THE BHOPAL DISASTER

Ashay Chitre, a film maker living in Bhopal's prestigious Bharat Bhawan, built by the state government to attract artists to this central Indian city, heard a commotion outside his window early in the morning at about 3 a m. It was a chill December and all the windows of Chitre's house were closed. As Chitre and his wife Rohini, seven months pregnant, opened the window, they got a whiff of gas. They immediately felt breathless and their eyes and noses began to stream with a yellow fluid.

Sensing danger, the couple grabbed a bedsheet and ran out of the house. Unknown to them, all the neighbouring bungalows, which had telephones, had already been evacuated. Their immediate neighbour, state labour minister Shamsunder Patidar had fled. The chief minister, who lives only 300 m from the Chitres had probably also been informed in time.

Outside their house the Chitres found chaos. There was gas everywhere and people were running for their lives in every direction, with nobody to tell them the safe way out. Some fell down vomiting and died. The panic was so great that people left their children behind, or did not stop to pick up those overcome by exhaustion or the gas. At one place, the couple saw a family stop running and sit down: "We will die together", they said. Another person ran for 15 km in a desperate bid to escape. A passing police van had no clue to the safe direction. Stepping over dead bodies, the Chitres ran towards the local polytechnic, half-a-kilometre away, where they stopped and decided not to go further.

Two hours later, at about 5 am a police van arrived announcing that it was safe to go back home. But nobody believed the policemen. From the polytechnic, the Chitres rang friends on the other side of the town for help. They returned home three days later. Their pomegranate tree had turned yellow and the peepul tree, black. Three days after that fateful night, Rohini began to experience pain whenever she exercised and Ashay felt his legs buckle. They immediately left for Bombay to see a neurologist to ascertain their fate and that of their unborn child.

Mass panic

There were thousands of others that night in Bhopal for whom this macabre drama began much earlier and who were a lot less luckier than the Chitres. Most of them were the city's poor, living in the sprawling settlements opposite and around the Union Carbide factory. One of them is Ramnarayan Jadav, a driver of the city corporation, who says that he had started feeling the gas around 11.30 itself. But he stayed on for at least another 45 minutes because "this much gas used to leak every eighth day and we used to feel irritation in the chest and in the eyes. But finally everything used to calm down." Even if the company had set off its warning siren then, many could have escaped.

But nothing happened and many thousands woke up only between 12.30 and 1 am, by which time the gas was spreading in high concentrations. People woke up coughing violently and with eyes burning as if chilli powder had been flung into them. As the irritation grew and breathing became impossible, they fled, some with their families and many without. They got on to whatever they could — cycles, bullock carts, buses, cars, autorickshaws, tempos, trucks and mopeds. Scooters had whole families on them. Trucks were full but people hung on outside, some grabbing the legs and hands of those already inside. Small children, old men and women were pushed in handcarts or carried.

By 3 am the main thoroughfares were jammed with an unending and uncontrollable stream of humanity. The streets were foul with vomit. Those who fell were trampled by the crowd. The worst affected were the children: unable to walk and breathe, they simply suffocated and died.

Thousands fled to towns hundreds of kilometres away: Sehore, Vidisha, Hoshangabad, Raisen, Obaidullaganj, Ashta, Ujjain, Dewas, Indore, Ratlam and even Nagpur, 400 km away. About 10,000 men, women and children reached Sehore between 2 am and 4 am. Another 10,000 went to Raisen. They flocked to the district hospitals for treatment. Hundreds of people who dashed to Ujjain and Indore had to be immediately hospitalised there. In the midst of this frenzy, there was no dearth of valour. Hundreds of taxi, autorickshaw, tempo and truck operators risked their lives to evacuate thousands of people.

The gas that spewed out of the hi-tech factory of the multinational Union Carbide spread over some 40 sq km and affected people seriously as distant as five km to eight km downwind. For nearly 200,000 people, a quarter of the city's population, Bhopal became a gas chamber. If it were not for the two lakes of Bhopal which came in the way of the gas cloud and neutralised it, an even bigger tragedy could have taken place.

Carbide's lies

The response of Union Carbide to the happening of that ghastly night was lies. As victims crowded into the Hamidia Hospital, L D Loya, the company's medical officer, told the frantic doctors: "The gas is non-poisonous. There is nothing to do except to ask the patients to put a wet towel over their eyes."

This was not Union Carbide's only lie. At about 1 am, city Superintendent of Police Swaraj Puri was woken up by a town inspector telling him that people in Chola, a settlement about two km from the plant, were fleeing because of a gas leak. Puri rushed to the police control room by 1.25 am only to find the duty staff coughing violently and rubbing their eyes. Between 1.25 am and 2.10 am he called the plant three times; twice he was told: "Everything is OK." The third time: "We don't know what has happened, sir," before the phone was banged down.

At about 1.45 am — 45 minutes after the leak was confirmed — the Additional District Magistrate got through to J Mukund, the works manager, at home. Mukund was not even aware of the gas escape and replied: "The gas leak just can't be from my plant. The plant is shut down. Our technology just can't go wrong. We just can't have such leaks."

At no point during that night did Union Carbide itself try to reach the authorities with information about the leak or tell them what to do. At about 3 am Union Carbide did send a man, a retired major who works with a private security outfit employed by the company, with the message that the leak had been plugged, a blatant lie as no plugging ever took place; the gas had simply stopped oozing. But Mukund again told a reporter the next morning that the leak had been plugged within minutes of his being informed.

In fact, even 15 days after the disaster and thousands dead, Mukund was still defending his statement: MIC is only an irritant, it is not fatal. "It depends on how one looks at it. In its effects, it is like tear gas, your eyes start watering. You apply water and you get relief. What I say about fatalities is that we don't know of any fatalities either in our plant or in other Carbide plants due to MIC," said Mukund.

That fateful night

Exactly what happened in the Union Carbide factory that night is still not known officially from the Government of India. But press reports have built up the following sequence of events.

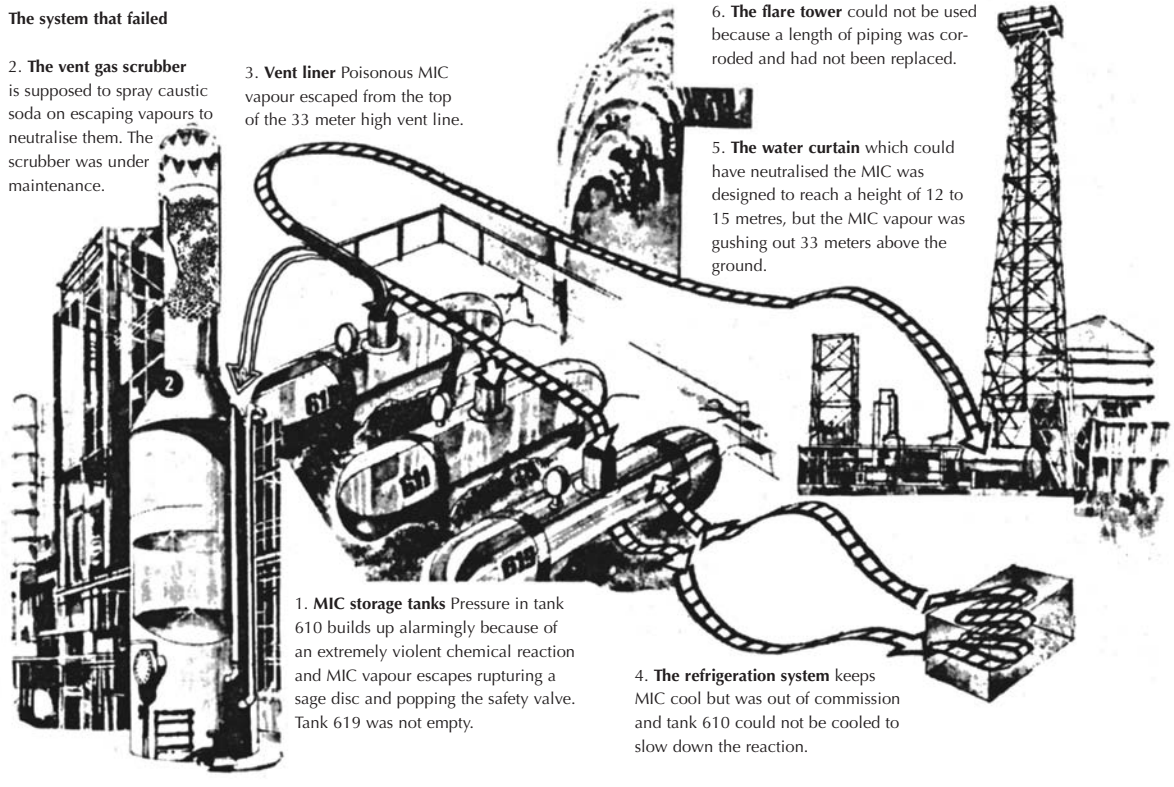
MIC is stored in three double-walled, partly buried stainless steel tanks — code named 610, 611 and 619. While thousands slept in their huts around the pesticide factory on the night of December 2/3, a skeleton staff of 120 workers inside the factory ended its evening shift around 10.45 pm and a new shift took over around 11 pm. One of the workers then noticed that the pressure in tank 610 — the tank from which all the MIC finally escaped — had risen from the two lb per square inch (psi), recorded by the earlier shift, to around 10 psi. Corresponding tank temperatures were not available as they were not logged normally. The five-fold increase in pressure within an hour was dismissed in the belief that the pressure recording instrument could be faulty. Shakil Qureshi, the supervisor on duty, said later, "Instruments often didn't work. They got corroded. Crystals would form on them."

About 11.30 pm, workers in the plant realised there was an MIC leak somewhere: their eyes began to tear. A few of them walked around the MIC structure and spotted a drip of liquid about 50 feet off the ground and some yellowish-white gas accompanying the drip. They told Qureshi about the leak at about 11.45 pm. Qureshi, however, decided to deal with the leak after the tea-break, scheduled for 12.15 am. Qureshi says he was told only of a water leak. But by the time the tea-break ended at 12.40 am, events were moving very fast.

