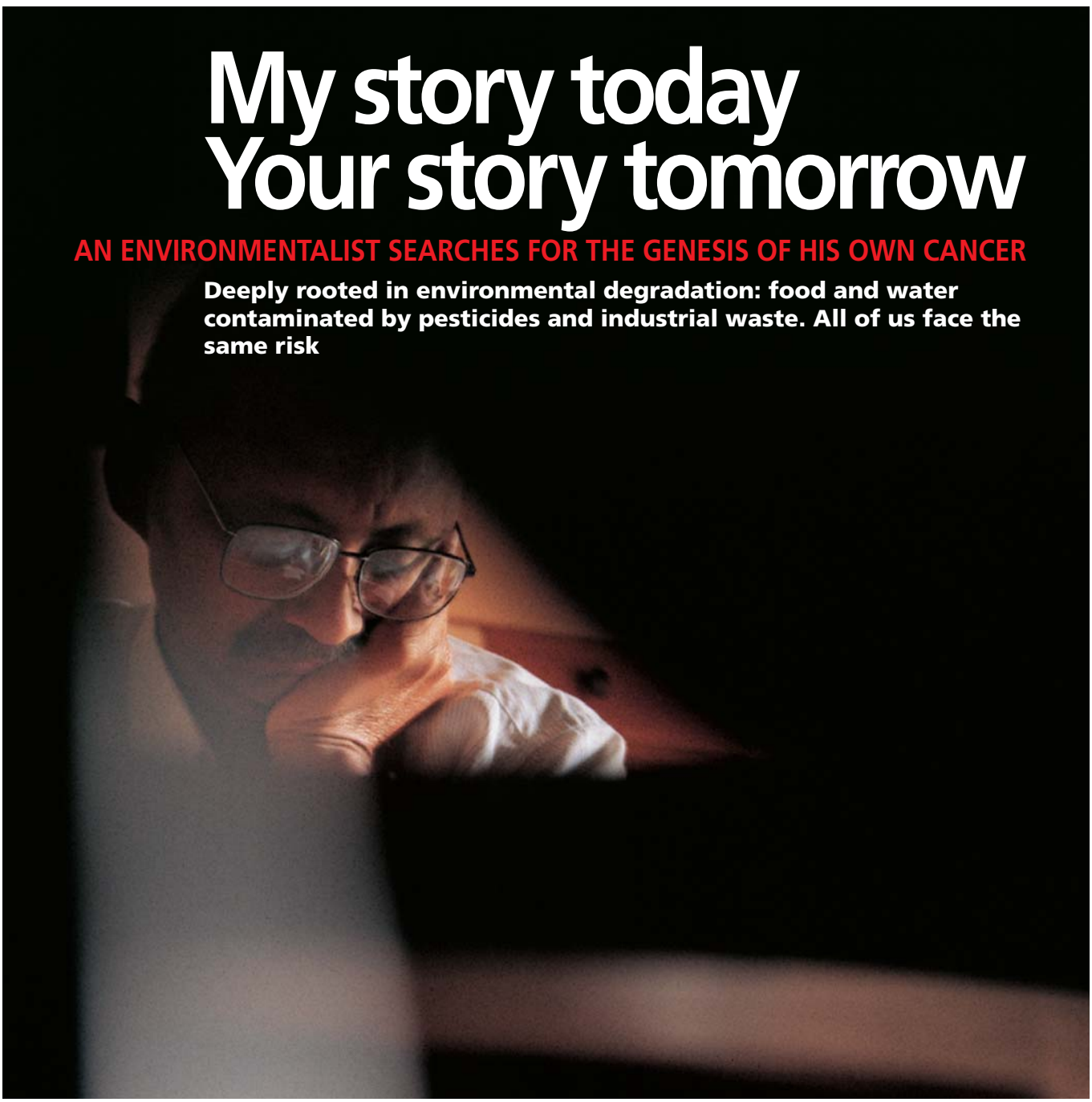
SCIENCE AND ENVIRONMENT FORTNIGHTLY

Down To Earth

Rs 20.00

NOVEMBER 30, 1996



My story today Your story tomorrow

AN ENVIRONMENTALIST SEARCHES FOR THE GENESIS OF HIS OWN CANCER

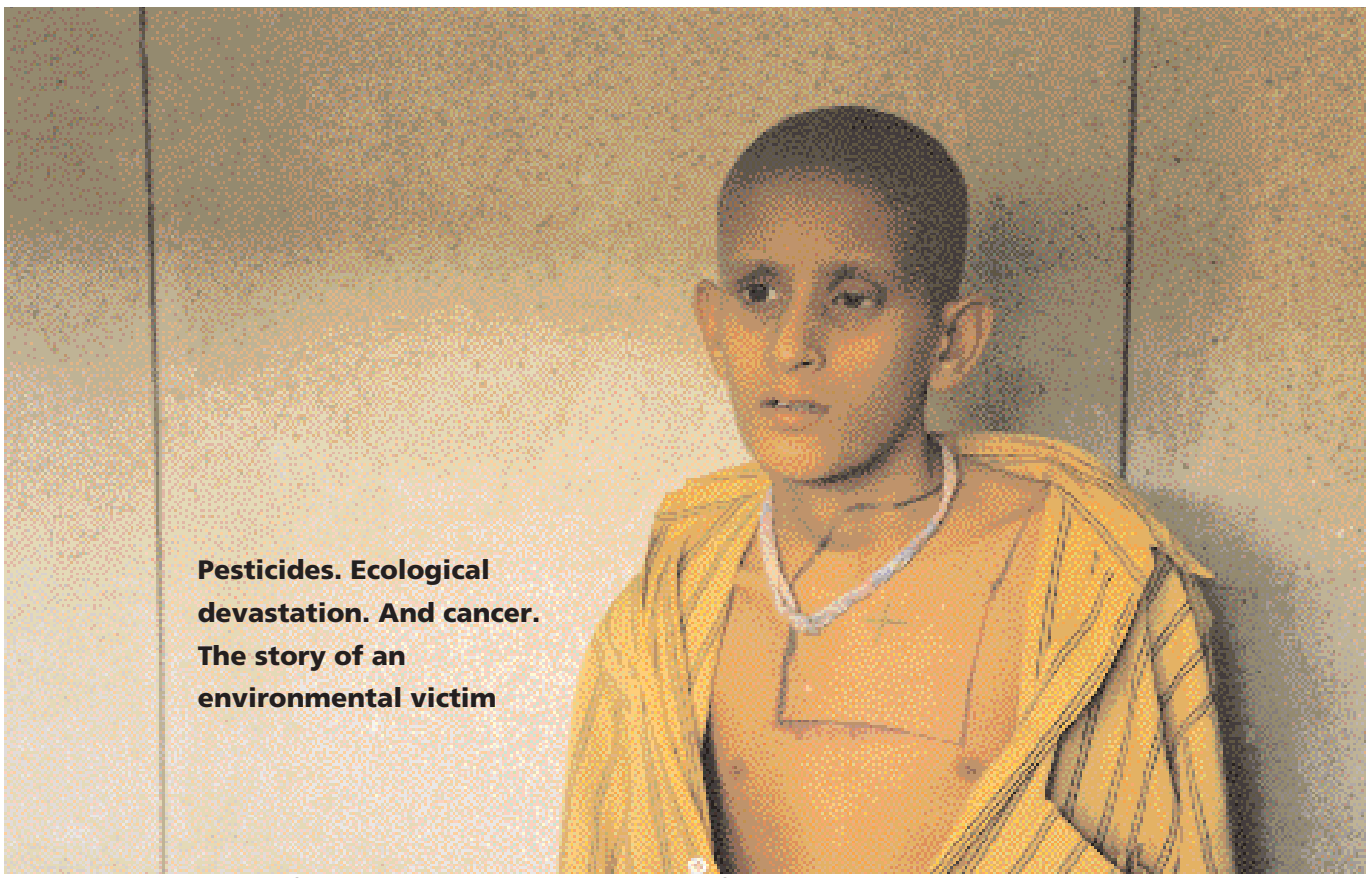
Deeply rooted in environmental degradation: food and water contaminated by pesticides and industrial waste. All of us face the same risk

Salmon ebb: overfishing and pollution hit the Pacific

Delhi's groundwater: a sour story

Microbe miracle: tiny builders

Facing a Silent Spring...



