



Union Carbide Corporation's factory in Bhopal

A brief & deadly history

1. A FLAWED DESIGN

- *Bhopal MIC Plant proposal approved by Union Carbide Corporation's Management Committee including Warren Anderson on December 2, 1973 specifically discusses the risk of using unproven technology*
- *Decides that the risk is 'acceptable' in order to save money*
- *Major cost saving is on fatal Sevin-to-MIC system*

A CALCULATED RISK

Secret Carbide document

Technology Risks

The comparative risk of poor performance and of consequent need for further investment to correct it is considerably higher in the UCIL operation than it would be had proven technology been followed throughout. CO and 1-Naphthol processes have not been tried commercially and even the MIC-to-Sevin process, as developed by UCC, has had only a limited trial run. Furthermore, while similar waste streams have been handled elsewhere, this particular combination of materials to be disposed of is new and, accordingly, affords further chance for difficulty. In short, it can be expected that there will be interruptions in operations and delays in reaching capacity or product quality that might have been avoided by adoption of proven technology.

UCIL finds the business risk in the proposed mode of operation acceptable, however, in view of the desired long term objectives of minimum capital and foreign exchange expenditures. As long as it is their feeling any

2. SEEDS OF DISASTER

- *Solar evaporation pond built in 1977*
- *Global Economy Drive. Cut maintenance staff, cut safety training, closed down refrigeration unit needed to keep MIC at safe temperature*
- *Alarming findings of 1982 Safety Audit by Union Carbide engineers from Charleston, West Virginia, were ignored*
- *Frantic telexes about leaking solar ponds were ignored by US bosses*
- *Urgent warnings from the workforce & public alarm were ignored*



Solar evaporation ponds

- *liner was supposed to be renewed every 2 years but never once was*
- *was flimsy as a plastic bag*
- *thousands of tons of lethal toxins dumped in ponds*
- *ponds leaked from the start*
- *caused cattle deaths*
- *poisoned soil & water*

Telexes about leaking ponds **Ignored**

25 March 1982

PHASE II EVAPORATION POND ALMOST EMPTIED. REPS OF KR DATEY AT :
AND INVESTIGATION OF THE LEAKAGE IN PROGRESS. UNFORTUNATELY
EMERGENCY POND HAS ALSO SHOWN SOME SIGNS OF LEAKAGE.

10 April 1982

APD:
MIC UNIT WORKING SATISFACTORILY AFTER THE PROLONGED ANNUAL SHUTDOWN
STOP CONTINUED LEAKAGE FROM EVAPORATION POND CAUSING GREAT CONCERN.
REPAIRS BEING PLANNED WITH ASSISTANCE FROM CONSULTANTS.

A **reckless** economy drive

- *335 jobs are culled, maintenance staff halved*
- *half the plant operators in the fatal MIC unit sacked*
- *safety training cut from six months to two weeks*
- *old parts re-used to save money on repairs, a leaky valve and a worn washer led to the disaster*
- *Carbide's own safety regulations require MIC storage tank to be kept at 0°C, but refrigeration is turned off to save freon gas worth \$37.68 a day*

1982 safety audit **Ignored**

Found 30 major hazards, 11 in the fatal MIC/phosgene units, every one of which was an identified element in the disaster 30 months later

- *badly trained personnel*
- *rapid turnover of staff*
- *leaking valves*
- *poor maintenance standards*
- *inadequate water spray protection*
- *faulty gauges*

Conclusion: 'a higher potential for a serious incident or more serious consequences if an incident should occur'

1984 US report Ignored

September 1984: an internal safety report at Institute, West Virginia – Bhopal's 'sister plant' – focuses on the hazards of MIC storage

It says that a certain combination of situations and possibilities could lead to a catastrophic failure of the tank

It points to instances of water contamination of the unit tanks in the past from several sources. The report is not passed on to Bhopal.

Three months later, the four central dangers foreseen by the report figure prominently in the disaster.

Warnings from workforce & public alarm **Ignored**

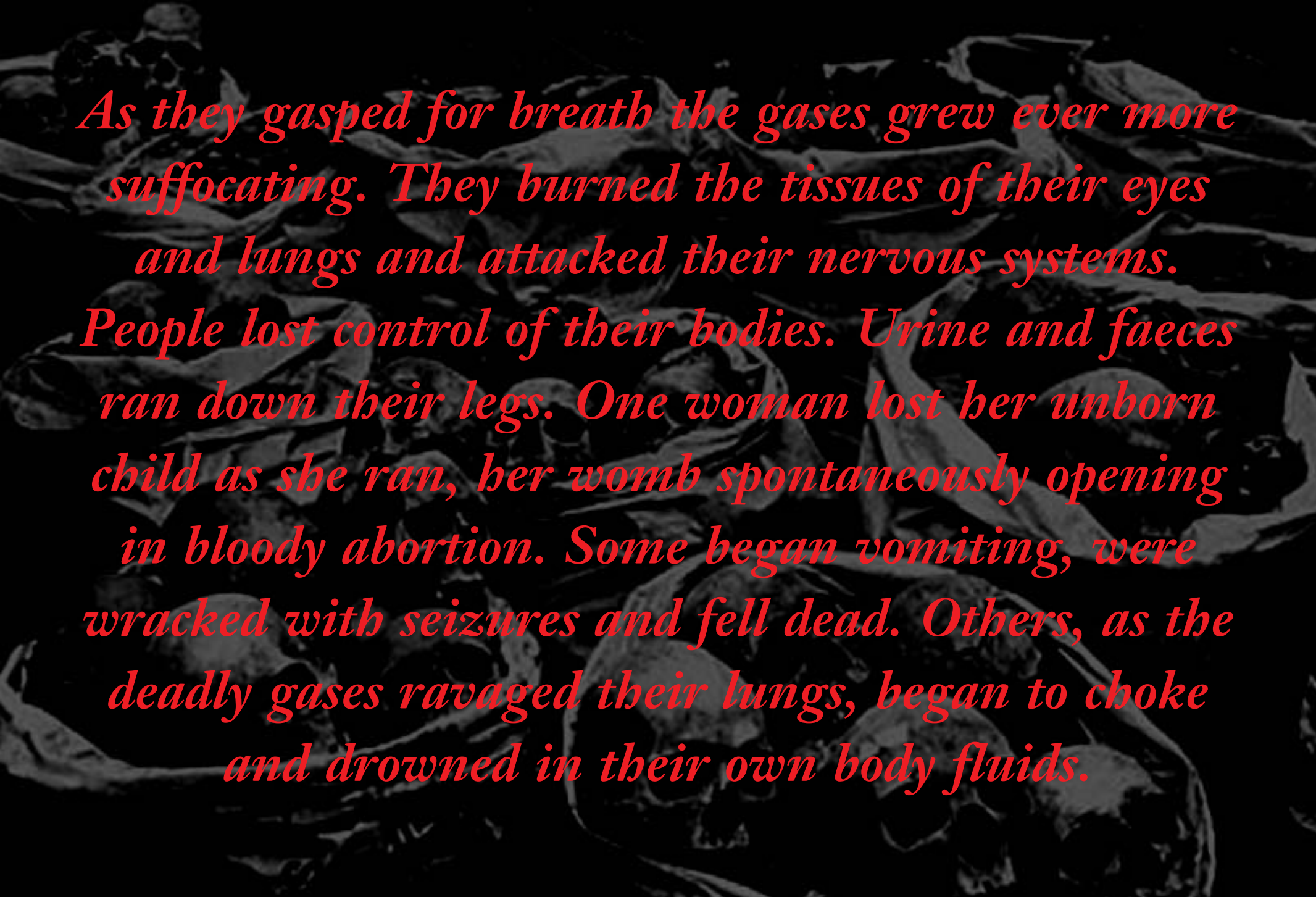
- *in 1982 workers launch campaign against unsafe practises after a number of accidents in the Bhopal plant*
- *complaints are forwarded to State and national government & US executives.*
- *union leaders are fired and the campaign is broken up*
- *journalist Rajkumar Keswani writes four articles between 1983 & 1984 warning of imminent disaster*