Suman Dey, a worker at the plant, noticed that the temperature gauge on tank 610 had reached 25°C, the top of its scale, and pressure was rapidly moving towards 40 psi, the point at which the emergency relief valve opens. He rushed to the storage tanks to investigate and was horrified. As he stood on a concrete slab above the storage tanks, the slab suddenly began to shake. "There was a tremendous sound, a messy boiling sound, underneath the slab, like a cauldron." He ran, only to hear a loud noise behind him. The slab, made of 60 feet of concrete at least six inches thick, was cracking. The heat was like a blast furnace. He couldn't get within six feet of it. He then heard a loud hissing sound and saw gas shoot out of a tall stack connected to the tank and form a white cloud drifting over the plant and towards the sleeping neighbourhood. In the plant, he found that the pressure indicator had gone above 55 psi, the top of the scale, and the safety valve had opened releasing MIC from the storage tank.

As the workers realised it was a massive MIC leak, Qureshi ordered all water sources in the area shut off. Over three hours before, a Calcutta battery factory owned by Carbide had asked a novice operator to clean a pipe. The supervisor told him to open a nozzle on the pipes and put a water hose in to clean the inside. The pipe took filtered MIC to the storage tanks. It had a valve that had been closed. The slip blind which ought to have been inserted to make sure the water did not leak through the valve, was missing. Valves in the plant were notorious for leaking. Qureshi claimed there were no instruments either to check leaky valves.

As Qureshi realised the enormity of the leak, he asked for water to be sprayed on the leak. But nothing seemed to work. The water jet failed to reach the top of the 120 ft stack from which MIC was escaping. Suman Dey then rushed to turn on the vent gas scrubber to neutralise the escaping gas. The scrubber had been under maintenance and had been removed from an "operating mode to a standby mode". The flow meter did not indicate that the circulation of caustic soda — the neutralising agent — had started. No one also knew of the caustic soda concentration because no analysis had been made since October.



India Today

The factory has two sirens: a loud, continuous one for the public and a muted one meant for factory workers alone. The public siren was put on around 1 am, nearly an hour after the gas had started escaping, but it was put on only for a few minutes, when the muted siren took over. This followed the company's procedure which was evolved to avoid alarming the public around the factory over tiny leaks.

Most residents around the factory woke up not because of the siren but because of the irritation caused by the gas. Meanwhile, an announcement was made over the factory's public address system about the wind direction and the workers fled opposite to it. This saved them all except Qureshi who fell, broke some bones, inhaled the gas, and was for long in hospital. The public siren came back at 3.00 am, after the works manager arrived, but by then there was no need to tell anybody: hundreds were already dead and many were destined to die over the next few hours and days.

UCC's report on the incident claims that tank 610 had 90,000 pounds of MIC at the time of the incident. For approximately two hours, the safety valve remained open releasing over 50,000 pounds of MIC in vapour and liquid form — and goodness alone knows what other gases: phosgene, hydrogen cyanide, carbon dioxide, all of which have been mentioned. Sometime between 1.30 am and 2.30 am the safety valve reseated, as the tank pressure went below 40 psi.

Safety devices

The plant has two main safety devices. The first is a scrubber, which neutralises the gas with caustic soda. If the scrubber fails, the gas goes to the flare tower to be burnt off. Both the safety systems failed to work that night. For days, newspapers reported guesses about why the safety systems did not work.

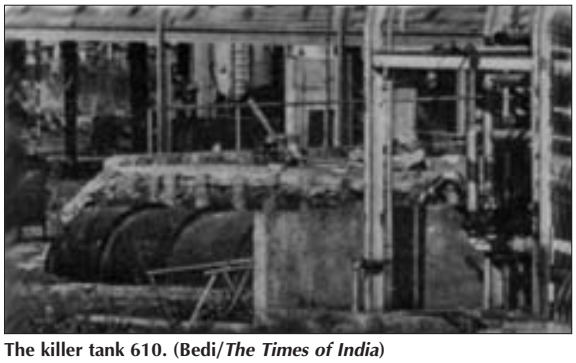
On December 7 the first real bit of news appeared. Leaders of the factory's employees' union claimed that the vent gas scrubber had been under repair. About 10 days later, the factory's works manager J Mukund publicly contradicted this report but was unable to answer how he knew the vent scrubber had worked. UCC has since claimed that the used caustic soda tank was hot to touch (60°C) on the morning of December 3, indicating that it must have worked. But it is now also widely accepted that the scrubber was grossly underdesigned and could not have neutralised more than a fraction of the escaping gases.

The flare did not work because the management had disconnected the pipeline running from the vent scrubber to the flare tower for maintenance and connected it to a vent gas pipe which went straight to the atmosphere. Even the flame on the flare tower had been shut off. Thus, all the plant's safety defences were down.

There were three other safety systems that were either not used that night or proved to be underdesigned. First, the factory has a network of water jets. But they could not reach the height at which the MIC was gushing into the air. Second, the MIC storage tanks are connected to a 30-t refrigeration system which keeps the liquid MIC at 0°C. The refrigeration system had been closed down in June 1984, and the gas was at 15°-20°C. Had the refrigeration system been working or capable of working, the MIC could have been cooled. Refrigeration would have increased the time available for detection of the chemical reaction and safe disposal of the material before the reaction reached a dangerous speed. Third, the Bhopal plant had three tanks, each with a 60-t capacity, one of which was to be always kept empty for contingencies. But all the tanks contained MIC that night.

Violent reaction

But what caused the violent reaction that night? Union Carbide's scientists have been aware of the possibility of an explosive 'runaway reaction' in MIC. This gas can react with almost any chemical, including itself, to generate substantial quantities of heat and carbon dioxide. The heat released causes the reaction to speed up, which generates more heat, and pressure can thus go on building up till it finally reaches an explosive level. The longer the MIC sits in storage tanks, the greater the chance of side-reactions building up to a runaway reaction. The MIC at the Bhopal plant had been sitting in the storage tank since October. Demand for carbaryl was not very high.



The killer tank 610. (Bedi/*The Times of India*)

The precise sequence of events still remains obscure. Carbide's report has claimed that it was an unique combination of large amounts of water (120 to 240 gallons), higher than normal amounts of chloroform in the stored MIC (several per cent instead of a maximum of 0.5 per cent), and an iron catalyst, that led to the violent reaction in MIC, stored at a higher than specified temperature. The heat released by the reaction between the water and MIC raised the temperature in the tank. Simultaneously, MIC got polymerised, the reaction being catalysed by iron resulting from the corrosion of the tank walls due to the high temperatures. Carbide claims that the corrosion rate increased markedly because of the presence of an abnormally high level of chloroform. The rapid release of carbon dioxide in large quantities then helped to build up high pressures, which forced the foaming mass of chemicals out of the tank.

Several Indian experts are not convinced of Carbide's explanation. The quantity of iron needed for the explosive reaction could not have come from the corrosion of the stainless steel tank. Carbide claims that the reaction lasted only three-and-a-half hours. Indian experts, therefore, argue that iron must have been already mixed with the water that seeped into the tank. UCC, in its drive for cost cutting, had used pipes and valves made of inexpensive carbon steel instead of stainless steel, against its own safety rules. Thus, the iron must have come from the pipelines and not the tank.

S Varadarajan, who led the investigations on behalf of the government, has expounded another hypothesis. Small quantities of water — probably as little as two to three litres — could have reacted with phosgene in the tank, mixed with MIC as an impurity to keep it stable. The phosgene-water reaction produced heat, carbon dioxide and hydrochloric acid. The heat and hydrochloric acid acted as the accelerators of the polymerisation of MIC leading to a runaway reaction. The reaction could have started even two weeks before the fatal night, steadily building up imperceptibly.

Speaking at the Indian Science Congress in January 1985, Varadarajan claimed that his team had not found anyone in Bhopal who had any idea of the chemistry of MIC. Engineers at the plant went by operating manuals only and did not know the plant design. Efforts to locate the original designers of the factory to learn more about the system had also failed. There is still an absence of hard evidence to confirm exactly what happened. No reliable records exist of a number of parameters involved. The examination of the contents of the tank, particularly the quantity of polymer available in the tank, may help to reach some conclusions.

But even more difficult was the task of journalists who were trying to reconstruct a picture of what happened that night for an overawed public. As one reporter put it, "There was virtually a total clampdown on any kind of information flow on the technical side of the matter. Government officials refused to talk. Only Varadarajan was empowered to talk. Varadarajan himself was not accessible." The Varadarajan report has not yet been made public.

The railway station lay close to the factory and smack in the path of the gas cloud. Rehman Patel, the deputy chief power controller, risked his life by staying on. When Patel's chief came in response to frantic calls, he found him still at work, while his wife and 14-year-old son had already died in the neighbouring railway colony. The control room which monitors movements of all trains on this vital trunk route, was, however, in a mess: vomit and human excreta scattered all around, files and registers in disorder, chairs knocked down.

After midnight, the 116 Up Gorakhpur-Bombay Express rolled in but its passengers miraculously escaped death, presumably because they kept their windows closed because of the cold night, but also because station superintendent H S Bhurvey risked his life to wave the train on to safety. Bhurvey, who was found dead later, also alerted all the nearby stations to stop trains from coming into Bhopal. For more than seven hours, this major station remained cut off from the rest of the world. Next morning, hundreds of sick and writhing people were found all around, on platforms, on staircases, in the office rooms and even on the railway tracks. On the roads and footpaths around the station were the bodies of poor beggars and urchins.

Those who could not flee made their way to the hospitals. At Bhopal's 1,200-bed Hamidia Hospital, the first patient with eye trouble reported at 1.15 am. Within five minutes, there were a thousand and by 2.30 am there were 4,000, suffering from not just eye ailments but also from respiratory problems. The hospital staff's first response was of shock and bewilderment. Nobody knew what to do and Union Carbide was not volunteering any useful information. Several staff members at Hamidia, about three km from the factory, were soon overwhelmed by the gas themselves. They had to be replaced by a fresh medical team. Journalists visiting the hospital at 2.30 am saw only one doctor, and he had no medicine to treat patients with. Till early morning, in fact, there were hardly any doctors and medical students from nearby hostels were filling in. Victims were still being brought in army trucks to the hospitals. In front of hundreds of silent, helpless spectators, people and especially small children were breathing their last. Even when the treatment began in earnest it was only for token relief: application of an eye ointment or an injection to ease the spasms caused by the constriction of the trachea.