Pesticides. Ecological devastation. And cancer. The story of an environmental victim

AMIT SHANKER / CSE

A young patient of cancer at New Delhi's All India Institute of Medical Sciences

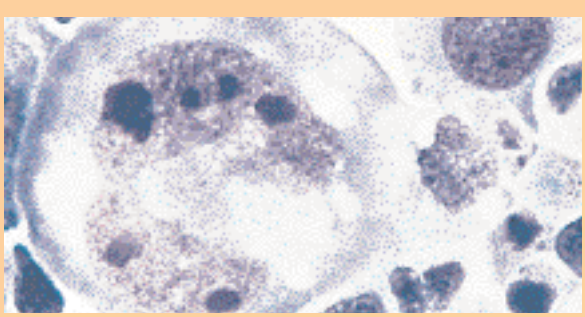
ANIL AGARWAL

AS AN environmental activist and writer, I have tried for years to promote nationwide concern about the deteriorating state of our environment. The idea of writing about my own travails as an environmental victim had, however, never crossed my mind. But obviously, I could not have escaped what was and is happening all around me.

Cancer is a frightening word. It means a terminal disease with periods of excruciating pain. And the treatment, full of poisons, is often as horrific as the disease itself. So how would you feel if you are told that you are suffering not just from cancer, but from such an extremely rare form of it that there is hardly any treatment available? That it has already invaded both your eyes, formed a small tumour in the centre of your brain so that it cannot even be surgically removed without cutting up the brain completely and has even reached your spinal cord? And that as the cancer grows in the eyes, the mass of cancerous cells will pull out the retina in

What're lymphomas?

Lymphomas are cancers that develop in the lymphatic system. They are parts of what are called lymphoid malignancies — lymphomas and leukaemias. The most common type is called Hodgkin's disease; the rest are Non-Hodgkin's Lymphomas. The lymphatic system is part of the body's immune system, consisting of lymphatic vessels carrying lymph, a watery fluid that contains infection-fighting white blood cells or lymphocytes.



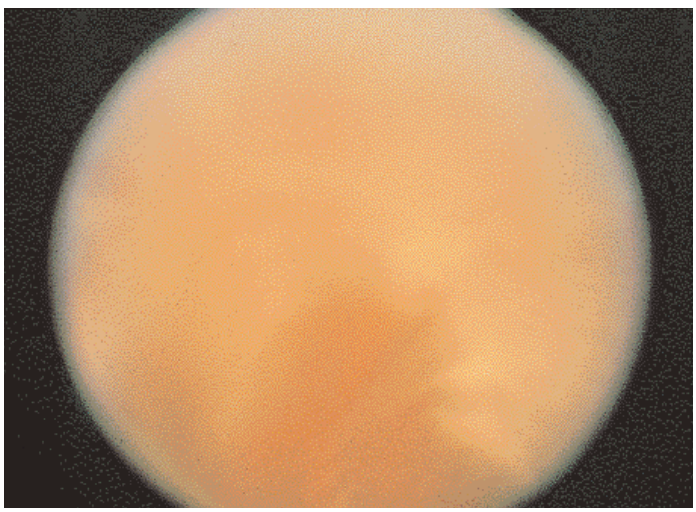
both your eyes and make you go permanently blind; the tumour in the brain will grow to put pressure on the brain and cause strokes, among other things; and the malignant cells in the spinal cord could affect the various nerve endings attached to the cord any time and cause you acute pain and/or irreversibly paralyse parts of your body? The end of all this suffering will, of course, be death. Maybe not more than a year later, but a large part of that year could be spent in bed groping in darkness and pain.

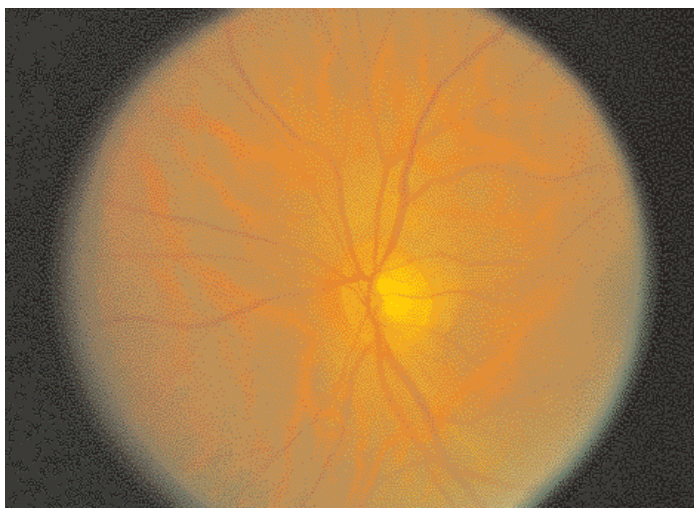
Terrifying prospects, as you will agree. These were the prospects I faced in early 1994. And they were enough to make me think how merciful was God to those whom he let die peacefully in their sleep.

In early 1994, I faced the prospects of blindness, neurological disorders and death

Failing to find even a diagnosis for the symptoms in my eyes — black lines inside my left eye so that I could hardly see from it — in India, I was finally referred to the National Eye Institute in USA, whose scientists after diagnosing ocular and central nervous system Non-Hodgkin's Lymphoma (NHL), referred me to their prestigious sister institution, the National Cancer Institute (NCI). I learnt that the black lines in my eyes were cancer cells which had formed a sheet in front of the retina.

Fortunately, doctors at NCI had an experimental chemotherapy for the disease. They first pumped in fatal doses of a cancer drug so that it could break past the blood-brain barrier and enter the otherwise well-protected central nervous system and eyes in quantities sufficient to kill the cancer cells. They had to immediately follow up with an antidote to save me from dying. The treatment gave me an year's blissful 'remission' (a period without measurable cancer). After an year, in late 1995, the cancer cells





Fluorescin angiogram of left eye before treatment (left): a cloud over the retina — sheet of cancer cells — hides it and makes the author blind in the left eye. Following chemotheropy, vitrectomy and radiation treatment, retina can be seen again, making vision possible

Table 1 Placing cancer

Age-adjusted cancer incidence rates (per 100,000 persons)

Year	Urban centres: Bangalore		Mumbai		Madras		Delhi		Bhopal		Rural centre: Barsi	
	M	F	M	F	M	F	M	F	M	F	M	F
1982	100.2	129.0	119.9	111.2	81.6	108.1						
1983	92.5	116.2	116.5	106.3	88.7	121.9						
1984	90.6	116.3	123.9	113.8	87.6	120.0						
1985	98.7	108.7	129.5	122.9	92.2	128.3						
1986	97.0	115.9	128.5	120.9	101.3	135.7						
1987	110.7	129.5	130.4	118.8	104.4	133.4						
1988	114.6	132.3	129.6	122.7	125.2	129.7	116.8	133.5	98.1	98.7	55.4	52.2
1989	112.2	124.7	130.4	120.4	118.5	135.0	118.8	140.7	106.2	100.1	57.6	52.2
1990	113.9	139.8	138.9	124.9	116.5	136.2	125.1	143.6	107.5	101.2	56.2	58.3
1991	115.7	144.6	132.9	130.8	121.11	131.4	119.1	137.1			55.5	67.3

M: Males F:Females

Source: National Cancer Registry Programme (NCRP)

Living in polluted cities more than doubles the chances of developing cancer, as compared to living in rural areas

Table 2 Placing NHL

Age-adjusted NHL incidence in India (per 100,000 people)

Year	Bangalore		Mumbai		Madras		Delhi		Bhopal		Barsi	
	M	F	M	F	M	F	M	F	M	F	M	F
1982	3.1	1.4	2.6	1.8	2.3	1.0						
1983	3.1	1.6	3.4	2.0	1.8	1.2						
1984	3.4	1.7	3.3	2.4	2.0	0.8						
1985	2.9	1.0	4.1	2.0	3.2	1.3						
1986	3.2	2.5	3.6	2.3	2.7	1.8						
1987	1.7	2.0	4.4	2.8	3.4	0.9						
1988	4.2	1.3	3.1	2.6	3.5	1.7	5.0	2.3	0.5	1.1	0.0	0.0
1989	3.1	2.1	4.0	3.0	3.9	1.8	5.1	2.4	0.5	0.5	1.9	2.0
1990	5.0	2.4	4.4	2.4	4.2	2.1	4.5	3.3	2.1	1.7	0.6	0.0
1991	3.7	0.5	4.0	3.1	3.6	2.2	4.8	3.3			1.1	1.2

M: Males F:Females

Source: NCRP

Delhi has the highest incidence of Non-Hodgkin's Lymphoma (NHL), followed by Mumbai

returned. I was faced once again with the prospect of blindness, neurological disorders and death.