3. THAT NIGHT

2-3 December 1984



'It felt like someone had filled our bodies with red chillies, our eyes were crying, noses were watering, we had froth in our mouths. The coughing was so bad that we were writhing in pain. We got up and ran in whatever we were wearing or even if we were wearing nothing at all. Some ran this way and some that. People were desperate to save their lives so they just ran. Those who fell were not picked up by anybody, they were trampled on by other people. Even cows were running to save their lives, crushing people as they ran.'



As they gasped for breath the gases grew ever more suffocating. They burned the tissues of their eyes and lungs and attacked their nervous systems. People lost control of their bodies. Urine and faeces ran down their legs. One woman lost her unborn child as she ran, her womb spontaneously opening in bloody abortion. Some began vomiting, were wracked with seizures and fell dead. Others, as the deadly gases ravaged their lungs, began to choke and drowned in their own body fluids.







The death toll: *official figures*

- *Early official reports placed immediate deaths at between 1,800 & 2,500*
- *A July 1990, affidavit submitted to the Supreme Court claimed a total 3,800 deaths from the disaster*
- *ICMR study of mortality rates was stopped in 1993*
- *The 2003 annual report of the Madhya Pradesh Gas Relief & Rehabilitation Department stated that 15,248 people had died as a result of the gas leak by October 2003*

The death toll: *unofficial figures*

Amnesty International says that at least 7 - 10,000 people perished in the first three days & about 15,000 more have died since then of their injuries

Amnesty researchers spoke to:

- *workers employed to clear corpses*
- *grave diggers*
- *suppliers of wood for funeral pyres*
- *suppliers of burial shrouds*

Reasons why the official figures are too low

- *there was no systematic recording of deaths*
- *many victims fled Bhopal never to return*
- *eye witnesses tell of mass disposal of bodies by the army*
- *entire families & small communities died unrecorded*
- *death claims arbitrarily denied by claims courts*

A photograph showing a large bonfire of white plastic waste burning in an open field at sunset. The sun is low on the horizon, creating a bright orange glow. Several palm trees are visible in the background. A group of people, mostly men in light-colored clothing, are standing to the right, watching the fire. The text "22,000 at least" is overlaid in large, bold, red font across the center of the image.

22,000
at least

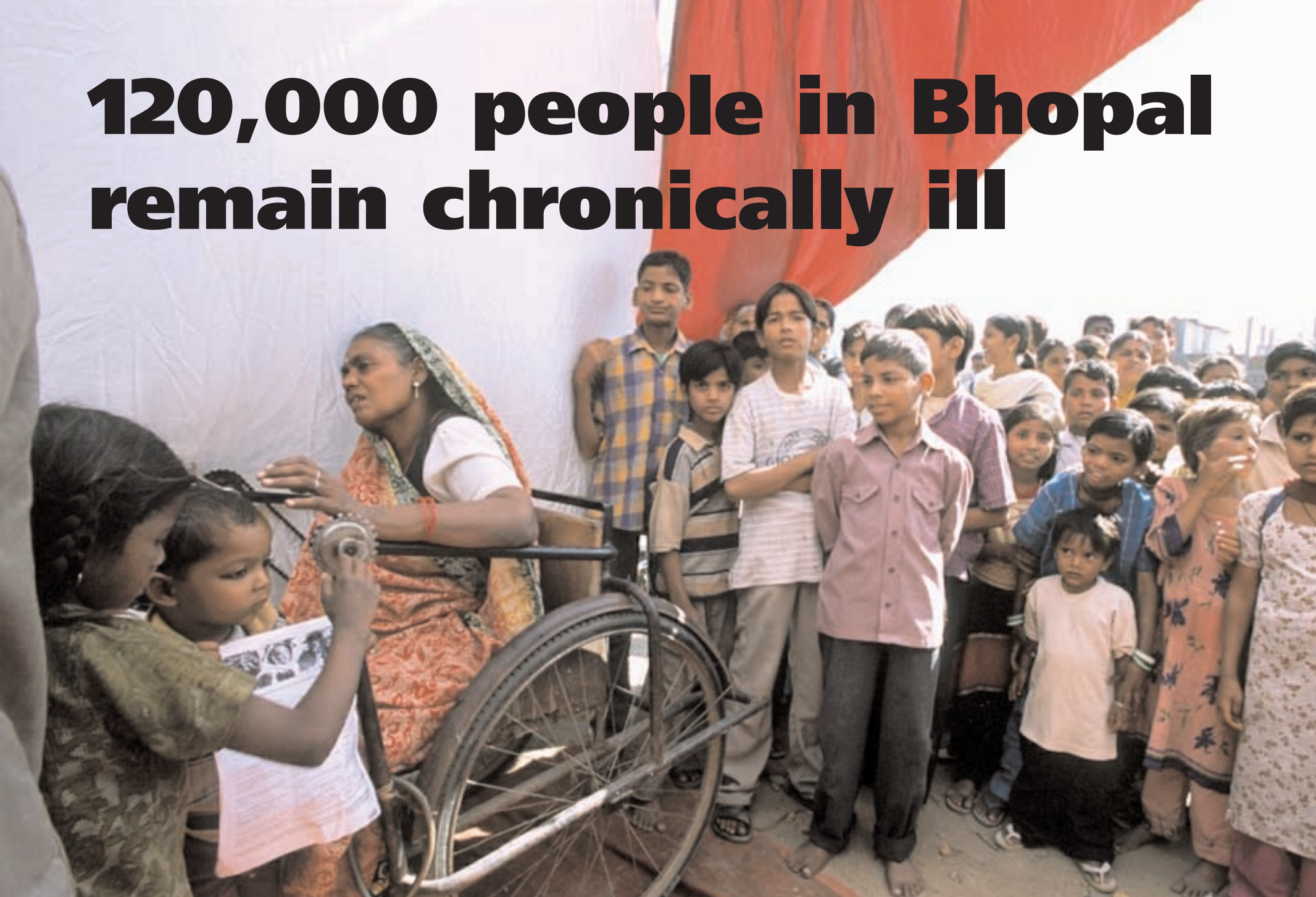
& **still they die**

- *mortality rates determined by the Indian Council for Medical Research in 1988 showed around 2,500 extra deaths in gas-affected areas in that year alone*
- *mortality rates collected by the Madhya Pradesh Department of Gas Relief and Rehabilitation reveal that in 1997, the number who died from gas-related injuries was 665*
- *since then there has been no adequate data*
- *Sambhavna Clinic estimates that 30 people are still dying every month of injuries sustained during the disaster*