By the time the sun rose, hundreds, some even say thousands, lay dead, many on the roads and many at home under their tattered quilts: corpses with distended bellies were beginning to rot, attracting vultures and dogs. Another 2,000 lay dying in hospitals and homes. An equally hideous sight was that of the carcasses of hundreds of dead cattle and animals all over the gas-affected area, swollen up to size of elephants.

By about 1 am, about 25,000 people were crammed into Hamidia Hospital. The floor was splattered with blood and vomit. Said a doctor at Hamidia: "I was standing in the pediatric department. There was such a terrible crowd, that there wasn't even place to keep bodies on the floor. As soon as a patient was declared dead, his relatives would just vanish with the body. I saw at least 50 bodies taken away like this. I would estimate that anything between 500 and 1,000 bodies were taken away before their deaths could be registered." It was difficult for survivors to identify their dead. It was difficult even to distinguish between dead and half-dead bodies. People at the mortuary were unable to cope and conduct post-mortems. One father cried: "They have taken away my son. He was only three years old. My father, mother and two children are in a serious condition. May Allah punish those scoundrels."

Dead administration

While the administration slumbered, the army moved in. The sub-area commander, Brigadier N K Maini, had been called by retired Brigadier M L Garg, general manager of Straw Products, a factory which lay in the path of the gas cloud at about 1.15 am. Garg, who had been told by workers at his factory that they were suffocating, needed help to evacuate some 176 people. He immediately approached the army and got help: several cars and closed trucks. Straw Products workers were evacuated to the military hospitals but not before some were dead and others seriously ill.

By 2.45 am the army had sent a fleet of vehicles and started a systematic search of houses for people trapped within. Major G S Khanuja of the Electrical and Mechanical Engineers Centre made repeated trips to the factory area setting up a continuous evacuation channel to the Military Hospital as well as the Hamidia Hospital all through the night. Khanuja went house to house looking for victims. The city's Superintendent of Police Swaraj Puri, who joined the army in this search later told a reporter, "It was awful, Knock on any door and all you found were bodies." Khanuja was finally hospitalised himself. As Praful Bidwai of *The Times of India* put it, "If there was a wretchedly undignified, hideously helpless form of megadeath after Hiroshima and Nagasaki, this is it."

At the Hindu cremation grounds, about 15 pyres were lit at a time, starting at 9 am. The crematoriums soon ran out of firewood and trucks had to be marshalled to bring in more. To save time, money, energy and humanpower, five to 10 persons were cremated on each pyre. As per Hindu rites, the children and infants were buried at breakneck speed by a group of gravediggers. Few parents were seen around.

At the Muslim burial ground, too, there was not enough space to bury the bodies coming in. Rescue workers dug graves each holding 11 bodies. When there was no more space left, old tombs were opened and 100-year old bones displaced to make room. The head priest of the Muslim clergy in Bhopal had to issue a *fatwa* to allow the digging up of old graves. Packs of dogs prowled around and if they found a grave not deep enough, they would haul out bodies and devour them.

Death drama

The death drama continued for days. Thousands continued to pour into the hospitals of Bhopal, as some 500 doctors and supporting staff rushed in from other cities of Madhya Pradesh. This is how a foreign correspondent, who reached the city 30 hours after the leak, described the state of gas-affected Bhopal: "At the factory, dead bodies were still on the ground, being picked up and loaded aboard a waiting truck. Everywhere one turned, people were retching, racked by violent coughing. All the shops in the city were closed, and on every street people were lying in the gutters. They

The death toll

Exactly how many died in the Bhopal disaster remains a mystery. On the first day, the government counted 400 dead and unofficial sources said 500. The second day, the gap widened. The government figures rose to 550 while unofficial figures jumped to 1,200. The third day saw another 400 deaths at city hospitals. The unofficial figures, thus, rose to 1,600 but the government gave out only 620 — 583 dead in Bhopal and 37 in other cities. On the fourth day, as unofficial figures went up to 1,700, the government doubled its earlier death estimates to 1,327. The chief minister, Arjun Singh, claimed there was no effort to hush-up the number of deaths. Information was yet to arrive from affected villages.

But from the fifth day, the gap between official and unofficial deaths increased again. By the end of January 1985, the government was counting 1,430 dead while newspapers all over the world and in India were quoting the unofficial figure of about 2,500. The Indian Council of Medical Research has since claimed that most of the deaths occurred in the first 48-72 hours, about 1,200 died in hospital wards and the total death figure was probably 2,000. In its petition in the US courts, the government has claimed 1,700 dead.

But there are many who believe that even the unofficial estimates are not anywhere near the truth. Members of the Zahreeli Gas Kand Sangharsh Morcha have claimed that corpses were picked up by the army in hundreds and trucked away to be buried and cremated *en masse*. In those first two horrendous days, few were interested in counting bodies. The Morcha has claimed that the number of dead must have been over 5,000.

A UNICEF official who returned to New Delhi after a week-long visit to Bhopal pointed out in his confidential report in December that the death toll may have been as high as 10,000 and that many government officials and doctors privately believed this figure to be true. The local Cloth Merchants' Association had claimed that retailers had sold or distributed cloth for over 10,000 corpses. UNICEF estimated that affected people were about 200,000 of which 80 per cent were Muslims, 75 per cent slum dwellers, 40 per cent children below one year of age, 20 per cent women in the reproductive age group, and 10 per cent elderly women.

The result of the door-to-door survey conducted by the Bombay-based Tata Institute of Social Studies and other schools of social work have failed to gain any credibility. The survey was commissioned with great fanfare by the state government and its results were to become the basis for relief, compensation and long-term treatment. But its total tally of 1,021 dead, even less than the officially counted bodies, has been a subject of much derision.

The survey failed to cover 600 families in which multiple deaths could have occurred. It could not enumerate 315 families in the worst affected areas who had migrated to other cities after the disaster, and another 286 families whose houses were locked. The survey also failed to cover over 3,000 people who were shelterless in the city. Many beggars and pavement dwellers who lived around the railway station had died in the gas tragedy. The government does not as yet have an authentic list of the victims.

The Centre for Social Medicine and Community Health of the Jawaharlal Nehru University in New Delhi has also conducted a survey in which one out of every 15 households living in the most adversely and moderately affected 29 *bastis,* with a total population of about 68,000, were enumerated. The survey actually found 82 dead and five missing people in 65 households — one death each in 49 households, two deaths each in 11 households, three deaths each in four households and four deaths in one household — which gives a total death rate of 1,305 in the 29 bastis surveyed.

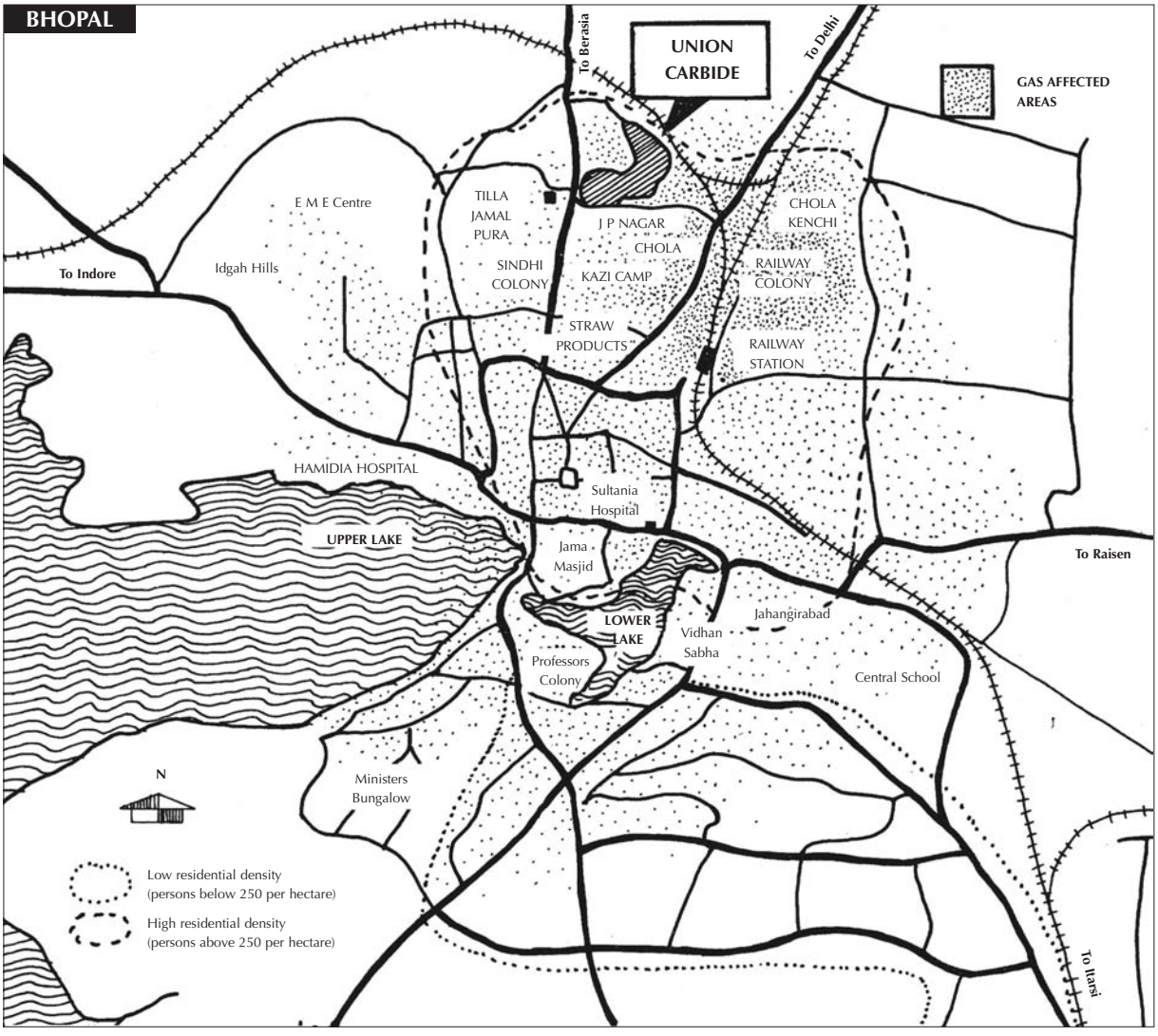
The study found that those who died were the poorest. More than half the affected people belonged to an income group — about Rs 150 per head per month — which cannot afford two full meals a day around the year. Those who died were even more disadvantaged than the overall affected population. The patched up planks, pieces of tin, plastic sheets and thatch which formed the walls and roofs of their hutments, left gaping holes for the gas to come into their grossly overcrowded single 'rooms'. Seventy-four per cent ran on foot after hearing of the poisonous gas, six per cent on a vehicle (motorised or bicycle), and 21 per cent decided to stay. None of those who went on a vehicle died. Three quarters of the deaths were amongst those who ran on foot and one quarter amongst those who stayed. The relatively affluent got better protection in their better built houses.