The doctors said that this time they had caught the recurrence so early that they were sure the 1994 treatment would get me back in remission, but they were also certain the remission would not last even a year. I needed something more definite, something with a higher probability of cure — "such that you can live till 70 or beyond till only old age kills you", as one of the doctors who was very fond of me put it. She and others knocked their heads together and came up with a solution: medicos in Paris were experimenting with bone marrow transplants to cure NHL. "After we put you into remission, you must immediately go in for this treatment," they recommended.

Bone marrow transplant is one the most invasive medical procedures developed by modern science. I went through it in mid-1996 and hope that I have finally gotten rid of the disease. That, however, is something that only time will tell. Meanwhile, I will keep praying that some medical scientist somewhere, will continue to look for a simpler, less horrifying and more definitive cure for this rare disease.

My cancer, like most cancers, is related to environmental pollution

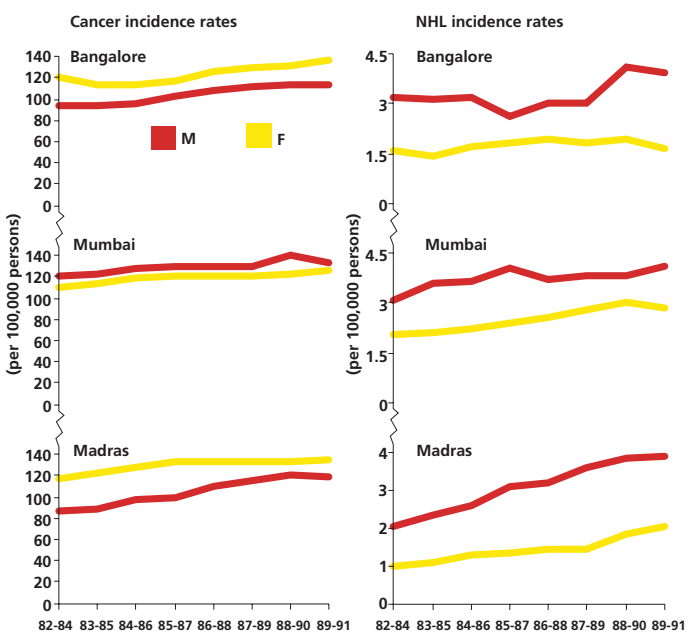
People as statistics

But why should this story of an individual cancer patient be of interest to anybody in a large and growing nation like India? Individuals are, after all, mere statistics. My case, however, is instructive because it represents today the scale of life-threatening and destructive processes that we are inflicting upon ourselves. My cancer, like most other cancers, is deeply related to environmental pollution — an issue, on which, ironically, I have written numerous articles and books, given lectures and made films to increase public awareness of the threats we face. Therefore, I feel a sense of moral responsibility for going on.

The poor, naturally, suffer more than the rich from

Incidental comparisons: cancer and NHL

Age-adjusted incidence rates and growth (bottom table) : 3-year running averages (1982-91)



SHRI KRISHAN

	Cancer		NHL	
	M	F	M	F
Bangalore	20.65%	13.17%	23%	23%
Mumbai	11.63%	13.53%	33%	37%
Madras	38.07%	15.05%	92%	103%

Incidence of Non-Hodgkin's Lymphoma is rising faster than general cancer incidence. In Madras, it has doubled in 10 years

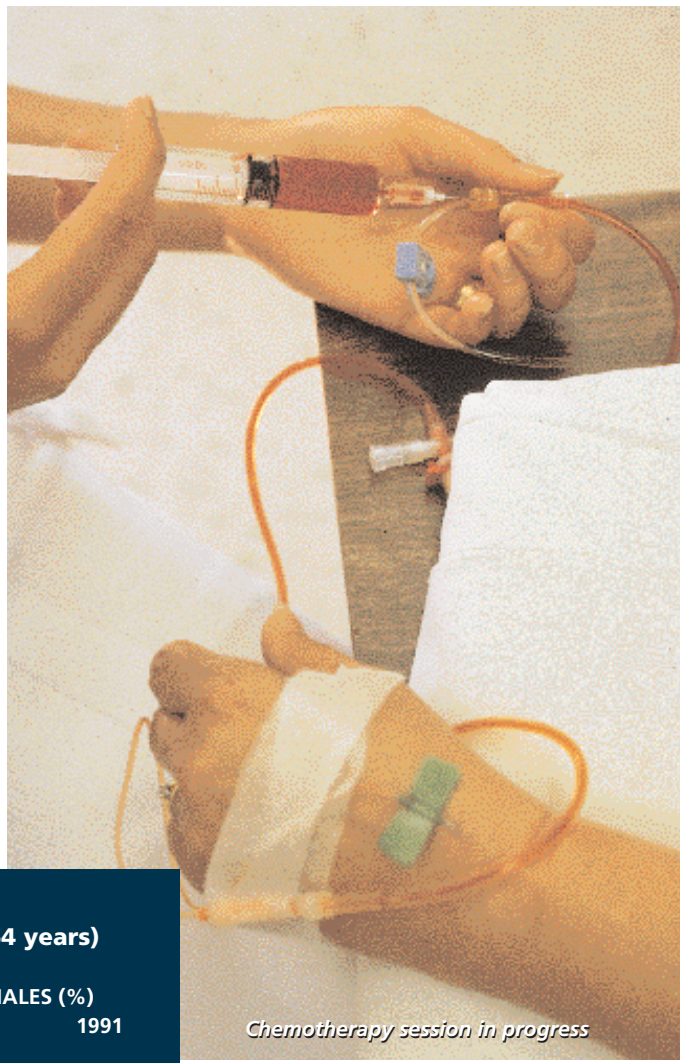
One of every 10-15 people living in metros are potential cancer victims

environmental degradation. However, at least the powerful urban middle and upper classes — we had thought — were intelligent and self-indulgent enough to try and protect themselves and moderate the impact of environmental destruction on their own lives. That theory has proved to be a total chimaera. The elite of our nation have failed to internalise the ecological principle that every poison we put out into environment comes right back to us in our air, water and food. These poisons slowly seep into our bodies and take years to show up as cancer, as immune system disorders, or as hormonal or reproductive system disorders — affecting even the foetus.

Is it, therefore, not imperative for a society to find a way that balances its urge for economic growth and material comforts with the requirements of its natural and human health? Isn't this something that we owe to ourselves and to our children?

Cancer as statistics

Although cancer statistics in India — relatively poor — probably understate the extent of the disease, what they tell us is terrifying. There are six hospital-based cancer registries in India — five in Bangalore, Mumbai, Madras, Delhi and Bhopal and one in the rural area of Barsi near Pune — which give us an idea of urban and rural cancer incidence in India (see Table 1). The data shows that age-adjusted cancer incidence rate per 100,000 people in the five urban centres varied between 101.2 (Bhopal) to 143.6 (Delhi) for women in 1990, whereas for males it was between 107.5 (Bhopal) and 138.9 (Mumbai). This incidence was twice the incidence rate of 56.2



Chemotherapy session in progress

Table 3 A lifetime of death

Cumulative (lifetime) cancer incidence rates (0-64 years)

	MALES (%)		FEMALES (%)	
	1990	1991	1990	1991
INDIA				
Bangalore	6.66	6.59	9.92	9.90
Mumbai	7.08	6.83	7.79	8.52
Madras	7.54	7.68	9.88	9.85
Delhi	7.59	7.33	10.56	10.08
Bhopal	6.70	—	7.79	—
Barsi	2.97	2.78	4.88	5.55
WORLD				
Connecticut (USA)-White	15.21 (1978-82)	15.8 (1983-87)	16.49 (1978-82)	17.3 (1983-87)
Oxford (UK)	13.15 (1979-82)	13.1 (1983-87)	14.10 (1979-82)	14.7 (1983-87)
Finland	12.27 (1977-81)	13.9 (1982-86)	10.54 (1977-81)	13.1 (1982-86)
Miyagi (Japan)	11.27 (1978-81)	8.79 (1983-87)	13.3 (1978-81)	9.8 (1983-87)

Source: NCRP

With their worsening environmental conditions, Indian cities are headed the same way as their counterparts in developed nations

The author being prepared for radiotherapy

CSE

in Barsi, which shows that living in our polluted urban centres more than doubles our chances of developing cancer.