Half a million were injured

- *Official figures for injuries slow to emerge: by July 1990 only 15% of injury claims had been medically evaluated*
- *By 1991, the Indian Supreme Court heard that 495,000 people had been classified as injured, 22,000 permanently injured or disabled, 3,000 seriously, and another 8,500 temporarily disabled*
- *By October 2003, 554,895 claims for minor and major injuries had been assessed and approved by the Madhya Pradesh government*
- *Unofficial figures assert that some 120,00 survivors remain chronically ill and in need of regular medical care*

120,000 people in Bhopal remain chronically ill



4. FINDINGS OF THE GOVERNMENT SCIENTIFIC COMMITTEE INTO CAUSES OF THE DISASTER

4.1 • design differences between Bhopal & the 'sister plant' in Institute, West Virginia

4.2 • negligence in maintenance

4.3 • inadequate and non functioning safety systems

4.1 Design differences

BHOPAL	INSTITUTE
<i>1. storage of large amounts of MIC for long periods</i>	<i>storage of small quantities for short periods</i>
<i>2. manual monitoring of gauges & alarms</i>	<i>fully computerised four-stage alarm system</i>
<i>3. no chemical inventory monitoring</i>	<i>chemical inventory monitoring</i>
<i>4. no 'knock down' tank</i>	<i>'knock down' tank to take out MIC discharge to the flare tower</i>
<i>5. vent gas scrubber with limited capacity</i>	<i>extra emergency gas scrubber with extra capacity</i>

Design differences (*contd*)

6. <i>MIC tank at ambient temperature, 29°C</i>	<i>MIC tank at -10°C</i>
7. <i>cooling system based on brine (highly reactive with MIC)</i>	<i>cooling system based on chloroform (inert with MIC)</i>
8. <i>no unit storage tank to test quality of MIC between refining and storage</i>	<i>unit storage tank to test quality of MIC between refining and storage</i>
9. <i>vent gas scrubber and flare shut down when MIC production stopped</i>	<i>continuous operation of VGS and flare</i>
10. <i>flare tower with limited capacity</i>	<i>flare tower designed for 'worst possible' scenario</i>
11. <i>vent headers made of carbon steel</i>	<i>vent headers made of stainless steel</i>

4.2 Negligent maintenance

- *absence of instrument maintenance programme*
- *safety valve testing ineffective*
- *no proper record of reviews of valves, instruments and alarm systems*



4.3 Inadequate & non-functioning safety systems

4.3.1 • *the vent gas scrubber*

4.3.2 • *the flare tower*

4.3.3 • *the cooling system*

4.3.4 • *the fire hoses*

4.3.5 • *pressure valves and gauges*

4.3.6 • *MIC run off tank*

4.3.7 • *alarm siren*

Safety failures

4.3.1 • vent gas scrubber

was designed for a flow of 190 pounds/hour at 35°C & a maximum pressure of 15 psig

On 'that night' MIC roared through it at 40,000 pounds/hour at 200°C & a pressure of 180 psig



Safety failures

4.3.2 • flare tower

its piping was too small to handle a large flow of gas and was anyway disconnected and under repair on 'that night'



Safety failures

4.3.3 • refrigeration unit, *designed to keep MIC at a safe 0°C, had been turned off to save \$37.68 per day on freon gas*

An aerial photograph of an industrial facility, possibly a chemical plant or refinery, with various structures, pipes, and storage tanks. The image is overlaid with large, bold, red text. The text reads: "They risked the life of a whole city for \$37.68 a day".

**They risked the
life of a whole city
for \$37.68 a day**

Safety failures

4.3.4 • fire sprays

the 1982 audit wanted more powerful water sprays installed – they weren't – on 'that night' the water sprays couldn't reach the escaping gas



Safety failures

4.3.5 • **pressure gauges & valves** *were malfunctioning*





Safety failures

4.3.6 • spare MIC tank *was already half-full of MIC*

Safety failures

4.3.7 • **alarm siren** *was switched off*



5. RESEARCH FINDINGS OF THE INDIAN COUNCIL OF MEDICAL RESEARCH (ICMR) & OTHERS

- *summary of studies by the Indian Council of Medical Research, taken from its 1994 report.*
- *figures from the Centre for Rehabilitation Studies, Bhopal*

ICMR studies

- *24 research studies into the short and long term impact of gas exposure*
- *studies covered respiratory, neurological, reproductive, ophthalmic, metabolic, forensic, genetic, psychiatric, orodental & paediatric effects*
- *however ignored effects on body systems such as cardiovascular, renal, gastrointestinal, musculoskeletal and endocrine*

ICMR findings

- *The ICMR found that the toxins had crossed into the bloodstream of victims and damaged the lungs, brain, kidneys, muscles as well as gastro-intestinal, reproductive and immune systems*
- *A survey of the prevalence of symptoms conducted between November 1988 and March 1990 showed that morbidity was higher in exposed areas (26%) than in the control area (18%)*
- *Approximately 11% of people experienced two or more spells of illness in a one-year period, with respiratory, ocular, and gastro-intestinal symptoms being most commonly reported*

ICMR findings *(contd)*

- *The ICMR found that more than ten of the symptoms originally reported persisted among survivors as late as 1992, with the addition of menstrual irregularities, spontaneous abortions and neurological and mental health problems*
- *A house-to-house symptoms survey in one community in early 1993 showed 65.7% of people suffering from respiratory symptoms, 68.4% with neurological problems and 49% with ophthalmic symptoms*