The government still does not know how many died. But they were invariably the poorest of the poor. (Ashok Chaddha)

were dead, dumped in agonised frozen postures, like birds shot from the sky. In their midst were real birds — vultures. When the vultures swooped away, the dogs would charge in and tear off pieces of flesh. Rescuing the dead from the predators were rifle-toting soldiers of the Indian army, joined by volunteer vigilantes carrying long staves. Little children with haunted, running, swollen eyes told of scampering through the night, with no particular destination. They asked the soldiers where they could find their parents. The soldiers replied, "Wait here. A truck will be along and take you to the hospitals. Everyone will be there." The frightened children waited. When the truck came, it took the children to Hamidia Hospital. The army was there too, keeping the human traffic flowing without the usual pushing and shoving. The troops had set up 60 tents, which became instant wards for 20 people each. Some distance away, the army had set up a morgue to which the patrols in the city brought the dead to be identified. "I thought I had seen everything," said Subedar A B Bhosale, "but this is worse than war!"

The third day saw another 400 deaths at the city's hospitals, which said that 75,000 people had been treated by then. Fresh cases of MIC poisoning continued to arrive, raising fears of after-effects. Some victims showed signs of paralysis, 500 developed corneal ulcers and doctors said that they could go blind. At the burial ground, people helping to dig graves were exhausted. "We are sick of burying the bodies. There is no space," they said.

On the sixth day there was yet another scare. Some 51 fresh cases who had earlier been sent home after being treated for minor eye ailments had to be rushed to the hospitals in serious conditions. Doctors believed that these people may have been affected by the fish eaten from Bhopal lake. The main fish market of the city was immediately sealed off by the authorities as a precautionary measure. The next day the government announced that slaughter houses were being closed down so that the meat of gas-affected animals could not be sold, but there was no ban on the sale of fish.



Many believe that the exodus from Bhopal was deliberately engineered by a state government anxious to diffuse growing public anger.

The neutralisation drama

Even as hospital admissions and deaths began to show a steady downward trend, the seventh day after the disaster brought a new source of panic to the city: there were still 15 t of the deadly gas left in the factory, which had to be disposed off before Bhopal could really feel safe.

The government entrusted the task of deciding the disposal process to a team of senior scientists headed by S Varadarajan, director-general of the Council of Scientific and Industrial Research (CSIR). Varadarajan set up his office in the Central government's Regional Research Laboratory at Bhopal and shrouded himself in complete secrecy, nerve-wracking for the rest of the city. Journalists were told that there were four ways of disposing off the gas: neutralise it with a chemical like caustic soda (as is expected to happen in the factory's vent scrubber), incinerate it (as is expected to happen in the factory's flare tower), pack it into drums and ship it off to the parent Union Carbide in the US or elsewhere, or simply start up the factory and turn it into the factory's final product, the pesticide carbaryl.

It was obvious that the company was pushing hard for the last option. UCC of the US had immediately recommended to its units across the world: use up the remaining MIC to produce carbaryl before governments move in to stop those plants. The local Union Carbide management had reportedly tried to reopen the plant on December 7 itself, just four days after the tragedy, to dispose off the remaining gas. But the staff which reported for duty was turned back by the district administration in control of the plant.

Starting the plant again would mean that the chief minister who had piously declared on the fourth day of the disaster that the plant would never be allowed to open again, would have to eat his words. *The Times of India* pointed out angrily this would amount to a "form of capitulation to the company responsible for the death of over 1,300 persons… It would be tantamount to granting Union Carbide some sort of safety approval or certificate and to letting its management, with its all-too-visible safety record, run the plant as it likes."

Word spread on December 10 that the factory had started up again, with one district official claiming that the work to "neutralise the gas had begun" by converting the deadly gas into finished products, but this was immediately denied in a press statement by Varadarajan. The city meanwhile waited tensely. The next day, amid reports that Varadarajan's team had restarted the plant for a test run, Arjun Singh appealed to the people: "There is no cause for panic and I repeat there is no reason to evacuate the city." But even as the chief minister was saying that, he and his government were acting differently. Government vehicles went around the city announcing to a surprised public that all schools and colleges were being immediately closed for 12 days from the next day. The Madhya Pradesh State Road Transport Corporation admitted to journalists that a large number of buses had been summoned to Bhopal from other parts of the state but clarified that this had been done only to cater to the extraordinary rush of people "returning to Bhopal"! *The Times of India* could not even get official confirmation of the decision to get buses.

The people obviously saw in all this a government plan for emergency evacuation while the chief minister gave them false assurances. The government got police vans to go around the city to assure people that there was no danger. A similar

assurance was broadcast over the local station of All India Radio. But all this had very little effect.

Zero-risk method

By the next day, the suspense was over. The government had decided to give in to the company. The chief minister announced that the government team had concluded that starting the factory was the "most practical and safe way" among all other options for disposal of the gas. This was the "zero-risk" method that he had earlier talked about. He said that the factory would start again from December 16 for four to five days to convert the remaining gas into carbaryl but all safety measures would be adopted and the 'neutralisation' process would pose no threat of any kind. He also proclaimed that he would be personally present in the plant throughout the neutralisation process. But to the people, already in a state of panic, all this meant little. Their worst fears were confirmed when they saw the government's two minds' policy continue. The chief minister in the same breath announced that his government was ready to evacuate up to 125,000 people from 13 vulnerable localities to refugee camps, if they wanted to leave, and additional buses would be available for those who wanted to go to friends and relatives in neighbouring towns. A separate camp would also be set up for people's animals.

The people displayed little faith in government pronouncements and decided to vote with their feet. The trickle which began on the day of the chief minister's announcement became a flood the next day. By the evening of December 13, over 100,000 people had left the city in an unprecedented peacetime exodus. The bus terminus was crowded the whole night and the authorities called up hundreds of extra buses. People travelled on rooftops of crowded buses and trains leaving Bhopal. Many transported their animals to neighbouring villages. Asked why they were leaving the town when the chief minister had declared that there was no danger, almost everyone said, "We do not want to die."

Said a PTI report: "The only people left behind (in the 13 localities identified by the chief minister as the sensitive areas) are either those with their own vehicles or those too poor to afford even a ride to safety. The spontaneous migration is unbelievable but true, defying logic or reason. It's like being driven by the fear of the unknown, a fever spreading like contagion. When told chief minister Arjun Singh himself would be present at the pesticide plant during the operation, they quipped, 'Men like him can fly away. How about us?"

The next day was no different and the exodus continued. The panic gripped the populace to such an extent that a large number of even those receiving medical treatment at several hospitals left their beds. By the evening of December 14, nearly a quarter of the city's population had fled.

Even the government's camps did not generate much confidence. Only a measly number — 4,800 people — reached them. But here too they were as terrified as they were in the slums. The Indore daily *Nai Duniya* reported: "If they had money, families, friends and relatives, they too would have gone far away from this ill-fated city. It is mostly beggars who have taken refuge in these camps." The authorities had to close down two empty camps.

The killer company

Union Carbide is the third largest chemical company and 37th largest industrial corporation in the US. It owns 700 chemical plants, mines, mills and other business operations in 37 countries. Like the other big chemical corporations, it has been going through a rough time in the last few years as the world market for chemical goods has fallen. As the world's largest producer of ethylene glycol, a major building block in plastics production, Carbide has been seriously affected by its overproduction. Its annual sales at US $9 billion were the same in 1983 as they had been in 1979, with less value in real money terms.

Carbide's operations are extremely diverse. It has been in the nuclear weapons game since the Manhattan Project of World War II, and is the sole contractor manufacturing enriched unanium and weapons components for the US government. It has uranium mines in South Africa and Namibia. It also makes consumer products like Eveready batteries — it is the world's largest producer of batteries — industrial gases, and molecular sieves for removing organic chemical pollutants from wastewater streams. Pesticides production is only a relatively small part of Carbide's operations and not the most profitable one. Sales of agricultural products declined in 1983. Carbamate pesticides, manufactured from MIC, account for most of Carbide's agricultural products.

All of Carbide's operations have the potential of risk to health of workers and communities, and to the environment. When the tragedy at Bhopal happened, Carbide tried to picture it as a freak accident that has happened to a company with an otherwise exemplary record in environmental and health matters. But this is not only untrue, Carbide has consistently fought any claims of damages caused by its operations. Vinyl chloride workers, for example, at Carbide's South Charleston plant, were found in 1976 to have not only six cases of angiosarcoma, of the 63 found worldwide — a rare cancer associated with vinyl chloride — but also four times the expected rate of leukemia and twice the expected rate of brain cancer. Yet three years later, one of Carbide's medical directors said, "To my knowledge there is no evidence on the face of the earth to link incidence of brain tumours to vinyl chloride." In 1982, Carbide faced some US $15-20 million in worker compensation claims. The company was fighting them in courts.