There is another way of looking at this data by asking the question: what is the chance that *I* will be affected by cancer during my lifetime? The answer is stunning. If you are living in one of the four metros — Bangalore, Mumbai, Madras or Delhi — the chance of your catching cancer during a lifetime is as high as seven-11 per cent. In other words, one out of every 10-15 people living in these cities is going to become a cancer victim during his/her lifetime. Or, assuming an average household size of five, it means every second to third household in these metros will have a member falling victim to the disease. However, if you were living in Barsi, the chances of cancer in a lifetime would go down by half — only one out of 20-36 persons will get cancer in their lifetime.

In India, cancer is still largely regarded as a relatively insignificant threat to public health

In industrialised nations like Britain or the US, the average lifetime cancer incidence rate in the late '70s was one out of every six to eight persons. With environmental conditions rapidly worsening here, there is no reason why Indian cities will not get there very soon.

But while cancer is an issue that impinges on national consciousness in the West, it does not do so in India. Experts in US argue that what is occurring in their country is nothing short of a 'cancer epidemic'. The concern for cancer shared by millions in the public has strongly fuelled environmental regulations for control of air and water pollution and toxic wastes. In India, cancer is still largely regarded as a relatively insignificant threat to public health. Yet one conservative estimate puts the total number of national cancer cases by the year 2001 at 806,000. This figure, of course, does not include people who probably cannot even reach hospitals and get diagnosed, especially amongst the vast population of rural and urban poor.

Let me look at statistics about the cancer I am suffering from Non Hodgkin's Lymphoma. In 1990-91, NHL was listed amongst the eight most common forms of cancer in Delhi, Madras and Bangalore amongst males and in Delhi, amongst females, too. But there are less than 200 medically recorded cases worldwide where NHL has affected the eyes; I am probably the first case of ocular lymphoma diagnosed from India.

Causes of NHL

It is impossible to pinpoint why a particular individual gets cancer. Carcinogenesis can result from stress (which depresses the immune system), bad diets, environmental toxins like pesticides, air pollutants and industrial chemicals, waste products and even genes. While diet and stress are factors more associated with personal lifestyles, environmental contamination is a societal problem and, therefore, needs greater attention and regulation.

Risk of lymphatic cancers increases when the body's immune system gets affected

In the US, where NHL incidence has increased by over 65 per cent between 1973 and 1990 — the second fastest increase in cancer incidence rates of all human cancers in the US in the last 15 years — there is considerable effort to identify the causes and quantify their impact on the increase of NHL. Says Sheila Hoar Zahm of the NCI, "NHL is increasing not just in the US but in all industrialised countries. Overall, we may be making gains in cancer, but because NHL incidence is small compared to the mega-cancers,

The study says it all

ICMR's "withdrawn" research points to pesticides-cancer connection

When I first pointed out to friends in India that scientific studies suggest exposure to pesticide residues as a strong cause of my cancer, many of them wondered how could I — living the protected life of a middle class Indian — have been exposed to pesticides. The findings of a seven-year study by the Indian Council of Medical Research (ICMR) called *Surveillance of Food Contaminants in India*, released in 1993, provides enough answers. Some 2,205 samples of cow and buffalo milk, collected from 12 states, were studied.

- **Detectable residues of alpha, beta and gamma isomers of HCH (or BHC, a highly poisonous pesticide) were found in 87, 85 and 85 per cent of the samples. The percentage of samples exceeding the scientifically determined tolerance limits were 21, 42 and 28 in the case of alpha-, beta- and gamma-HCH, respectively.**
- **The worst contamination was in the states of Andhra Pradesh (AP), Bihar and Uttar Pradesh; dietary intake of beta-HCH was about twice the acceptable daily intake (ADI) amongst populations with high incomes in urban areas of AP.**
- **DDT residues were detected in about 82 per cent of the samples. About 37 per cent contained DDT residues above the tolerance limit of 0.05 mg/kg. The maximum level of DDT residues was found to be 44 times above the tolerance limit — 2.2 mg/kg.**
- **Maharashtra had 74 per cent samples with DDT residues above the tolerance limit, Gujarat 70 per cent, AP 57 per cent, Himachal Pradesh 56 per cent and Punjab 51 per cent.**
- **Industrial milk — infant formula, for instance — also had pesticide residues. Out of some 186 samples of 20 commercial brands of infant formula, 70 per cent showed DDT residues and 94 per cent revealed the presence of HCH-isomers. The dietary intake of beta-HCH by an infant fed on infant formula was 90 per cent of the ADI.**

On its release, the report had claimed the attention of the media and the Parliament. But in mid-1996, the ICMR refused to give this author a copy of the study saying that it had been "withdrawn" and was being "reconstituted" because "it had faults in its data and analysis", and that it would not be available until 1997.

say breast cancer or lung cancer, figures for the latter cancers tend to swamp the overall cancer statistics."

In India, the meagre data collected by NCRP for different cities shows a steady increase. In Madras, there is literally a doubling of incidence in 10 years between 1982 and 1991 amongst both males and females, besides substantial increases in Mumbai and Bangalore. While the database for Delhi and Bhopal is too small to identify any trend, the statistics do show that Delhi has the highest incidence amongst both males and females followed by Mumbai. Interestingly, a comparison (see:

Programmes for ill-health

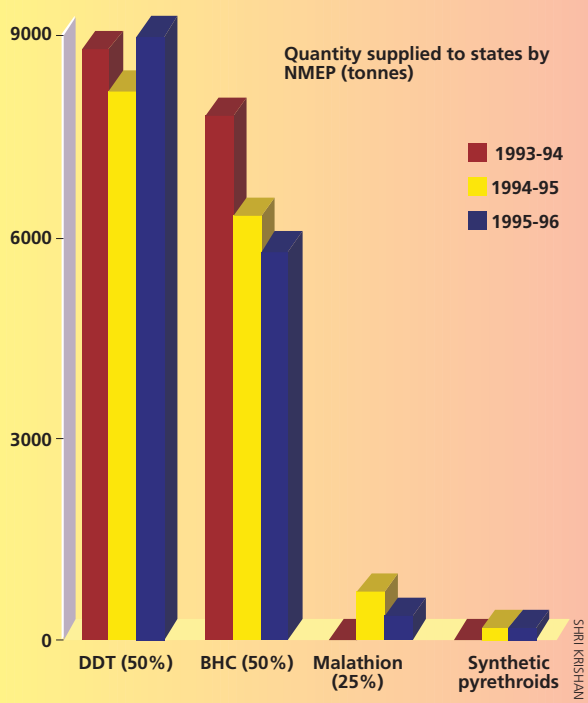
Indian public health programmes use toxic pesticides with impunity

Indian planners doggedly persist in using DDT in their spraying programmes, though several nations have banned its use. Part of the government's obduracy is the result of the worst form of 'state capitalism': the major manufacturer of DDT in India is a state-owned company called the Hindustan Insecticides Ltd.

Even as late as 1995-96, some 9,000 tonnes (t) of DDT were supplied to state governments by the National Malaria Eradication Programme (NMEP). Though the government has begun phasing out the use of another dangerous insecticide, BHC, 5,784 t of it were used in 1995-96. Use of alternatives like malathion and synthetic pyrethroids, that began in 1969 and 1995-96 respectively, has remained restricted because of high costs — which shows how little money the government is prepared to spend on safe public health programmes.

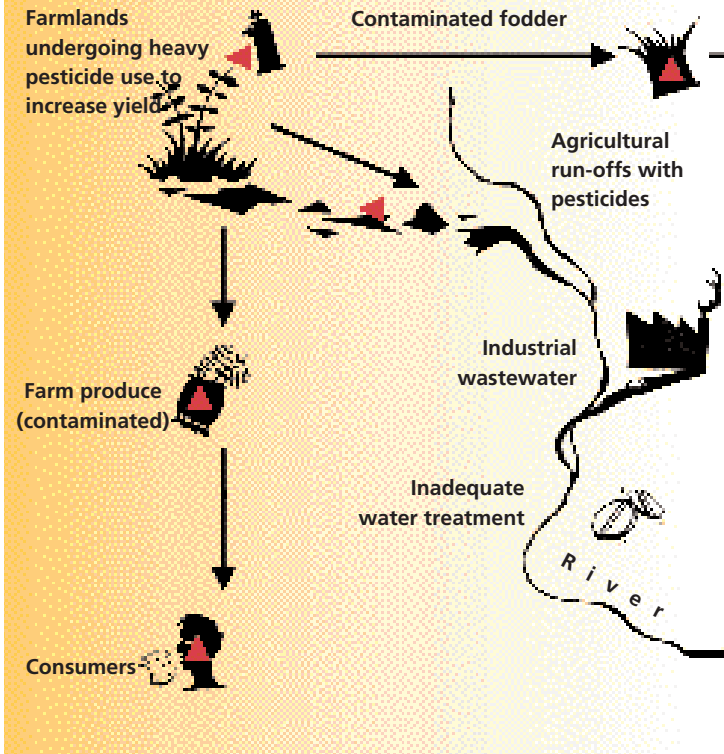
Even though some excellent work has been done by institutes like the Malaria Research Centre, New Delhi, and the Vector Control Research Centre in Pondicherry on environmental control of disease-spreading insects, policy-making and implementing agencies like the ministry of health and the NMEP have paid no attention.