ICMR & women's health

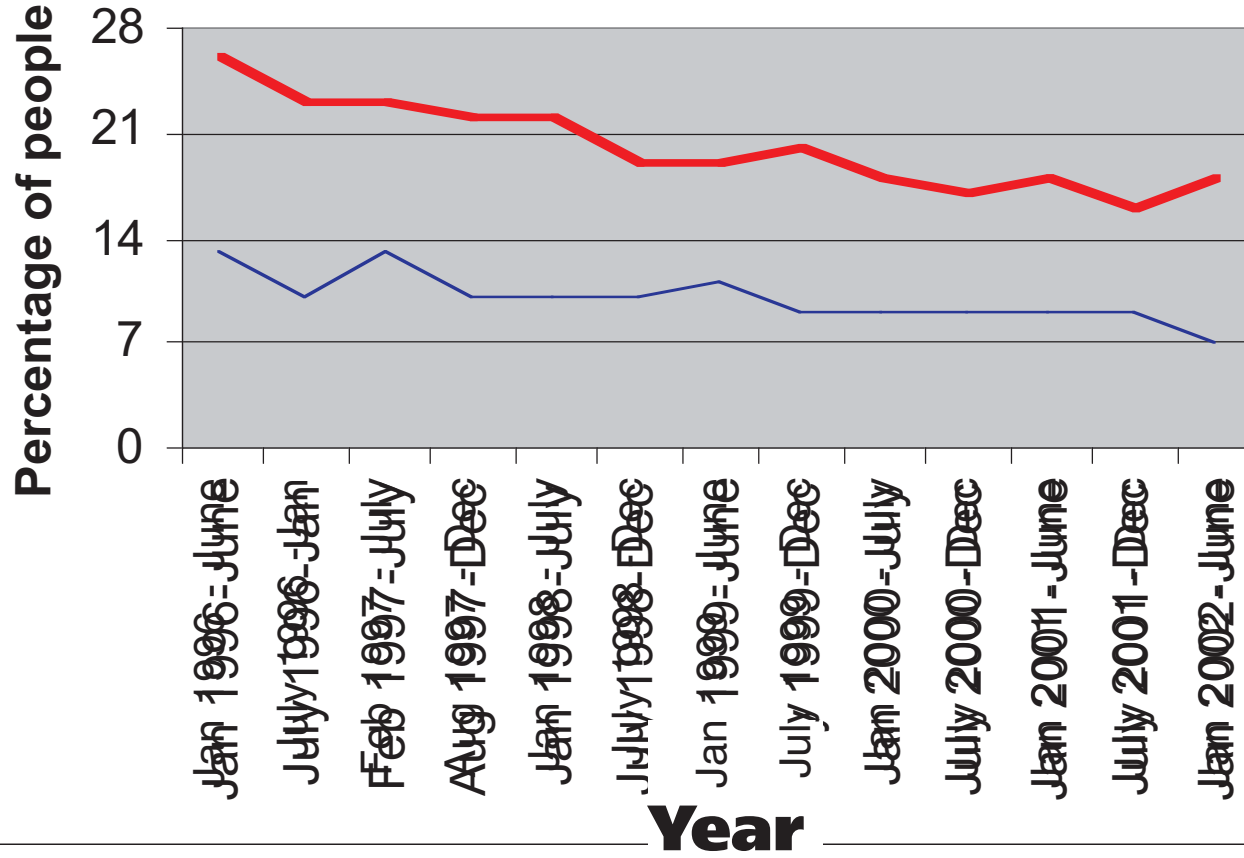
- *the toxins also crossed the placental barrier, leading to foetal poisoning. There was evidence of a higher incidence of adverse outcomes of pregnancy such as miscarriages, stillbirths and fewer live births*
- *ICMR studies were reporting gas-exposed women having an abortion rate five times that of unexposed women, even five years after the disaster*
- *among women of reproductive age, 43.2% suffered from reproductive disorders*
- *the ICMR terminated all its projects in 1994 but has yet to publish a consolidated report of all its findings*

Centre for Rehabilitation Studies

- *Between 1996 and 2002 the Centre for Rehabilitation Studies of the Madhya Pradesh Gas Relief & Rehabilitation department compiled figures comparing morbidity, eye, lung and gastro-intestinal diseases between gas-affected and non gas-affected populations*
- *Its findings are presented as a series of charts*