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Carbide's double standards: In Institute (USA), it informed neighbours about the dangers, but never in Bhopal (*The Hindustan Times*)

A Union Carbide subsidiary was also responsible for the Gauley Bridge tunnel disaster in the early 1930s, regarded as one of the world's worst industrial disasters. Construction of the tunnel began in 1930. Tests showed that the rock was almost pure silica, a mineral known to cause silicosis. Instead of revising plans for tunnel construction Carbide decided to expand its size and to use the silica at a steel-making subsidiary. Unemployed coal miners in West Virginia knew enough about mining and quickly left. So the company recruited black workers from other south-eastern states, who were forced to take any job because of the Depression. Gauley Bridge tunnel workers began dying nine to 18 months after exposure to the dust. The company avoided autopsies and death certificates. A US official has put the total at 476 dead and 1,500 disabled. The callousness which killed these workers has seldom been equalled in corporate history.

Union Carbide possesses four plants in Tennessee and Kentucky which manufacture nuclear weapon components, enrich uranium, and carry out scientific research in nuclear weaponry. Three of these plants were built in the 1940s in Oak Ridge, Tennessee. During the Second World War, Carbide operated part of the Manhattan Project in Tonawanda, New York. In both facilities, information has only recently surfaced about the environmental and health legacies the company's operations have left behind.

In the 1950s and early '60s, processes were being developed to use mercury for the separation of lithium-3, a vital component of the hydrogen bomb. One-third or more of the known mercury in the world was bought up for Oak Ridge at this period. Carbide took no notice of the advice of electrochemists on how to work with and contain the mercury. A huge quantity of it was lost: 2.4 million pounds is unaccounted for. Some 475,000 pounds is known to have been spilled into a creek.

In 1983, Union Carbide's secrecy cover in Oak Ridge was blown. Mercury at levels 35 times greater than allowed by the state was found in the soil. All the contaminated soil had to be excavated and removed, and a long, costly clean-up began. Shortly afterwards, Union Carbide announced that it would not seek renewal of its contract to operate the Oak Ridge facilities.

Union Carbide has also had many problems with its major pesticide, Temik. Pure aldicarb is probably the most toxic pesticide manufactured today but it is claimed that it breaks down very rapidly. Because it is so acutely toxic, studies have focussed on high level, short-term effects, and no systematic study has been made of long-term effects of low doses. The best documented human poisoning case is that of a nursery worker in Florida, who spent one Friday spraying Temik in a greenhouse, and was found dead in his apartment the following Monday. There have been other cases of lesser, but still severe, Temik poisoning among farmworkers.

By 1983, Temik was being used in 38 states, and exported to 60 nations. But events in the early 1980s began to refute the assumption that Temik could not prove a human health hazard because of its rapid breakdown. Temik had been widely used in New York potato fields under Carbide assurances that it could not migrate into groundwater. In 1979, 1,500 wells were found to be contaminated with Temik, at levels above the state's safe limit for drinking water of seven ppb.

Just when Carbide was striving to reassure people that Temik had only migrated into groundwater in Long Island because of some unique features of the island's topography and geology, it was found in groundwater around Florida citrus groves. Carbide has refused to release to the public its own information about Temik's health effects, claiming it is a trade secret. Other states — Wisconsin, Maine and North Carolina — have also discovered Temik in groundwater.

The problems with Temik demonstrate a major problem with toxic chemical regulation: although some testing of chemicals takes place before they are marketed, there are still many instances of new impacts on the environment or human health being discovered only after the chemical has become widespread. Union Carbide's chemicals are associated with this pattern.

Union Carbide has been particularly lax about health and environmental safety in the Third World. It has been operating several plants in Puerto Rico since 1959. Neighbours of at least one of Carbide's operations have been complaining about the ill-effects of air pollution created by the plant. In Yabucoa, Carbide manufactures graphite electrodes for the steel industry. Graphite and coke dust, hydrogen sulfide and coal tar gases are emitted into the atmosphere. These materials can damage lungs as well as eyes and skin, and may even lead to cancer. In 1978, the government issued Carbide a show cause notice why it should not be fined for violating air pollution standards. It was not until 10 hearings later that the government fined Carbide, the largest fine it had ever levied on any company. Although the company agreed to pay the fine, the problems have not stopped. Air pollution has continued, and Carbide has launched a much-publicised 'ecology' campaign in schools, educating children in the need for clean air and water.

In 1981, Carbide's Jakarta factory making Eveready batteries hit the headlines for personnel and worker-health practices that would never be condoned in the US. In 1978 a worker was killed by electrical shock as he stood in water, immersed in a haze of carbon dust, having worked three consecutive days overtime. The new health officer became so distressed with company policy that she resigned in 1979. She found kidney disease and respiratory disorders among workers, excessive heat in working conditions, and mercury in well water supplying drinking water to the workers, and leaching into groundwater under neighbouring rice fields. In 1980, a new and bizarre health problem was added to those already being experienced at the Carbide plant: inspectors on the battery inspection line began to develop behavioural problems, and six had to be removed from their jobs.

Safety systems

Regardless of what people thought, the government team began preparations for ensuring extra safety during the disposal process. Experts finally came up with, as they described it to eager newspaper reporters, a six-step safety system. The first step was, in fact, no safety system: it was simply the process by which the pesticide carbaryl is produced by reacting the deadly gas with alphanaphthol. The second was the standard vent scrubber in the factory that had earlier failed to work. The only addition to this system was a set of fire hoses kept on two sides of the scrubber to keep it cool, in case too much gas came into the scrubber and the reaction with caustic soda increased its temperature. The third safety system was again the standard flare tower.

The three new systems that were devised by the experts were based on the high propensity of MIC to react with water, but their flimsiness and simplicity drew much comment. The first of these consisted of a tarpaulin *shamiana* that covered the chimney through which the MIC escapes. This shamiana was to be kept constantly wet, so that any escaping gas, which did not get burned by the flare tower, would react with water and get converted to harmless dimethyl urea. The second system consisted of jute mattings hung up on the perimeter wall of the factory on the side of the worst-hit colony on December 3, Jayaprakash Nagar. These too were to be kept wet so that any escaping gas could react with water. The sixth safety system consisted of Indian Air Force helicopters hovering over the plant which could spray water on the escaping gas if needed. If despite all this, immediate evacuation became necessary, people would be warned through sirens and army units, kept on five minutes notice, would move in to help.

The jute mattings in particular attracted much derisive comment. Said Praful Bidwai: "There is a length of flimsy jute sacking fastened just over a short stretch of the boundary wall, which is grandiosely termed 'Safety System Five'. The sacking, ruffling in the wind, does not reach beyond 12 ft or 15 ft from the ground level, a rather low altitude for trapping the gas in case there is an accidental release. In fact, the leaking gas, the authorities have presumed without any basis, will also move in a very definite direction and it is not necessary (or as Varadarajan says 'possible') to mount the sacking along the entire perimeter wall of the factory."

Apart from these safety systems, newspapers also commented on who was really in charge of the entire operation. Said *The Times of India*: "Inspite of the presence of the Indian experts led by S Varadarajan of CSIR, there is very little doubt as to who is really in charge. The team of Indian experts does not yet seem to be in full and direct nuts-and-bolts-level command. The details of the job have been left to the Union Carbide management. As Dr Varadarajan says, "We didn't really know the plant all that well." Even more significant, the involvement of the managers of Union Carbide Corporation, USA, in the present operation is visible."

The very UCIL officials who were arrested on the first day of the tragedy, were released on bail on December 16, on the

Carbide's double standards

Union Carbide has claimed that its plant at Bhopal is simply a smallscale replica of the plant at Institute in West Virginia in the US. But there is now damning evidence to show that the company has practised double standards in the installation of safety equipment and in the observance of safety and operational practices.

One, the company never installed in Bhopal the computerised pressure/temperature sensing system, which it has used for several years in the US plant as a warning device. Two, the community living near the plant had never been told of the significance of the danger alarm. The danger alarm had sounded several times accidentally in the past and resembled a nearby factory's shift change hooter. Many people on hearing the alarm after the gas leak actually rushed towards the factory. Thirdly, the community had never been informed about the dangers posed by the materials used in the plant. Several neighbours thought that the plant made medicines. This contrasts sharply with the right-to-know laws in West Virginia and other US states. In West Virginia, Union Carbide is forced by law to inform people regularly about the dangers they face and instruct them about appropriate action during an emergency.

Safety conditions within the Bhopal factory were extremely bad as compared to the Institute plant. The record of plant accidents has been much worse than the US plant. There has been no death in the US plant in 17 years of MIC use. There was one phosgene spill in which one person was treated at the plant dispensary and others sent for X-ray. In 1978, MIC was released when a line broke while loading tank cars. One man was hospitalised for two days and 13 were treated at the plant dispensary. On the contrary, the Bhopal plant has been plagued with problems since it started. In December 1978, there was a major fire in the naphtha storage area. In December 1981, a phosgene leak killed a maintenance worker. In January 1982, a phosgene leak left 24 people severely ill. In October 1982, a flange broke and a mixture of gases (MIC, chloroform and hydrochloric acid) escaped, causing a mini-stampede in the slums around the plant. In 1983, there were two more minor leaks and in January, 1984, a factory worker died of a chemical allergy after working at the plant.

The Bhopal plant's management gave little heed to safety and maintenance. Engineering control equipment had not been working for a long time before the December gas disaster, the result of an indiscriminate economy drive. Control instruments at the plant were faulty. The MIC refrigeration unit had not been in operation for months, contrary to safety rules. The caustic soda scrubber and the flare had been out of service.

Maintenance and operational practices had sharply deteriorated. Chemical reactors, piping and valves were not purged, washed and aired before maintenance operations, which caused the death by phosgene in 1981. Lack of adequate spare parts meant that vital devices like pressure gauges were not functioning. Underqualified people were running the plant engineering backgrounds had been replaced by less skilled operators. The number of blue-collar workers at the plant had been reduced from 850 to 642 over the two years preceding the event. Shortly before the disaster, the operator's duty relieving system was suspended. If someone failed to appear for a shift, the plant would simply run without the operator.

The operating manual supplied by the US company was also grossly inadequate. The MIC control room plant manual did not have instructions for procedures to follow in the event of a rise in temperature or pressure of stored tanks of MIC.