Use of insecticides under NMEP



Source: NMEP

How pesticides



The reach: Is

In human adipose (fatty) tissue
(Ahmedabad, Calcutta, Delhi, Lucknow, Bangalore and Gujarat)

In human milk
(Ahmedabad, Lucknow and Chandigarh)

In human blood
(Coimbatore, Delhi and Jaipur)

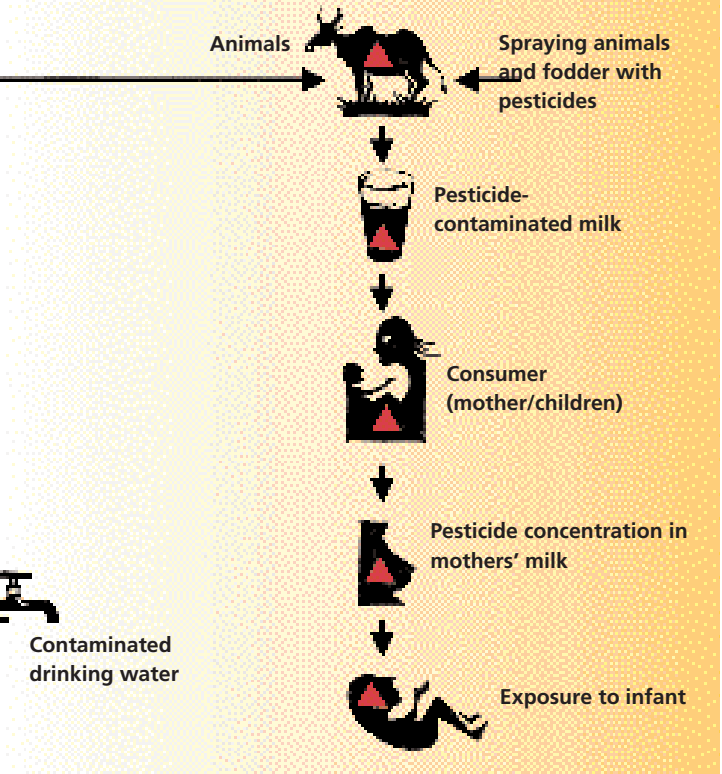
In foodstuffs like pomfret fish (Mumbai)

In crabs
(Malnad)

In sheep meat
(Jaipur and Srinagar)

In eggs (Mumbai and Lucknow)

affect you and me



'Incidental comparisons') clearly shows that NHL incidence is rising faster than overall cancer incidence; in Mumbai and Madras, the difference in increase is quite dramatic. However, in a conspiracy of silence, almost all specialists at the Tata Cancer Memorial Centre in Mumbai interviewed by Ambika Puri, a CSE researcher, replied in the negative when asked if NHL was increasing in India.

Cancer experts believe that risk of lymphatic cancers including NHL increases when the body's immune system gets affected or suppressed. Says N K Mehrotra, head of the environmental carcinogenesis laboratory in the Industrial Toxicology Research Centre (ITRC), Lucknow, "The causes of lymphoma are as yet unknown, but it mainly occurs due to cumulative effects of pollutants and reduced immunity in the body." A number of NHL cases in the US occur in people who have been affected by HIV, the dreaded AIDS virus. In India too, the spread of HIV will definitely boost the incidence of NHL. But the NCI does not believe that the HIV virus, or cancer-causing viruses like human T-cell leukaemia virus-1 or the Epstein-Barr virus, play an important role in the increase of NHL. Neither do dietary factors, according to it.

High levels of pesticide residues are present in every necessity of life

The NCI says that certain immunosuppressive genetic syndromes can play a role in causing NHL, but that they are too rare to bring about any major increase in cases. Similarly, 50-fold increases in risk of NHL have been observed among organ transplant patients, because they receive powerful immunosuppressive drugs on a long-term basis; but again, these conditions affect very few people. A detailed statistical study in the US concludes that accuracy and completeness of diagnosis, the impact of HIV and occupational exposures leave unexplained an 80 per cent rise in incidence among white men. The NIH study also argues that improved diagnostic facilities and recent reclassification of other cancers into lymphomas account for a tiny fraction of the increase in NHL.

The menace: pesticides

The key factor which is, therefore, attracting worldwide interest amongst epidemiologists is environmental pollution. Several studies carried out in Canada, Sweden and the US have shown a strong correlation between the risk of NHL and use of pesticides.

there anything at all that is uncontaminated by pesticides?

In butter (Hissar, Chandigarh, Delhi, Lucknow, Ludhiana, Pantnagar and Gujarat)

In processed *ghee* (Lucknow) and animal milk (Lucknow, Pantnagar and Ludhiana)

In infant milk preparations (Mumbai, Chandigarh and Gujarat)

In goat and buffalo meat (Lucknow)

In animal fats and oils (Calcutta)

In foodgrains like wheat, rice and pulses (Mumbai, Calcutta, Lucknow and Gujarat)

In fruits and vegetables (Lucknow, Calcutta, Delhi, Ludhiana and Mysore)

In condiments (Calcutta)

In vegetable oils (Delhi, Lucknow, Sitapur and Gujarat)

In soils (Chikmagalur, Delhi and Pantnagar)

In drinking water (Lucknow)

In the air (Ahmedabad)

Frequent use of herbicides, particularly 2,4-dichlorophenoxyacetic acid (2,4-D) has been associated with a 200-800 per cent (two-eight times) increased risk of NHL in Sweden. According to one study, the association between NHL and phenoxy acid herbicides may be because of contamination by dioxin, a highly poisonous immunosuppressant. The NCI study argues that though the number of people working in agriculture occupationally exposed to these and other pesticides is not large enough to explain the overall increases in NHL, the general population is also at a heightened risk because of the use of these pesticides in homes, lawns and golf courses. Dogs whose owners have used 2,4-D, for instance, have a heightened risk of contracting malignant lymphoma.

Since the use of pesticides, particularly phenoxy herbicides (2,4-D, 2,4,5-T or 2,4,5-trichlorophenoxyacetic acid, and MCPA or 2-methyl-4-chlorophenoxyacetic acid) and organophosphate pesticides has increased over the last 40 years, the NCI argues that they could have played a significant role in contributing to the rising incidence of NHL.

According to a book written by ITRC's N K Mehrotra, there are several pesticides which cause cancer of the lymphatic system in experimental animals (rats and mice).

The general population can be exposed to pesticides in three ways:

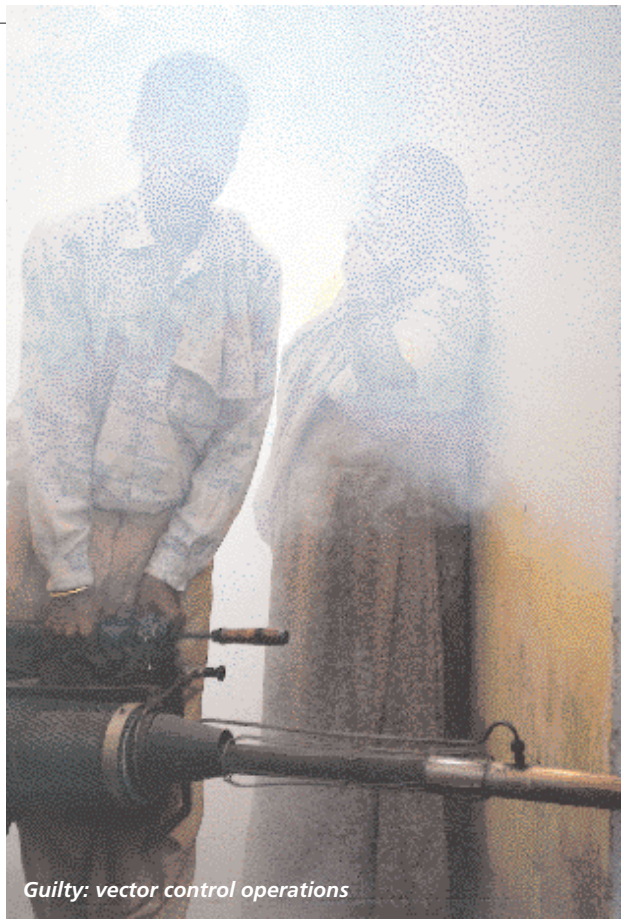
- through vector control
- through residues in environment
- through residues in food

This segment of population tends to have only a low-dose, chronic exposure, but larger doses can be transmitted if the exposure is persistent and bioaccumulative. Persistent pesticides move through air, soil and water, finding their way into living tissues where they can bioaccumulate up the food chain into human diets. Roughly 85-90 per cent of pesticides applied agriculturally never reach target organisms, but disperse through the air, soil and water. People who can be exposed to high levels of bioaccumulated pesticides include

- habitual consumers of fish, livestock and dairy products;
- foetuses and nursing infants whose mothers' bodies have accumulated persistent pesticides; and,
- sick people who metabolise their fatty tissues (which contain bioaccumulated pesticides) while ill.