General morbidity

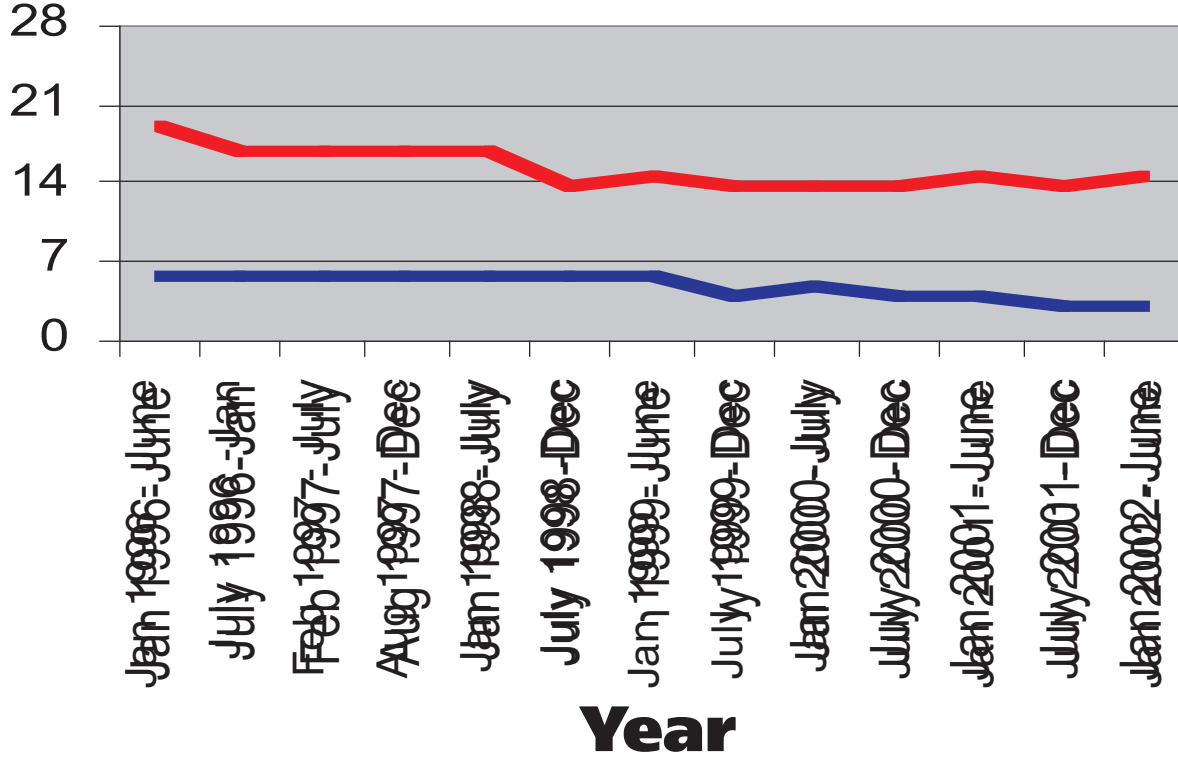
— Gas affected
— Non affected



Lung diseases

— Gas affected
— Non affected

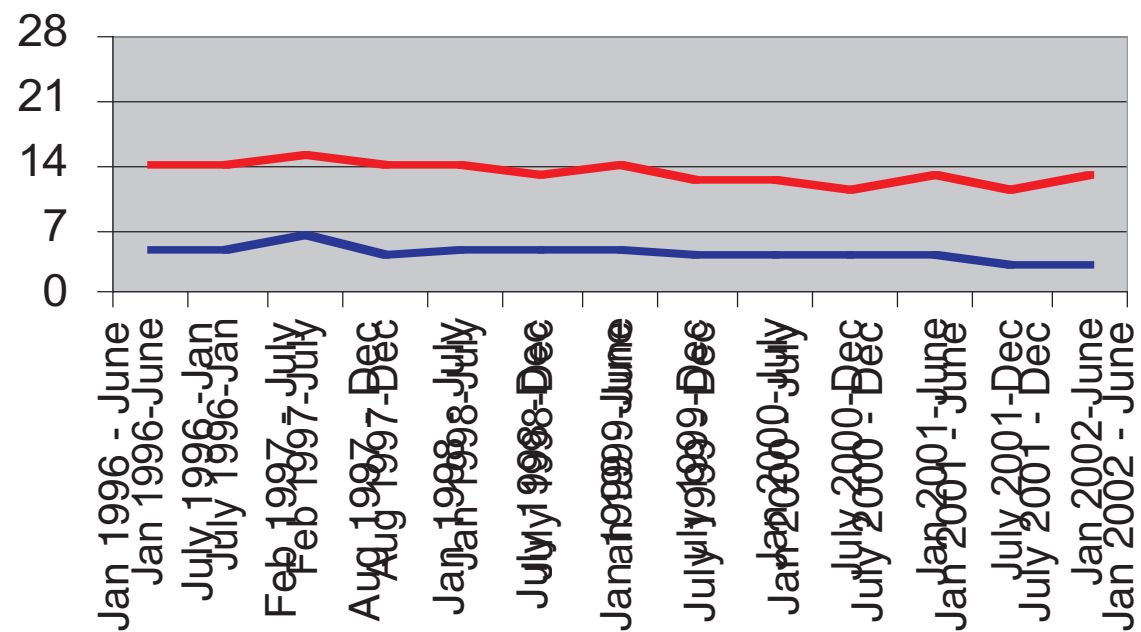
Percentage of people



Eye diseases

— Gas affected
— Non affected

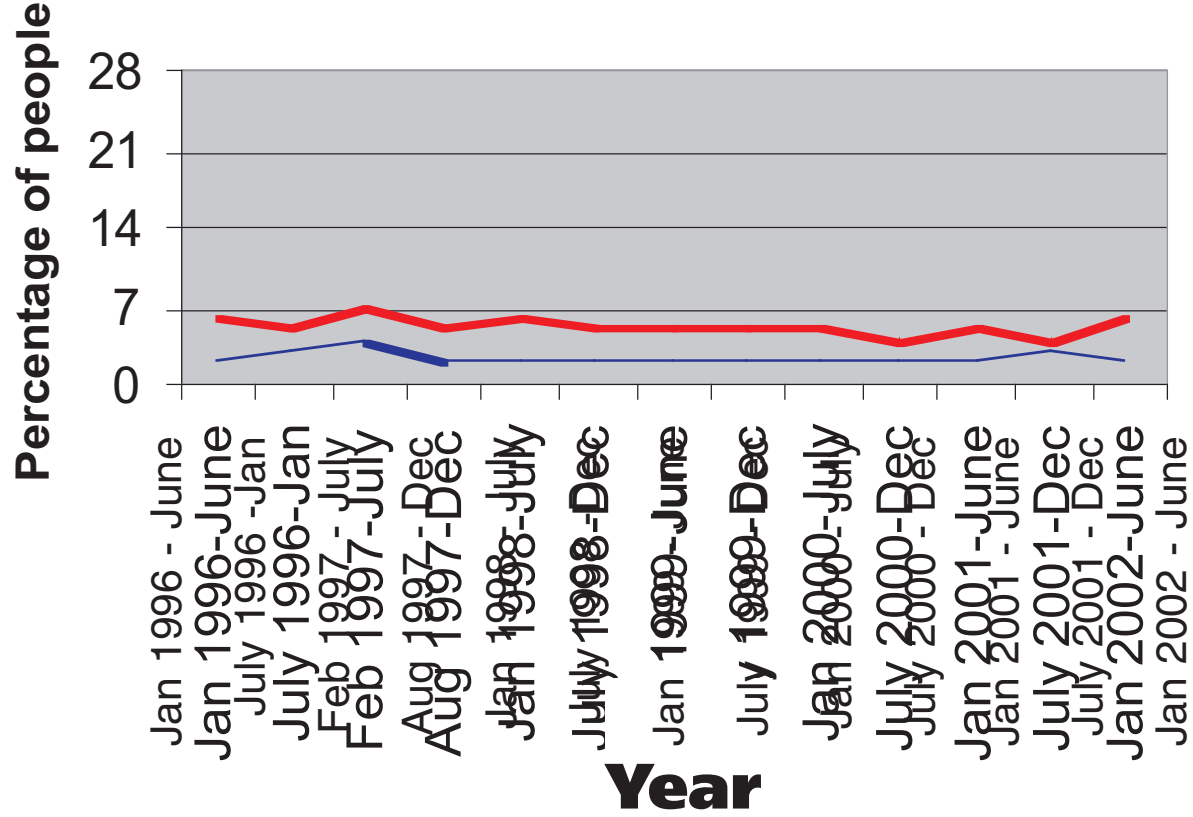
Percentage of peop



Year

Gastro intestinal

— Gas affected
— Non affected



A person wearing a white tank top, dark shorts, and a white cap is bent over, working with large, light-colored bags in a dusty, industrial or construction environment. The person is positioned in the center-left of the frame. The ground is covered with a thick layer of dust and debris. In the background, there are concrete walls and a metal door with some graffiti. The overall scene suggests a hazardous or unregulated waste disposal site.

**6. ENVIRONMENTAL
PROBLEMS ASSOCIATED
WITH TOXIC WASTE
DISPOSAL**

A partial list of chemicals found to be present within the Union Carbide factory, Bhopal, and their health effects

1	<i>Carbaryl (Sevin) 4,5</i>	<i>stockpiles4, disposal sites5</i>	<i>Can cause toxicity if breathed in, by oral intake and by passing through skin. Exposure to carbaryl can cause nausea, vomiting, diarrhoea, bronchoconstriction, blurred vision, excessive salivation, muscle twitching, cyanosis, convulsions, coma and respiratory failure.i Repeated exposures may affect the liver, kidney and nervous system.vii</i>
2	<i>Chlorinated biphenyls (PCB's)4</i>	<i>stockpiles4</i>	<i>shown to cause cancer, and to effect the immune system, the reproductive system, the nervous system, the endocrine system and to have other health effects in animals. ii</i>

3	<i>Chlorinated naphthalenes</i> 4	<i>stockpiles</i> 4	<i>symptoms include effects on skin, liver, digestive tract and peripheral nervous system.iii</i>
4	<i>Chlorobenzene</i> 4	<i>stockpiles</i> 4	<i>Human exposure causes CNS depression and respiratory tract irritation and animal studies have reported liver necrosis, renal toxicity and effects on the pancreas, blood and lymph and adrenal glandsiv, v</i>
5	<i>Dichlorobenzene, 1,2, 4</i>	<i>soil</i> 1, <i>soil</i> ,2 <i>stockpiles</i> 4	<i>Effects reported are anaemia, skin lesions, vomiting, headaches, eye and respiratory tract irritation, anorexia, weight loss, yellow atrophy of the liver, blood dyscrasias, porphyria, and chromosomal breaks in blood samples. Animal experiments recorded liver and kidney damage to be the most frequent effects, though high doses caused CNS perturbation and death through respiratory depression. vi</i>