There was only one corporate health and safety audit over the seven years of plant operations. No follow-up check was undertaken after 1982 even though conditions were becoming visibly worse, and local newspapers and politicians had raised alarm signals.

The only conclusion possible is that the Union Carbide did not care about safety, and, in a developing country, with inadequate government regulations and a relatively uninformed public, it was simply cheaper and more profitable to neglect.

Who is to blame?

Union Carbide's coming to Bhopal was welcomed by all, because it meant jobs and money for Bhopal, and savings in foreign exchange for the country, with the rising demand for pesticides after the Green Revolution. The first phase of the project was completed in 1977 and the second in 1979; total cost: Rs 25 crore. Pesticide formulation developed into pesticide manufacture and in 1983, the company's licenced capacity stood at 5,250 tonne (t) of MIC-based pesticides, 200 t of methabenzthiazuran, and 50 t of propoxur.

The MIC plant was troublesome from the very first year and there were several leakages, light and heavy, until the Bhopal disaster. The first death occurred in 1981, when plant operator Mohammed Ashraf died. However, the government steadfastly ignored warnings, notably from M N Buch, administrator of the Bhopal Municipal Corporation, who issued notice to Union Carbide to move out of Bhopal in 1975. Buch was soon transferred and the company donated Rs 25,000 to the corporation for a park.

The warnings kept coming. In May 1982, three experts from Union Carbide Corporation, USA, surveyed safety measures and pointed to alarming lapses: water could contaminate the tank, the tank relief valve couldn't control a runaway reaction, manual filling could lead to overfilling, the phosgene tank pressure gauge was defective, valve leakage was endemic and there was no water spray system for fire protection or vapour dispersal in the MIC operating or storage area. These fears were repeated in a local weekly, *Rapat*, edited by Rajkumar Keswani in three prophetic articles in 1982 titled: 'Sage, please save this city', 'Bhopal sitting on the brink of a volcano' and 'If you don't understand, all will end'.

At about the same time the factory's employees' union also wrote to Central ministers and the chief minister warning of the situation. The state labour minister, Tara Singh Viyogi, reassured legislators at various times that the factory was safe, adding at one point: "It is not a stone which I could lift and place elsewhere. The factory has its ties with the entire country. And it is not a fact that the plant is posing a major danger to Bhopal or that there is any such possibility." The enquiry begun after Ashraf's death took two years to complete, the report was finally submitted in March 1984. Nobody read the report thereafter and only in January 1985 — after the December disaster — were those responsible asked to proceed on leave and explain their negligence. Only a few weeks before the gas leak, the factory had been granted an 'environmental clearance certificate' by the state pollution control board.

The Central government rivalled its state counterpart in casualness. It ignored the plant's safety record in granting the letter of intent and later, the industrial license in 1983, and ignored Department of Environment guidelines on the siting of hazardous plants. It extended its collaboration with the parent corporation on the assurance that Union Carbide Corporation would provide safety know-how and technology for handling situations like toxic gas releases on a continuous basis.

Why the warnings were ignored is clear. The company employs the relatives of powerful politicians and bureaucrats. Its legal adviser is an important leader of the Congress (I) and the public relations officer is the nephew of a former education minister of the state. The company's well-furnished guest house at Shyamala Hills was reportedly always at the disposal of the chief minister and many Union ministers stayed there during a Congress convention in 1983. Arjun Singh is himself facing a court case alleging that he had personally received favours from Union Carbide: his wife received generous hospitality from the company during visits to the US in 1983 and 1984 and the Union government has admitted that the company, as per its records, donated Rs 1.5 lakh to a children's welfare society in the chief minister's hometown, Churhat.

Union Carbide Corporation also played its full part in the run-up to the tragedy. It did not have a computerised early warning system. Indeed, one of the authors of the 1982 safety report, C S Tyson, emphasised that the onus was on the human being in Bhopal, rather than on automatic systems. He alleged that Indian workers were not asking 'what if' questions. The company had not worked out emergency evacuation procedures with the local community.

The plant was clearly not being maintained, and operated with the requisite level of efficiency (see box: Double standards). Morale was low because sales were dropping and the plant was running at a third of its capacity — it had never worked at even two-third of its capacity. For another, the alphanaphthol plant had to be abandoned — alphanaphthol is reacted with MIC to produce carbaryl — because during the trial runs it was found that even if alphanaphthol of the right purity could be made the cost of production would be higher than the imported cost. Workers allege that the plant's 200-page safety manual was hardly followed and in any case it doesn't specify all the necessary emergency procedures. Many instruments were out of order.

On the personnel front, too, there was laxity. Between one-half and two-thirds of the engineers who were there when the project began had left by December 1984. Several operators had left and staff from the abandoned alphanaphthol plant arbitrarily posted to vital positions in the MIC plant. Operator strength was reduced: in the MIC plant each of the three shifts were to be run by six operators instead of 11. The MIC control room was managed by two operators earlier; at the time of the accident, there was only one who found it virtually impossible to check the 70-odd panels, indicators and controllers. During shutdowns — as was the case when the accident took place — the understaffing was even more.

The plant was also underdesigned. Take the scrubber, the key safety device. The assumed normal feed rate of MIC gas is 86 kg/hour. During the incident, the peak flow could have been as much as one tonne per minute. The scrubber was simply overwhelmed. Carbide cannot also plead that it did not know about the inadequacy of the scrubber to deal with a runaway reaction. In July 1984, its own engineers in the US had warned that the system was not good enough. As MIC tanks had been contaminated with reactants like water several times before, they had advised UCC to warn all operating personnel worldwide. But no such warning was passed on to Bhopal.

The second safety device in Bhopal, the flare tower, even if it was in operation, also might not have worked. As Union Carbide works manager Mukund told a journalist: "The flare tower is not designed to handle anything but a small quantity of MIC, such as a few hundred litres an hour. It could not take the 40 t that was released during the accident; that would have created a massive explosion and the flare tower would have collapsed. The proposition is altogether absurd."

The magazine *Business India* has alleged in a detailed article that water could have gone into the MIC tank through a piping modification: a jumper line that had been put in to interconnect the relief valve vent header and the process vent header lines, both of which lead into the scrubber. This was a major design modification, and the local subsidiary had undertaken the task only after clearance from UCC.

In any case, UCC alone is responsible for designing a plant which stores such large quantities of MIC. Mitsubishi Chemicals in Japan uses MIC but does not store it at all. Said the company's manager: "The material is too dangerous to store in a tank."

UCC has tried every gimmick to pass on the buck. It has blamed its local subsidiary, the Bhopal plant's workers, and has even tried to suggest sabotage. Carbide's vice-president Jackson Browning has insisted that water could not have accidentally got into the tank: "It would have taken a bushing or some adaptive device to hook (the water hose) up and force the water in." But when asked by a US Congressional panel, chairperson Warren Anderson admitted that he had "no evidence whatsoever that sabotage was behind" the Bhopal disaster.

condition that they would help in the neutralisation of the gas left in the plant. And the neutralisation experts included the same W Woomer from USA who was earlier denied entry into the plant for fear that he would destroy evidence.

Matter of faith

Even more ironically, at the end of all this sophisticated technology and expertise, it was still a matter of faith. The chief minister announced on the evening of December 15: "The scene is set for the operation to neutralise the poisonous gas in the Union Carbide plant. Even though the actual handling is to be done by the Union Carbide people taking full responsibility, the go-ahead has to be given by us — that is me. It is no doubt one of the most crucial and agonising decisions I have been called upon to make. In such moments of supreme loneliness, nothing impels us more than one's faith in our creator. Even though faith springs eternal in the human heart, at this moment of time it stands rudely shaken by the horrendous events of last few days. That faith has to be restored. This operation shall, therefore, be called Operation Faith. Let us pray for its success."

Said *The Hindustan Times* on this announcement: "It was not so much the fear of the lethal gas as the 'crisis of faith' that had forced a few lakh people to flee the city. The chief minister's statement issued on the eve of the operation was generally interpreted to show that he himself was not quite confident about the course he had chosen to dispose off the MIC gas."

However, overnight the preparations for the operation began. Water tankers and fire brigade vans drenched every street with water, though nobody knew how this would prevent the gas from affecting people. The policemen on duty prepared for their own safety by keeping ready buckets filled with water and small towels. At the factory itself, fire tenders drenched the jute screens on the perimeter. Other fire tenders sent jets of water soaring into the screens covering the MIC section of the plant. Once every five to 10 minutes a helicopter would hover over the plant spraying water, and occasionally even over neighbouring colonies. Hundreds of oxygen masks were rushed in for plant personnel to use as a safety measure.

At 8.30 am on December 16, the operation started with the much publicised presence of the chief minister, who even took time off to argue with journalists that only 85,000 people had left the city. The governor, K M Chandy, who had earlier refused to drink any water in Bhopal, also visited the plant twice. Outside the factory's gate, Bharatiya Janata Party president Atal Behari Vajpayee argued with policemen who first denied him permission to enter the plant and then allowed him in. By the end of the first day, four tonnes out of the 15 t estimated to be in storage tank no 619 and 1.2 t in stainless steel drums, were converted into pesticides.

The next morning, the same routine of fire tenders and helicopters was repeated. In front of the gate, to instil confidence in the people, stood two army officers, Brigadier N K Maini and Major G S Khanuja, who had risked their lives on the morning of December 2 to evacuate some 10,000 people. By the end of that day, another four t had been used up.

By the end of the third day, 12 t had been disposed off, leaving just about four more tonnes to be converted. But by that day, the government team also realised that there was a lot more gas in the tank than the factory's records had earlier indicated. The operation which was expected to end in four or five days finally ended on Saturday — seven days after it began — and nearly 24 t of the gas had to be converted, over 50 per cent more than earlier estimated. Union Carbide did not even know how much gas it had in store.

The government's response

The government's response was uncertain and tardy. The Central government, at the request of the state government, flew in a team of doctors, followed by a Central Bureau of Investigation (CBI) team. The district magistrate ordered closure

The company's engineer responded: "The gas leak just can't be from my plant. Our technology just can't go wrong." (Raghu Rai)

of the factory on December 3 itself and arrested five officers of the company in Bhopal. A judicial enquiry into the tragedy was announced. The next day two teams of chemical industry and environmental experts were flown in from Delhi. The new Prime Minister, Rajiv Gandhi, broke his election campaign to fly to Bhopal.