People in Delhi have one of the highest levels of DDT in their body fat

According to an ITRC survey of studies on pesticide residues, high levels of residues of BHC, lindane, heptachlor, endosulphan and dieldrin have been found



Guilty: vector control operations

AMIT SHANKER / CSE

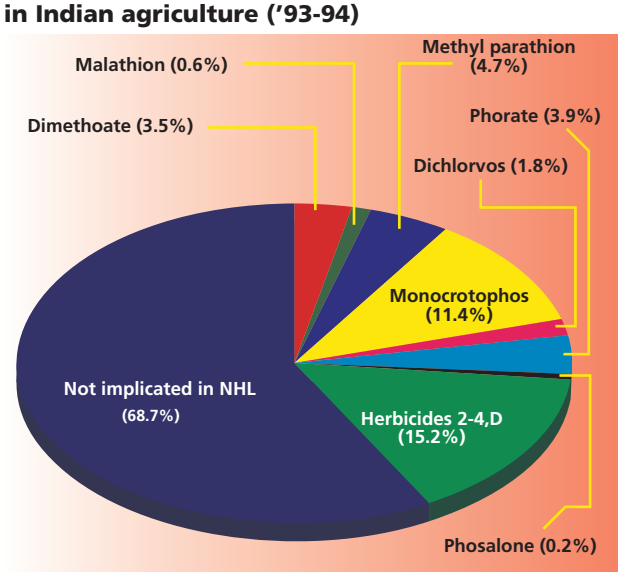
Pest controllers

Pesticides which cause lymphatic cancer in rats and mice

1. Toxaphene (organochlorine, general name Camphechlor)
2. Hexachlorocyclohexane (organochlorine, used as gamaxine)
3. Trichlorophenol
4. Strobane (organochlorine)
5. Perthane
6. TCDD (Dioxin) (a chlorophenoxy herbicide, which is often found as a contaminant in trichlorophenol, hexachlorophene and 2,4,5-T)
7. Dieldrin (organochlorine)
8. DDT (organichlorine)
9. 1, 2 Dichloroethane (DDE, breakdown product of DDT)
10. Heptachlor
11. Picloram

List of suspects

NHL implicated pesticides and their consumption in Indian agriculture ('93-94)



SHRI KRISHAN

Nearly 40 per cent of pesticides consumed by our farms are possible causative agents of Non-Hodgkin's Lymphoma

Home truth

Environmental pollution does not spare even those concerned about the environment

Official statistics show that every seventh to 10th person living in Delhi, Mumbai, Madras and Bangalore is likely to fall prey to cancer during his lifetime. I was keen to check whether this rate applied to people I know personally — among the board members of the Centre for Science and Environment (CSE).

I found that the lifetime cancer incidence rate in this group was, sadly, on the higher end of the officially predicted range. What is worse is that as many of the board members are still young, the full story has not yet been told. Since 1980, CSE has had a total of 45 board members. Of these, 34 have lived for long in the four accursed metropolises listed above. Of them, five have already been stricken with cancer — one from brain cancer, one from breast cancer, one from prostate cancer and two from Non-Hodgkin's Lymphoma — leading to a lifetime incidence rate of slightly more than one in seven.

in just about everything necessary for life from food to water.

The list does not even include tea whose DDT residues are so high that Germany is refusing to import Indian tea.

How do these residue levels compare with residues in industrialised countries or with acceptable daily intake (ADI) standards? Badly, at best. A report published in 1992 in the *Journal of Agriculture and Food Chemistry* by K Kannan and A Subramaniam concludes: "Significantly high levels of food contamination with HCH, DDT, aldrin and dieldrin were evident throughout India...The average daily intake of HCH and DDT...were higher than those observed in most of the developed nations. The dietary intakes of aldrin and dieldrin exceeded the acceptable daily intake recommended by WHO/FAO...." Studies have shown that people in Delhi have one of the highest levels of DDT bioaccumulated in their body fat. Another study of 1991 on pesticide residues in Delhi by A Nair and M K K Pillai reports that DDT and HCH residues were present in Delhi's water, soil and fauna. Human breast milk samples in Delhi show DDT and HCH levels comparable to those found in Punjab, an area of intensive farming. Infants ingesting this breast milk receive roughly 12 times the allowable daily intake of DDT.

Adding to the concern about carcinogenic effects of pesticides are the latest findings of a new discipline of science called immunotoxicity, which studies substances with a negative impact on the immune system. A recent review of over 100 primary experimental studies of immunosuppressive nature of pesticides reports that the large majority of these studies reveal various types of immunosuppressive effects. Reduced immunity influences cancer incidence. A weak or devastated immune system allows cancerous cells to escape and form a tumour. One can only imagine the kind of havoc pesticides can play in a country where a large percentage of the population is malnourished and, hence, suffers from immunodeficiency.

Organic solvents and other industrial chemicals

According to NCI, exposure to organic solvents also leads to increased risk of NHL. According to Shiela Zahm, "There is now a strong feeling amongst scientists that apart from pesticides, organic solvents play an important role." Organic solvents are widely used in the paints industry, in dry-cleaning and woodcrafts, and large numbers of workers are potentially exposed to them. Among the solvents which are suspected carcinogens are chlorinated hydrocarbon solvents, methylene chloride, trichloroethylene, chloroform, formaldehyde and benzene. A Swedish study also lists styrene, trichloroethylene, perchloroethylene and chlorophenols as substances whose exposure heightens the risk of NHL. A British study shows heightened risk of NHL amongst those exposed to wood dust and expoxy glues.

The maximum likelihood of exposure in my case is through food and water

Says Zahm, "The general population is also exposed to these carcinogens through commercial products and contamination of drinking water sources." Enquiries in India conducted by researchers of CSE reveal that no study of contamination of drinking water sources by these solvents has been conducted so far. Studies, however, have shown that the following solvents were present in effluents of the paint industry:

Tenuous links

On NHL's associations with ailments like asthma

According to National Cancer Institute (US) scientists, "Weak associations (with Non-Hodgkin's Lymphoma or NHL) have been noted for some common (medical) conditions... like asthma, allergies, rheumatoid arthritis, rheumatic fever, tuberculosis and infectious mononucleosis, and commonly taken steroidal drugs. Some conditions that warrant further investigation include asthma and steroid use."

Steroids are known to be immunosuppressive; asthma too is an immune system disorder. Asthma — known to get exacerbated by air pollution — cases have been rising in many countries lately. In the US, 10 million people — four per cent of the total population — suffer from asthma. I have been an asthmatic for more than 30 years now and Delhi's growing air pollution has definitely not helped much. Still, these are weak associations suggested by epidemiological studies, and US scientists continue to look for other major causes of increase in NHL.

Eco-mandarins: a no-show

The MEF is non-functional as far as controlling hazardous pesticides is concerned

What does the baby of environmental concern — the much-hyped Union ministry of environment and forests (MEF) — do to protect human beings from harmful pesticides? Precious little, it seems.

The ministry has neither restricted the use of hazardous pesticides and monitored pesticide-induced pollution nor studied the health or overall environmental impact of pesticides. The agriculture ministry is responsible for approving pesticides. The MEF, says a senior official, acts only if an accident were to occur in a pesticide firm, *a la* Union Carbide in Bhopal.

Says R R Khan, the scientist in charge of MEF's technical unit dealing with safety aspects of pesticide use, "We only have an advisory role. We offer advise to the ministry of agriculture regarding safe use of pesticides. We also conduct regular training programmes for pesticides industries as well as users." Period. This is the state of environmental governance in India. If the ministry closed down tomorrow, it would make no difference to mine or your health. Then why should we pay taxes to this incompetent government?