6	<i>Hexachlorobenzene (HCB)</i> ⁴	<i>stockpiles</i> ⁴	<i>Carcinogen. May damage the developing foetus, liver, immune system, thyroid and kidneys and central nervous system. Porphyria is a common symptom of HCB toxicity. Can cause irritability, difficulty with walking and co-ordination, muscle weakness, tremor and/or a feeling of pins and needles on the skin. Repeated exposure can lead to permanent skin changes, such as changes in pigmentation, tight, thickened skin, easy wrinkling, skin scarring, fragile skin and increased hair growth, especially on the face and fore-arms.</i> ^{viii,ix,iii}
7	<i>Hexachlorocyclohexanes (HCH – e.g. Lindane)</i> ^{2,3,4,5}	<i>soil, 2,3 stockpiles, disposal sites</i> ⁵	<i>Depressant of the nervous system</i> ^{xi,xii} <i>Different isomers present have caused in animals; tremors of the extremities and inability of animals to make coordinated movements; lameness and a peculiar flaccidity in the entire musculature; prostration, motionlessness. They are anticipated</i>

		<p><i>They are anticipated carcinogens xwith the potential for causing reproductive damage in humans.xiii,xiv Animal poisoning by lindane causes an increased respiratory rate, restlessness accompanied by increased frequency of micturition, intermittent muscular spasms of the whole body, salivation, grinding of teeth and consequent bleeding from the mouth, backward movement with loss of balance and somersaulting, retraction of the head, convulsions, gasping and biting and collapse and death usually within a day.xii Long term effects can last for months or years. Lindane has been shown to cause liver, lung, endocrine gland and other types of cancer in animals xii, xv</i></p>
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8	<i>Hexacholoro butadine 2,4</i>	<i>factory,2 stockpiles4</i>	<i>toxic to humans and may cause damage to animals, birds, fish, and plants.iii, x</i>
9	<i>Lead 2,3,4</i>	<i>soil 2,3 stockpiles 4</i>	<i>exposure to excessive levels of lead can cause brain damage; affect a child's growth; damage kidneys; impair hearing; cause vomiting, headaches, and appetite loss; and cause learning and behavioral problems. In adults, lead can increase blood pressure and can cause digestive problems, kidney damage, nerve disorders, sleep problems, muscle and joint pain, and mood changes. xvi</i>
10	<i>Mercury2,3</i>	<i>soil,2 factory,3</i>	<i>toxic to the nervous system - the brain and spinal cord - particularly the developing nervous system of a fetus or young child. Adults who have been exposed to too much methyl mercury might begin to experience trembling hands and numbness or tingling in their lips, tongues, fingers or toes. These effects can begin long after the exposure occurred. At higher exposures, walking could be affected, as well as vision, speech and hearing. In sufficient quantities, methylmercury can be fatal.xvii</i>

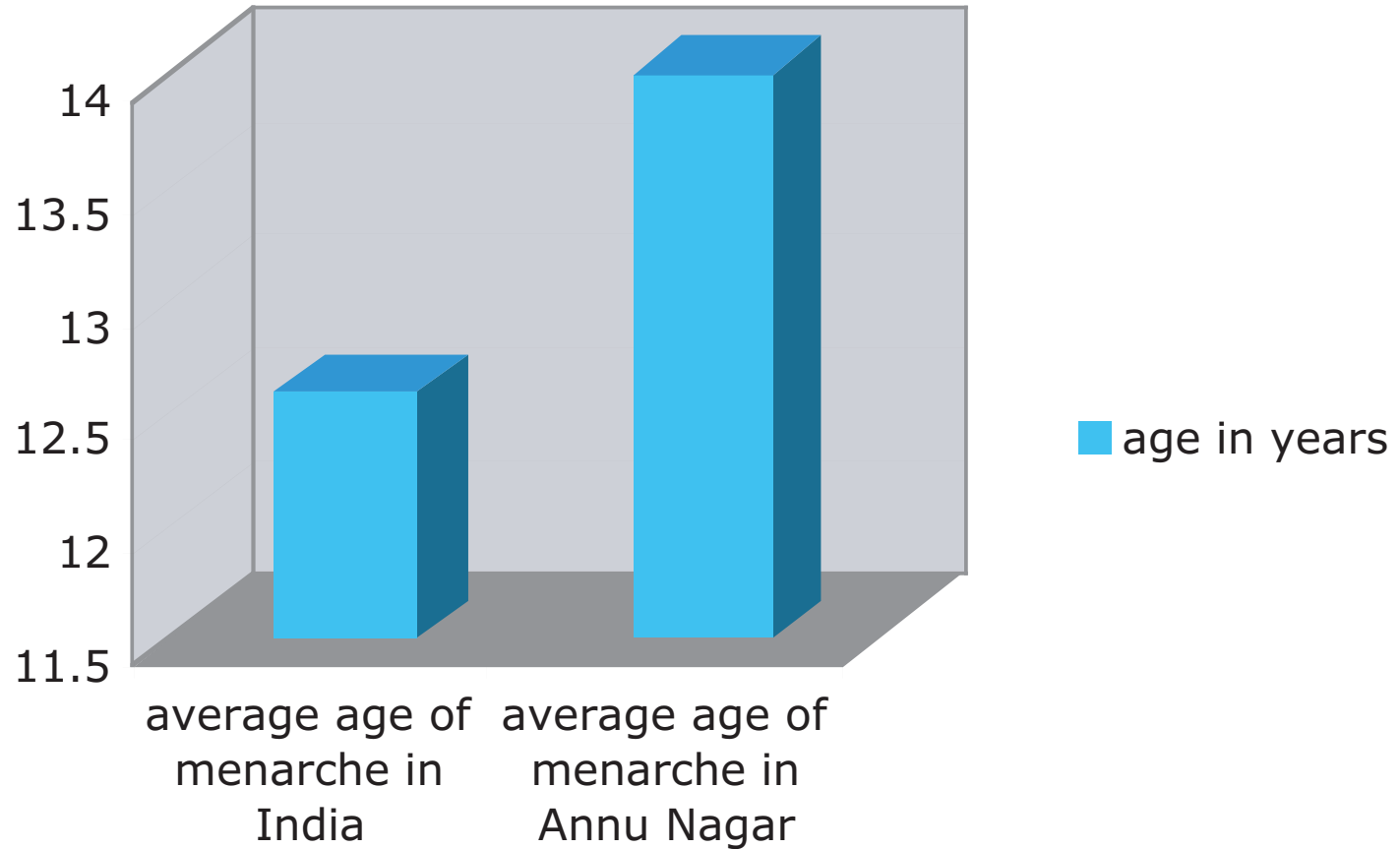
Sambhavna findings on health effects

- *in Annu Nagar (population 1528), 91 % of the residents were using water from the contaminated hand pumps*
- *every second person in the community was suffering from a multitude of symptoms*
- *the commonest symptoms among all age groups were found to be abdominal pain followed by giddiness, pain in chest, headache and fever*