But apart from these routine bureaucratic responses, the state or the Central government did precious little during the first two days. Except for the army, there was no help coming to the 100,000-odd people who fled from their homes that morning. Bhopal's superintendent of police claimed that police used whatever vans and trucks were available and took people out of Bhopal. But he argued that as the administration had no clue of the nature of the gas leak, there was little it could do.

The government's centralisation and lack of initiative, so visible on ordinary days, caused it to literally collapse under stress. Individuals in the administration worked themselves to the wall but there was no overall planning. In those first few hours, there was complete confusion. Once the leak had been confirmed the government apparently decided to evacuate the city. But no one announced this decision to the public at large. The only people who got informed through the government grapevine were the elite: the ministers and those who lived in the colonies far from the plant, and even among those it was mainly people who had telephones. The rest of the people were left to fend for themselves. Said *Frontline*: "Neither the state government headed by a panicky and strange-acting Arjun Singh, nor the Central government, seemed to know how to respond to this calamity." Had it not been for the valour of the army, the death toll would have been considerably higher.

The first coordination meeting of secretaries and heads of departments was called only on the night of December 4, more than 40 hours later. Fortunately, there was a stock of medicines available in the town because of the national programme to combat blindness. For two days, some 2,000 animal carcasses still littered streets and houses and posed a real danger of a cholera outbreak. Finally, cranes and dumpers were obtained from the army and Bharat Heavy Electricals Ltd. The coil of one crane actually broke when lifting a dead buffalo. The walls of 32 houses had to be broken down because the buffalo corpses had bloated so much they couldn't be taken out of the narrow doors of the slum houses. Finally the dead animals were carried five km away from the city and dumped in 10-ft deep trenches, dug by bulldozers and lined with four trucks of salt, two trucks of bleaching powder, 10 trucks of lime and half a truck of caustic soda.

The first patient came at 1.15 am; within five minutes, a thousand were there. Nobody knew what had hit them. (*The Hindustan Times*)

Epidemic fears

But three weeks later, there were again fears of outbreaks of epidemics as millions of green flies, attracted by improperly disposed off carcasses invaded the city. The army had initially helped in the removal and disposal of animal carcasses but the authorities admitted that all the animals could not be buried because of a shortage of sanitary workers and scavengers. Most of the local municipal staff had been affected by the gas and sanitary workers had to be summoned from other towns.

Equally disorganised and callous was the administration's response to people's queries. The government began broadcasting news bulletins over All India Radio on the second day itself that the situation was fast returning to normal and that everything was safe, which journalists told the chief minister sounded much like the pronouncements of Carbide officials. The people were suspicious about the air they breathed, the water they drank, and the meat, flour, fish and vegetables they ate. The wanted to know whether the dead animals would lead to an epidemic, whether any gas remained in the factory and whether it could leak out again.

Instead of taking the people into full confidence, there was a volley of confused and contradictory statements. A newspaper report pointed out that on December 4, on his visit to Bhopal, Rajiv Gandhi had declared that the water had been

The controversial antidote

Was it MIC? Or phosgene? Or a mixture of both? Or some other gas like hydrogen cyanide?

It was confusion confounded. Amazingly, even as hundreds died in Bhopal, the confusion over what it was that was killing them persisted right through the horrendous first week and after. Nobody knew anything, including experts at the Union ministry of chemicals in New Delhi.

At first, the majority of doctors in Bhopal plumped for phosgene, partly the result of the prompting of local Carbide officials, who kept on insisting that MIC is only an irritant and not lethal. Moreover, phosgene vapourises at low temperatures (8°C) unlike MIC (above 38°C), and is far more likely to have done so that cold December night. So felt J M Dave, dean, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, and he also added that while MIC does not cause visible damage to plants, phosgene does. Dave was backed by seven teachers from the chemistry department of Nagpur University. Not more than a handful of doctors in Bhopal in the first five days knew or believed that the gas was MIC, or that it was toxic at all.

Later, opinions veered round to MIC. Scientists of the Indian Agricultural Research Institute in Delhi claimed that tests on affected plants had revealed traces of MIC and not phosgene. Experts at the Industrial Toxicology Research Centre (ITRC) in Lucknow also said that there were "very little chances of phosgene being the killer gas" as it causes delayed pulmonary oedema — lungs swollen up with water — and does not kill immediately, as happened in Bhopal.

Days later, opinion had veered yet again, to a mixture of both. S R Saxena of the Safdarjung Hospital in Delhi, who led the expert team despatched by the Central government, said that two gases appeared to have been at work because of the changing symptoms of the patients: "The reaction to one came within a couple of hours and to the other after a passage of 48 to 72 hours." This could be evidence that phosgene, which has delayed effects, was mixed with MIC. S Varadarajan, director-general of the Council of Scientific and Industrial Research, who had earlier asserted that only MIC was responsible, pointed out towards late December that pure MIC is unstable and as such is always stored with a small amount of phosgene as impurity, usually between 200 ppm and 300 ppm. He said that the phosgene content in the killer tank was higher, about 500 ppm.

Union Carbide's own pronouncements from the US added to the chaos. Carbide's medical director in the US, Bipin Avashia, cabled the authorities in Bhopal to administer sodium thiosulphate to the victims "if cyanide poisoning is suspected". But at his press conference in Bhopal 10 days after the disaster, Avashia got into a slanging match with Bhopal's doctors crying out: "It is not phosgene, it is not phosgene, it is not phsgene". He argued that there could be no cyanide poisoning and sodium thiosulphate was no antidoate to MIC poisoning. Union Carbide even issued a statement: "MIC is not a cyanide. In no way should it be confused as such. MIC naturally degrades in the environment by reacting readily with water to become harmless substances while cyanides do not react with water." But when quizzed how he could have suggested administration of sodium thiosulphate in his first cable, he simply said that he could not be expected to know what sort of gas the Bhopal plant stocked. However, the telexed prescription had clearly referred to "treatment of MIC pulmonary complications".

The victims suffered in the confusion. The treatment was mainly directed towards alleviation of eye and lung symptoms and each symptom was treated separately: eyedrops for smarting eyes, steroids for inflammation, antibiotics to prevent secondary infection, antacids for the stomach and oxygen respirators in acute cases.

Patients were administered Lasix for oedema and lung inflammation and according to some exerts, the effect was devastating. Patients had come to hospitals complaining of intense heat and thirst. A large

number of corpses had come to the morgue naked, as if they had ripped off their clothes in desperation. Administration of Lasix only increased dehydration.

In the meantime, controversy arose over the possible antidote. Heeresh Chandra, director of the Medical-Legal Institute in Bhopal had immediately conducted autopsies. His most important finding was the dark, cherry-red colour of the blood, a phenomenon that was later observed also in dead cattle. Organs like the lung were also red. If death had occurred because of suffocation as a result of excess fluid in the lungs, then the deoxygenated blood should have been bluish. Though the patients were dying of 'acute respiratory distress', the red colour indicated that the blood had oxygen in it. Clearly some poison was blocking its use in the cells.

Intrigued by the red colour, Heeresh Chandra argued that death was due to or similar to cyanide poisoning and pushed for the immediate use of sodium thiosulphate — the known antidote — as patients were still dying. A large number of deaths occurred within the first 48-72 hours. But for inexplicable reasons, he only met with ridicule from his own colleagues who demanded more evidence. Said N P Mishra: "You are a doctor of the dead, so do not interfere with the living." This, despite the fact, that sodium thiosulphate is known to be a harmless drug, definitely far safer than the massive administration of antibiotics and steroids.

On December 8, as patients were still dying, German toxicologist Max Daunderer administered sodium thiosulphate to a few desperate cases. While one patient showed remarkable recovery, another died and word went around that the German doctor had killed a patient using sodium thiosulphate. The German was bundled out of Bhopal. A congress of senior professors of Gandhi Medical College presided over by K W Jaeger, a WHO toxicologist, rejected a proposal to use sodium thiosulphate. And M N Nagu, director of health services in the state government sent out a circular on December 13 stating that "under no circumstances shall sodium thiosulphate be given unless it is correctly and conclusively proved in the laboratory that it is cyanide poisoning". In Bhopal, the word was that Nagu had been so informed by the Indian Council of Medical Research (ICMR), but ICMR's own circular of December 14 addressed to doctors in Bhopal, which included a pamphlet on the use of sodium thiosulphate, a tacit endorsement of the drug,

was not made available to them by the state government until January 7. But even then there was no largescale administration of sodium thiosulphate.

Carbide's role in this controversy remains shrouded in mystery but was probably crucial. Admitted N R Bhandari, Hamidia's medical superintendent to journalists, "Dr Avashia told us it was not necessary or advisable to use sodium thiosulphate." Nobody in authority seems to have realised that UCC, facing the world's biggest compensation claim and for which MIC is a major product, could have been deliberately playing down the ill-effects of MIC.

However, with the symptoms of poisoning persisting and Carbide's prediction that MIC would not lead to many long-term effects looking more and more like a lie, the demand for sodium thiosulphate as a detoxification agent has also grown. Voluntary groups like the Zahreeli Gas Kand Sangharsh Morcha, Nagrik Rahat aur Punarwas Samiti and Medico Friends Circle have strongly argued for mass administration of the drug, while newspapers have given them prominent coverage. In early February, the ICMR held a press conference to announce that it was now tentatively convinced that MIC-affected patients were suffering from chronic cyanide poisoning, though it was not able to say where this cyanide was coming from. It would have come directly through the inhalation of a gas like hydrogen cyanide (which could have been mixed with the MIC released from the tank) or it could be the breakdown product of MIC in the body adding to its 'cyanide pool'. ICMR instructed the state government to use sodium thiosulphate because patients given the injection reported remarkable improvement, and tests showed eight-10 times increased quantities of thiocyanate in the urine, which indicated that the body was getting rid of the poison. In early May, ICMR announced that biochemical tests had confirmed that MIC had affected the haemoglobin in the blood through a 'carbamylation' process, reducing its ability to carry carbon dioxide away from the tissues. Thus, even though the blood was rich in oxygen, tissues were starving for it.