VISHWAJYOTI

They throw, we use

Pesticides are good for you as long as you are an Indian

The Indian government persists in allowing the production of a variety of deadly pesticides, even after many of them have been banned or severely restricted abroad. In 1983, the UN had produced a *Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved by Governments*. When Sunita Narain of the Centre for Science and Environment compared the pesticides listed in this report with those approved and used in India, she found that in terms of tonnage, an amazing 70 per cent of all pesticides used on Indian farms were banned or severely restricted in Western countries and identified by the World Health Organization (WHO) as hazardous. The proportion of such pesticides used in public health programmes was even higher.

In 1996, even after a decade of environmental regulatory institutions, I found that the figure in agriculture was 54.25 per cent: 46,826 tonnes (t) of pesticides out of a total of 86,311 t used in 1994-95 had been restricted or banned in the West. In public health, the figure was 94.5 per cent. Since I am still looking at the 1983 UN list, the figure is lower as many restricted pesticides have not been included. If an updated list becomes available, India's extraordinary record in taking care of its people would plunge further.

These pesticides include, besides DDT, carbofuran, dimethoate, endosulphan, lindane, methyl parathion, monocrotophos, mancozeb and paraquat. A number of other pesticides which are currently under special regulatory review on health grounds in the US — for instance, carbamates like aldicarb and carbaryl — are widely used in Indian agriculture. A number of pesticides implicated in the causation of NHL are also in use, including 2-4,D (1,200 t in 1993-94, about 15 per cent of total herbicides consumption in India).

The truth, maybe, is that the Government of India is the most persistent pest in India for which we need a truly deadly pesticide.

PESTICIDES BANNED/RESTRICTED IN THE WEST, BUT USED IN INDIA (1994-95) (TONNES)

Pesticide	Use in agriculture	Use in public health
BHC	24,000	6305.00
Carbofuran	280	
DDT	—	8181.25
2,4-D (Dichlorophenoxyacetic acid)		1,200
Dichlorvos (DDVP)	1,500	
Dimethoate	1,900	
Endosulphan	4,600	
Lindane	50	
Methyl parathion	2,600	
Monocrotophos	6,296	
Mancozeb	4,000	
Paraquat	400	
	46,826	14,486.25
Total use of pesticides	86,311	15,327.25
Percentage of use consisting of banned or severely restricted pesticides	54.25	94.5

2,4,6-Trichlorophenol	Benzene
2,4-Dichlorophenol	Chloroform
2,4-Dinitrophenol	Methylene
4,6-Dinitro-o-cresol	Chloride
Pentachlorophenol	Trichloroethylene
Phenol	

What is frightening is that not all these contaminants can be removed by existing wastewater treatment processes in India, thus leading to the contamination of natural water sources which ultimately provide us with drinking water.

Growing horde

The Indian pesticide industry today has an installed capacity of 1,16,000 tonnes (t) per annum, of which about 70,000 t is in the organised sector, whereas the rest is in some 500-odd units belonging to the smallscale sector. It is doubtful that the smallscale sector has any appreciable control over contamination by pesticides. In 1994-95, India produced almost all the pesticides it consumed — some 83,000 t in the agricultural sector alone. Imports are currently about 2,000 t only. With liberalisation, controls on creating additional capacity for pesticide formulations has been lifted and there is no restrictions excepting six pesticides (aluminium phosphide, dimethoate, quinalphos, carbaryl, phorate and fenitrothion) for which licensing is compulsory. A Planning Commission study has projected pesticide consumption by 2000 AD at 1,18,000 t — 97,000 t for agriculture and 21,000 t for public health. It is interesting to note that most of the growth in the world pesticide industry is in developing nations. In value terms, growth in the pesticide industry between 1987 and 1993 in Latin America and Asia (outside Japan) was more than twice the global average.

The MEF has no team working on the dangers posed by toxins like pesticides

Like the pesticides industry, the Indian paints industry has also been growing rapidly. Between 1950 and 1982, production increased from 40,000 t to 190,000 t (107,000 t in the organised sector and 83,000 t in the smallscale sector) — the smallscale sector increased production eight-fold compared to the organised sector's slightly over three-fold increase. The smallscale sector is particularly notorious for its poor or non-existent wastewater treatment facilities. Following liberalisation, a lot of hazardous paint and dyestuff industry has moved to India because of growing environmental controls in the West and inadequate controls in India. K R V Subramaniam, managing director of Colour Chem, a large paints company, said in an interview to the *Economic Times* in 1993, "Large Indian companies by and large meet pollution standards. But many others, who contribute 40-50 per cent of our exports, do not."

More questions

There are countless questions that keep crossing my mind. Why did I get afflicted with this disease? How cancer-prone are we becoming as a nation? Who is responsible? What should we do about it? It is clear from the sum total of the evidence available that environmental contamination could have been a key cause of my cancer. As I am not an agricultural labourer or a farmer spraying pesticides, the maximum likelihood in my case is of exposure through food and water.

Shame

An Indian institute is accused of callousness

A telling indictment of India's native cancer treatment facilities was recently brought forth through the 'Letters' column of a leading national daily. A patient undergoing chemotherapy for cancer of the lymph nodes in the capital's prestigious Rajiv Gandhi Cancer Institute and Research Centre died; the deceased's family members allege that the extremely low haemoglobin count of the patient following chemotherapy was treated with total indifference by the institute's specialist. Besides, administrative delays in readmitting the patient and providing blood transfusion apparently led to death. The institute, of course, contends that the patient died despite the "best possible treatment", and not due to lack of efforts on the hospital's side.

My principal interest in writing this article is to inform the Indian people that they must not remain ignorant and nonchalant about the acute threats they face to their own health and to the health of their children. I find no concern in India about clean air, water or food, all of which are not just bacteriologically but also chemically contaminated today. At a seminar organised by a leading Delhi-based NGO on Delhi's drinking water supply system in 1995, I had to point out that while there was so much talk about the inadequacy of water supply, there was almost none about its quality. What good is lots of water if it is so contaminated?

Bacteriological contamination shows up in acute epidemics and hence, often leads to a hue and cry amongst the public and in the media. But chemical contamination takes years to show up in the form of cancers or hormonal and reproductive disorders, and hence unless there are good epidemiological studies carried out on a regular basis and a constant effort made by the medical profession and a vigilant media to inform the public about the health threats it faces, there will be no pressure whatsoever on the regulatory authorities to do anything to protect the environment.

Ignorance is bliss for the the politician and the bureaucrat. Apart from the influence of industrial lobbies which may operate underhand, India's overt governance systems themselves are incompetent. An excellent illustration of this is the fact that the ministry of environment and forests has no team working on the dangers posed by toxins like pesticides that permeate the environment and food systems.

Summing up, I can only say that had not fate, friends and well-wishers and committed scientists from various parts of the world not intervened to help in my case, it would have been a Silent Spring for me in the prime of life. I can only hope and wish that that no fellow citizen has to suffer the same fate. And that Indian civil society can, one day, force our misguided government to come to its senses. ■

(The author is grateful for inputs provided by Ambika Puri, Madhumita Dutta, Ambika Sharma, Max Martin and Sunita Raina, and the time provided by Sheila Hoar Zahm)

COMMENTS

"Statistics say that incidence of cancer in urban areas is almost double that in rural areas, which proves that cancer cells thrive in a polluted atmosphere. We cause pollution in the name of progress, as automobiles contribute significantly to it. Developing countries should, as a matter of policy, encourage public transport to keep pollution to the minimum. Pesticides are another major cause of cancer. Use of pesticides has grown in the present era of increased agricultural productivity. What causes the problem apparently is the residue of pesticides; this means the quantity of pesticides used needs to be reduced and their strength should be reviewed downwards.

"There is another aspect of the problem. MNCs introduce products which have been banned in countries of their origin, into our markets. The fact of the ban is probably carefully concealed. There is a growing shift of such hazardous products following a mistaken belief in industrialisation and liberalisation. It may be difficult to persuade commercial ventures to be more socially conscious as they look to profits. But non-government organisations will have to be more vigilant."

Madhu Dandavate, deputy chairperson, Planning Commission

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"Coming from a person who has suffered from this dreaded disease, the article rightly brings out the elements which threaten humankind. The deteriorating state of our environment — brought about by chemical and bacterial contamination — is by far the most dangerous cause of cancer."