Sambhavna findings *(contd)*

- *these symptoms were most frequent among gas affected people who were additionally exposed to contaminated water.*
- *one of the significant findings of the survey was that among the teenage females between 13 and 15, 43% had not begun their periods.*
- *date of survey: July 2001-January 2003. Survey by: Sambhavna Clinic. Survey sample: 1528 individuals [819 male 54 %, 709 46 % female] from 270 families. Out of 1528 individuals (1175 individuals) 77 % are only contaminated water victim and (353 individuals) 23 % are gas victim + water Victim.*

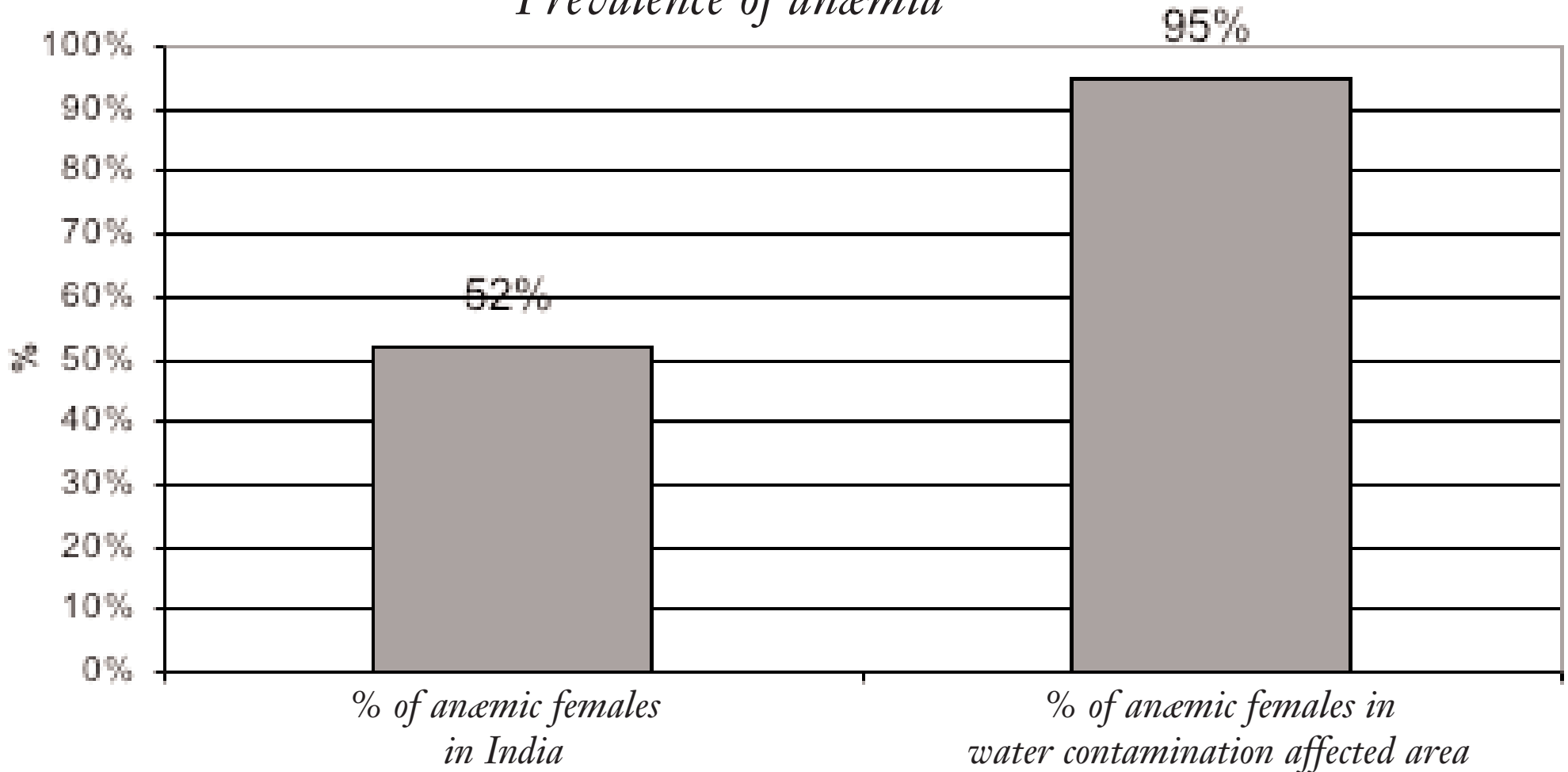
*Average age of menarche in Annu Nagar -
a water contamination affected community.*



India data: Journal of Indian Pediatrics, Department of Pediatrics and Gynecology NSCB Medical College, Jabalpur, MP
Annu Nagar data: Sambhavna Trust Clinic.

Abnormal health indicators among residents of water contamination affected communities, Bhopal

Prevalence of anaemia



Date of survey: July – December 2000. Survey by: Sambhavna Clinic. Survey sample: 141 women, 40 men. Data for anemia among females in India provided at <http://www.unicef.com>, Unicef International

7. LEGAL CASES IN THE US & INDIA

- *Bano v Union Carbide Corporation in New York*
- “*Writ Petition (c) No. 657 of 1995*”, *Supreme Court of India*
- *Public Interest litigation in the High Court, Jabalpur, Madhya Pradesh*
- *Criminal case State v Warren Anderson & Others*

Bano v Union Carbide Corp

- *A class action suit Bano v. Union Carbide Corporation was filed in 1999 in the Southern District Court of New York under the Alien Torts Claims Act. In 2004 a related case Sahu v. Union Carbide, was filed*
- *plaintiffs were seven individual Bhopal survivors and five organizations representing survivors, claiming relief for damage caused by the Bhopal factory contamination*
- *the suit has been dismissed three times by Judge Keenan, twice he has been reversed and the third reversal is awaited, at which point the judge is likely to recuse himself*

“Writ Petition (c) No. 657 of 1995”, **Supreme Court of India**

- *the Research Foundation for Science Technology & Natural Resource Policy filed a 1995 petition against unregulated hazardous waste imports*
- *the scope was later widened to cover issues of local waste generation and was used by survivors to petition the Apex court for clean water supplies*
- *the court appointed a Monitoring Committee to enforce its order that contaminated communities must be provided with clean water was carried out by local politicians. Promises have flown but no action has been taken*

Public Interest Litigation in the High Court Jabalpur

- *filed by Alok Pratap Singh of 'Jabrili Gas Peedit Morcha' against UCIL with regard to the contamination at the Bhopal plant site*
- *The High Court served notices upon the Union Government of India, the Madhya Pradesh government, Union Carbide, EIIL and the Dow Chemical Company*
- *NGOs have succeeded in stopping an incompetent 'clean-up' begun at the direction of the court and have been asked to contribute their expertise*

Criminal Case No.