Abid Hussain, vice chairperson, Rajiv Gandhi Institute of Contemporary Studies, New Delhi

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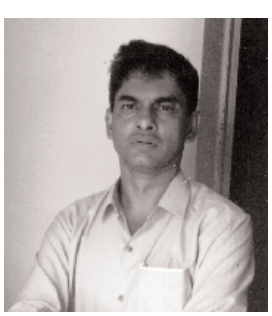

"Reading the travails of Anil should be enough to move any rational mind to search for remediation. But would it happen here? I visualise a second cancer — a cancer of the mind promoting the first, the cancer of the body. How otherwise did a country not refuse products of Union Carbide, even after the company caused Bhopal? MNCs are now selling 'environmental technology' to the poorer world because they don't have markets in their own countries. To do this, they are equipping themselves with appropriate international trade regulations; this act is dished out as niceties in trade and environment linkage. Meanwhile, we continue to give lip-service to sustainable lifestyle, remaining steadfastly indifferent to the wretched and deprived millions, and allow business decisions to rule the next century. History, till then, will continue to be one of sustainable impoverishment."

Dhrubajyoti Ghosh, trustee, eastern region, World Wide Fund for Nature-India

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"We are caught in a difficult cycle of population, poverty, development and environment... Four decades ago, how many policy-makers expected Delhi to grow to its present size? Even today, we continue to debate for a mass transport system which would reduce pollution and absolve Delhi of the dubious distinction of being the most polluted city... How much do we know about the way pollutants like sulphur dioxide play havoc with people's health? Precious little. I remember a paper published in 1964-65 on the loss of ability of eggs to produce chicks in sea-gulls. The eggs were found to contain BHC derivatives. The world did not care to ban BHC at that time, and continued on the path of development. It is possible to overcome the problems raised by Anil partially, provided that we do not go beserk on the bug of commercialisation and trade. We need sincere and committed scientists who can speak plain facts and educate our politicians."

S K Sinha, national professor, Indian Council of Agricultural Research, New Delhi

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"While Anil points at politicians and bureaucrats, he does not spare me and my colleagues either. For he accuses the Indian scientific community of playing down serious issues of public interest — a "conspiracy of silence". I must, unhappily, concur. Scientists alongwith others in the organised services — like industry — constitute the country's omnivores, the all powerful consumers. We are collectively engaged in equating development with state-sponsored resource-flows for our own benefit, even if it is at the cost of the environment and the rest of India's population. Consider chemical pesticides. The state provides largescale subsidies for supply of pesticides to farmers. Not all of these actually reach the farmers; politicians and bureaucrats share in the misappropriated spoils. The pesticide industry has its sales boosted by the subsidies and profits in the protected sellers' market. Undoubtedly, it kicks back part of these profits for being allowed to set up a unit. The green revolution farmers, too, do well under the system... The agricultural scientists find it profitable to with the pesticide industry — to get research contracts or post-retirement jobs. The chemists too are either allied with the chemical industry or are busy pursuing problems in fashion in the West. Thus, we have built up a high-cost, low-quality economy, and we have an environmental regime which builds up the world's highest level of pesticide residues in human bodies, while maintaining one of the world's lowest levels of pesticide consumption. Only a radical restructuring of our system of governance, to render it transparent and accountable and to stop pampering a narrow elite at state expense will get us out of this mess. But will we omnivores ever agree?"

Madhav Gadgil, Centre for Ecological Sciences, Indian Institute of Science, Bangalore

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"Besides pesticides, indiscriminate use of hazardous drugs have destroyed the immune system of the body. On the other hand, bacteria and pests have developed immunity against drugs. The nexus of politicians, bureaucrats and businessfolk in India have no consideration for clean air, water or food. Because of their apathy and self-interest, our country has become the dumping ground of hazardous and toxic wastes of the developed world. During the last two years, US, Australia and Canada exported 11,859 tonnes (t), 9,034 t and 7,270 t of hazardous wastes respectively to India alone. It is time that a vigorous campaign of awareness of toxic materials and contamination should be carried out amongst the people. Our right to a pollution-free environment should be guaranteed."

Banka Behary Das, president, Orissa Krushak Mahasangh

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"The post-World War II period has been one of synthetic compounds, totally alien to our biosphere and to biochemical cycles of our planet. This led to the publication of a remarkable book — *Silent Spring* — by Rachel Carson in 1962. Perhaps the compelling reason for Carson to write the book was that, like Anil, she too suffered from cancer, and wanted to forewarn others. Our biosphere has no capacity to degrade the human-made unnatural compounds, and these accumulate, biomagnify and cause a host of problems. The regrettable part is that governments and the industry have underplayed these aspects. Human being in its present form is the most unnatural species of the biosphere — involved in a war against the biosphere and committing ecological sins against its only home, the earth. The moral from the ordeal faced by Carson and Anil is that we must dedicate ourselves to a life of voluntary simplicity, and must relentlessly fight for our natural environment and reject all that is alien to our biosphere so as to ensure safety for those who will follow us on this planet."

T N Khoshoo, distinguished fellow, Tata Energy Research Institute, New Delhi

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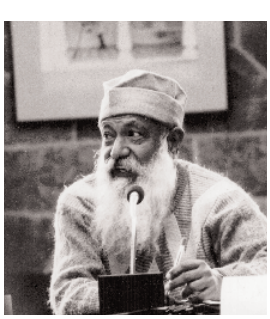

"There can be no denying either the horrifying nature of cancers in general and lymphoma in particular, or the growing prevalence of cancer in our country, particularly in congested and polluted urban areas. Nor are there any doubts about statistical associations between incidences of cancer and concentrations of toxic pollutants in the environment and the consequent risks to human health and welfare, or the serious public concern the above should cause in our country, which considers economic poverty and improper distribution of wealth as its only two problems…

"In the activated sludge process of biological wastewater treatment, the most dreaded condition that fouls up the system is called 'sludge-bulking'. With all the research and knowledge behind us, no one is still able to say what causes 'sludge-bulking'. To me, it seems cancers are similar to sludge-bulking. And what does one do to avoid such a condition? The only alternative is to ensure balanced and stable operation, in line with the original assumption of the design. In my opinion, awareness and concern for the hazards posed by toxic chemicals and processes that were not part of the original assumptions of the design of the human body, are a must. Such awareness should lead to a willingness to live without the facilities or products that application of these delivered. For such chronic, systematic ailments caused by imbalance or pollutants, the treatment has to be as horrific as the disease. The only desirable and practical course to avoid such suffering would be serious curtailments of our needs and lifestyles, not just on individual but on community and national levels."

G D Agarwal, ex-member secretary, Central Pollution Control Board

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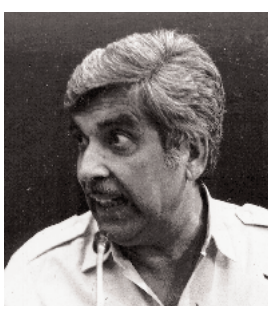

"There can be a clinical description of environmental toxicity, carcinogens and malignance. However, the essence of the matter is the human being. Statistics and environmental sciences do not dilute the essential human context in which this article has been written. This relates to a set of issues. Firstly, the Indian city is rapidly declining. I stay off and on in Delhi. The degradation of Delhi as a city is far more obvious to an individual who sees it after a number of years. One of the other key features of the Indian scene has been a rapid deterioration in the nature of information given by different sources. This is true of land and its characteristics, besides areas like demographic indicators, health indicators and morbidity. Anil Agarwal picks out his facts and carefully marshals them in directing his ire at 'experts', who discuss the problem casually. Is somebody listening out there?

"His resume of the current pesticide scene and the injection of carcinogens into human bodies, mothers' milk, daily foods, etc is devastating. I had written a similar article in the *Economic and Political Weekly* and showed that while the absolute level of pesticide application was still low, in some groups and regions (paddy and cotton, for instance) it had reached intolerable levels. At the policy level, there was the same wooden-headed response. Excessive controls — not for reaching objectives — excessive protection of domestic vested interests, and an inability to master the great technology changes taking place were also there. Nobody was willing to respond to knowledge. Fifteen technical grade pesticides were put on the open general licence, but industry got the finance ministry to withdraw the initiative. Urbanisable India is not required to obey any laws — because in many cases they are not there. Luxury bungalows and high-rise houses come up without any sanitation, roads or water supply; cesspools emerge; sewage mixes with drinking water; we get the plague and the dengue. But there are no reliable morbidity statistics… How many more people have to die before individual hedonism and myopia will give way to social concern? You had better heed me, dear reader, for as Anil Agarwal says, it won't be him the next time."

Y K Alagh, minister of state for planning and programme implementation and science & technology

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