(MJC) No. 91 of 1992:

State v Warren Anderson & others;

Criminal Case

No. RT- 8460/96:

State v Keshub Mahindra & Others

- *A suomotu FIR was recorded by the SHO at Hanumanganj police station on 3 December 1984 against UCC, UCIL and its executives and employees under section 304(A) of the Indian Penal Code – the charge is culpable homicide*
- *7 December 1984: Warren Anderson (A1), Keshub Mahindra (A2) and V.P. Gokhale (A3) were arrested and released on bail on the same day*
- *On February 1, 1992, The CJM Bhopal directed Warren Anderson, UCC and UCC (Eastern, Hongkong) to be proclaimed absconders, later attaching UCC's assets in India – the assets were subsequently unfrozen by the Supreme Court and sold in order to fund the construction of a 500 bed hospital*
- *an attempt to extradite Warren Anderson was refused by the State Department. Efforts to get Dow into court in place of its missing subsidiary are presently stalled. The case is still pending before the Bhopal Chief Judicial Magistrate*

8. SOCIAL & ECONOMIC CONSEQUENCES OF THE DISASTER

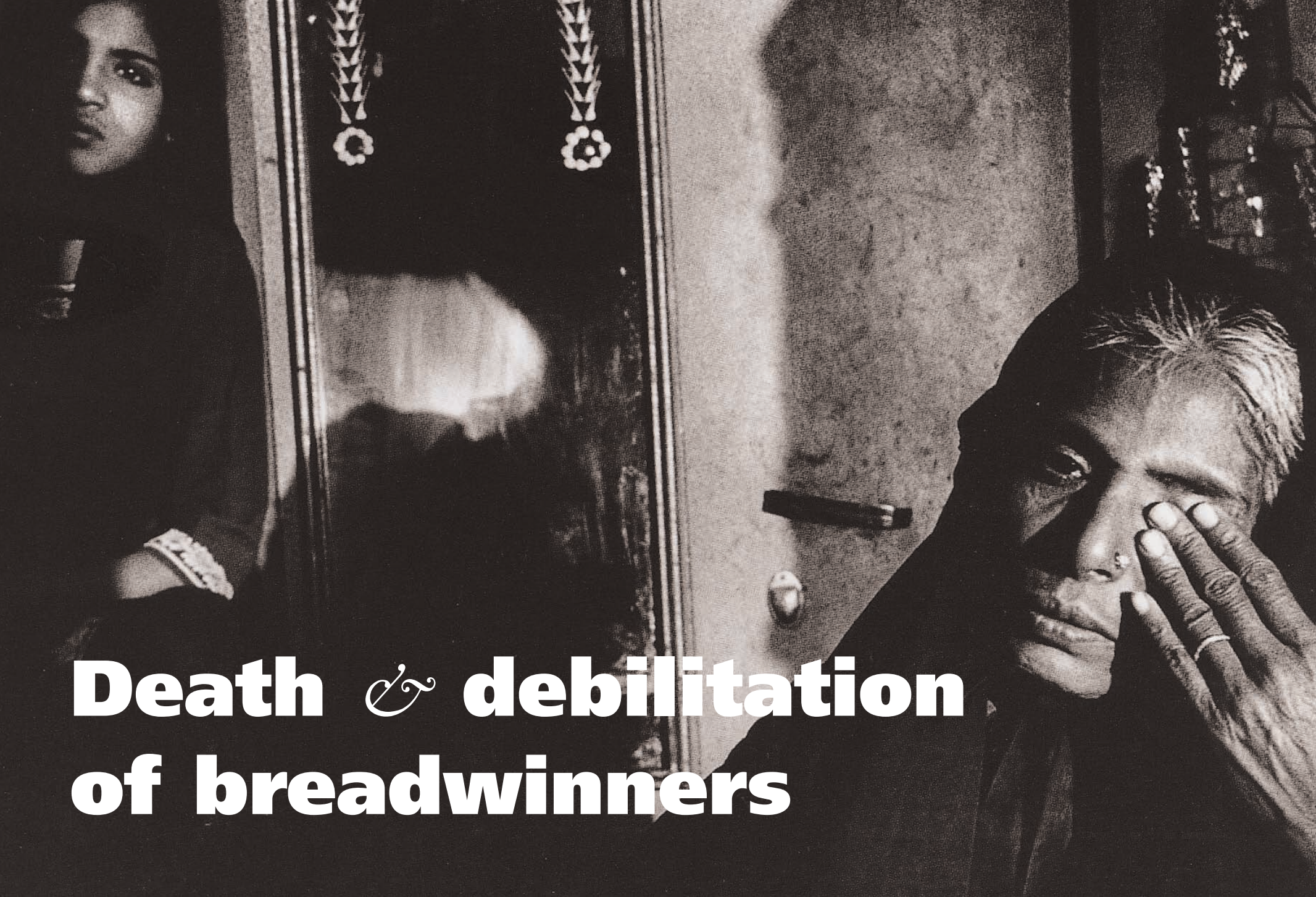
- *effect on livelihood*
- *death and debilitation of breadwinners*



Effects on livelihood

- *ICMR studies place 68-86% of the population in the severely affected area of Bhopal in a 'very depressed socio-economic class'*
- *A 1985 Medico Friend study found that 65% of working people in the severely exposed area faced a drop in income ranging from 20% to 100%*
- *In 1990, 90% of those who had worked before the leak reported a reduced capacity to work. Daily wage labourers – an estimated 70% of the gas affected working population – felt the effects most keenly*

- *According to a survey of workers conducted by the Fact Finding Mission on Bhopal (FFM Bhopal), 35% of male workers and 25% of female workers became unemployed after the gas.*
- *Economic rehabilitation schemes created by the MP govt have employed less than 100 gas survivors since 1994.*



**Death *&* debilitation
of breadwinners**

- *456 workers in the FFM Bhopal survey suffered chronic cough (81%); weakened eyesight (67%) and breathlessness & weakness (34%).*
- *many respondents had left their job because of ill-health*
 - *had slowed down in their work*
 - *were able to work only intermittently*
 - *suffered perpetual fatigue*
 - *and were not able to work after sunset because of eye problems*
- *thousands of homes have been thrown into debt through full-time care of family members.*
- *widows receive a paltry Rs 150 per month. Their claims are often denied because of their age*

9. WHAT HAS BHOPAL TAUGHT

- *corporations*
- *governments*
- *civil society*

Bhopal isn't only about charred lungs, poisoned kidneys and deformed foetuses. It's also about corporate crime, multinational skullduggery, injustice, dirty deals, medical malpractice, corruption, callousness and contempt for the poor. Nothing else explains why the victims' average compensation was just Rs 25,000 for a lifetime of misery. Yet the victims haven't given up. Their struggle for justice and dignity is one of the most valiant anywhere. They have unbelievable energy and hope. The fight has not ended. It won't, so long as our collective conscience stirs.

OUTLOOK INDIA 7 OCTOBER 2002