The conformation of cyanide poisoning has raised the possibility of hydrogen cyanide being one of the gases that afflicted the people of Bhopal. Suspicion that UCC has been suppressing information has grown. Contrary to its own assertion that cyanates do not break down into cyanides, a 1976 UCC publication itself points out that "under thermal conditions" MIC breaks down into hydrogen cyanide. As the gases had come out of the MIC tank at a high temperature — maybe even as high as 400°C — they could also have contained hydrogen cyanide. Tests in France have shown that MIC when burnt with air gives rise to hydrogen cyanide.

For some inexplicable reason, even after ICMR's stand, little seems to have moved in Bhopal. The state's health secretary has issued a statement criticising Carbide for its callousness in refusing to divulge information relating to proper treatment of gas-affected victims. But even until May, thiosulphate had been given to extremely few people. The only place administering thiosulphate in Bhopal was the 30-bed hospital, hastily set up by ICMR for gas victims in a shabby police bungalow. Several local doctors tried their best to undermine the thiosulphate therapy — N P Mishra claimed that even glucose injections given as a placebo had more patients claiming improvement — while others spread rumours about imaginary harmful effects of thiosulphate. The authorities also starved the ICMR hospital of proper facilities. They could not spare even an air conditioner for its sophisticated equipment kept in the outhouse. In late March, Saheli, a Delhi-based women's group, organised an angry demonstration of 150 women to demand immediate thiosulphate treatment. Dr Nagu received their memorandum but said he had no communication from ICMR regarding thiosulphate treatment.

Pointing out that if UCC had been honest about cyanide poisoning, hundreds of lives may have been saved, an angry article in *Business India* concluded: "The impression is inescapable that there were concerted efforts by the senior-most members of Bhopal's medical establishment to suppress information on the nature of this mass poisoning." Said Tania Midha in another report in *The Telegraph*, "Interestingly, most documents produced by Dr Mishra in refuting the validity of Dr Heeresh Chandra's claims, are studies by Bryan Ballantyne, the expert sponsored by Union Carbide to visit Bhopal."

tested and that no toxic substances had been found in it. But Varadarajan later revealed that testing started only on December 5. Not surprisingly, when it came to neutralisation of the remaining gas, the people simply fled the city in unprecedented numbers.

The CBI team which arrived on December 3 itself immediately began interrogation of officials and the supervisory staff of the plant, warned Carbide officials not to leave Bhopal without permission, and seized all log books and relevant papers pertaining to the storage and release of MIC. When a team of US technical experts of the Union Carbide Corporation (UCC), USA, headed by former works manager W Woomer turned up in Bhopal three days after the disaster, the government refused them entry into the plant as they could destroy evidence.

Arrest fiasco

But the manner in which the government handled the arrest of Warren Anderson, the UCC chairperson, was ridiculous. As Anderson landed in Bhopal with Union Carbide of India Ltd's (UCIL) chairperson Keshub Mahindra and managing director V P Gokhale, all three were taken into custody, whisked away in a car with a heavy police escort to the company's guest house, and lodged in separate rooms from which telephone lines had already been disconnected. They were charged with a series of offences, several of which are non-bailable and punishable with life imprisonment or terms ranging from five to 10 years.

A government official said that the arrests were made for "constructive criminal liability for the events that led to the great tragedy". The chief minister himself boldly declared: "This government cannot remain a helpless spectator to the tragedy and knows its duty towards thousands of innocent citizens", and charged that lives of citizens had been "so rudely and traumatically affected by the cruel and wanton negligence on the part of the management of Union

Western papers called these dead children the 'pain of progress' and the 'balance sheet of death'. (Raghu Rai)

Deadly environment

For days the people of Bhopal were on tenterhooks. Are air and water safe? Are fruits and vegetables edible? What about fish and meat?

The authorities gave out limited information and only added to the confusion. They said "the water is safe, but boil it before you drink"; the "vegetables are safe, but wash them before you cook"; "the fish is safe" but promptly closed the fish and meat markets and banned the slaughter of animals. They refused to answer questions about what tests and when they had been conducted. The Bhopal Municipal Corporation, for instance, promptly declared that water was safe. But what had the water been tested for? MIC? Its derivatives? Its carcinogenic derivatives? What were the types of tests conducted? How safe was 'safe'? No effort was made to take the public into confidence.

Eklavya — a voluntary agency funded by the Madhya Pradesh government to promote science education in village schools — immediately took steps to organise tests of air, water, plant, flour and charcoal samples, emphasising the people's right to know. But it soon came up against the fact that most scientific laboratories are controlled by the government and only an occasional scientist was prepared to help. Tests, therefore, had to be conducted in various parts of the country.

Government reports have come out slowly. A team from the Indian Council of Agricultural Research (ICAR), which arrived in Bhopal on December 11, found that animals had died within three minutes of inhaling the gas. They were frothing from the mouth, full of tears and breathless; many cows miscarried. "In clinically ill animals," reported the team, "there was an immediate drying of milk after exposure and milk production came down from about eight-10 kg per day to 0.5 kg-to-nil."

Official records put the number of dead animals — cattle, goats, sheep and so on — at 1,047, while about 7,000 received therapeutic care. Poultry, it seems, was relatively less affected for inexplicable reasons.

Samples of fish, plankton and water were taken from 15 locations. Bhopal is famous for its lakes. As fish in affected areas were found to be suffering from anaemia, the ICMR scientists felt that further studies were required and have since been collecting data on the effect of Bhopal's effluents on Indian carp like *catla* and *mrigal*. As with the case of human beings, there is no scientific data on the likely impact in the long run of MIC on animals, insects and plants.

The effects of MIC on plants and soil was also studied by the Central Board for the Prevention and Control of Water Pollution. The board used neem as an atmospheric indicator because it was found to be one of the most sensitive trees. A vegetation damage contour map was prepared to indicate which parts of Bhopal were hit by the deadly gas. The board found that the vegetation in an area of 3.5 sq km around the factory was severely affected, 10.5 sq km was badly affected, six sq km was moderately affected and five sq km was mildly affected.

Leaves bore the brunt of the damage: *methi* saplings, for instance, showed symptoms of scorching and all the top leaves had withered. *Methi* and brinjal seedlings were found to be most sensitive. These plants were completely destroyed even three to four km away from the factory. Even after eight days, none of the methi and spinach plants examined showed any signs of recuperation. Other severely damaged plants were castor, neem, *karanja* and *ber*, whose leaves were completely bleached, curled up and were falling. The scientists found that there had been instant death in the exposed tissues.

Interestingly, the same species of plants which were otherwise badly affected, were unharmed when found growing near lakes, which probably shows that water had a scavenging effect. It was claimed that the lakes had prevented the MIC from creating an even more widespread havoc.

As a precaution, the board's team suggested that the consumption of fruit from trees in affected localities — especially ber, mango, papaya and tamarind — should be avoided for at least a season.

A team of scientists from the Banaras Hindu University has also warned the people of Bhopal against consuming locally grown vegetables till after the monsoon as these have shown genetic defects. MIC seems to have acted as a mutagen. They have advocated the destruction of all standing crops and keeping the land fallow till after the monsoon.

These scientists have also found that several wild plants were less damaged than cultivated plants. Plants submerged in water escaped the wrath of the gas while leaves of floating plants got scorched. Many birds escaped death presumably because of their habit of pushing their beaks inside their feathers while asleep. A health department official even reported a bright side to the disaster: Gas-affected areas have recorded a reduction in malaria incidence. Mosquito breeding grounds have apparently been affected by MIC.

List of plants damaged by MIC

Completely damaged	Partially damaged	Undamaged
Methi (fenugreek)	Alfalfa	Mint
Radish	Mustard	*Arvi*
Spinach	Cabbage	Cuscuta
Brinjal (fruits turned yellow)	*Cauliflower* (only leaves were scorched)	*Parthenium*
Tomato	Water hyacinth	Wild rice
Chenopodium	Marigold	Bougainvillea
Castor	Coriander	*Moringa*
Datura	Rose	Date-palm
Jasmine	Bottlegourd	*Jamun*
Calotropis	Wild spinach	Mango
Lantana	Lemon	*Kaner* (oleander)
Ber		Banana
Neem	Guava	*Kaitha*

Source: Indian Council of Agricultural Research

Over a thousand animals died within minutes of inhaling the gas; survivors stopped producing milk (Ashok Chaddha)

Carbide". An early release of an Indian news agency even declared that the officials of the multinational UCC "can be sentenced to death".

But this bravado, which even brought protests from the White House, ended almost as soon as it began. Within six hours of his arrest Anderson was whisked away from Bhopal in full secrecy, without being produced before a magistrate, as normally required under law, with a paltry bail sum of Rs 20,000, put on a government plane and flown to New Delhi. Said an embarrassed chief minister who tried to make the best of the situation: "What has been done is within the four corners of the law… we wanted him to go in the overall public interest. Not that I feared violence but it could have happened." But few were impressed by this feat. Said *Nai Duniya*: "The government is staging this drama in order to hide its own shortcoming with regard to the gas tragedy."

The worst record of the government was in the manner it took up relief work. On December 9, the government announced an immediate relief of Rs 100 for ordinary injuries and Rs 2,000 for seriously injured persons. This immediately became an excuse for political favours. At Hamidia Hospital, a Congress (I) municipal councillor insisted that doctors readmit a patient while doctors alleged that the patient wanted to take the relief money of Rs 2,000 by being admitted to the hospital for five days at a stretch, even though he was fit to be discharged. The doctors resented this political interference and went on a lightning strike. They relented only when the corporator apologised. Said a strike placard: "Congress musclemanship is deadlier than MIC."

Newspapers also reported considerable resentment over the distribution of relief money. One gas-affected woman whose eyes had been badly affected wanted to return the paltry relief money of Rs 200 that she had been given. Financial assistance was handed over in crossed cheques. To cash these cheques, the victims had to first get themselves identified and open an account in the banks after depositing Rs 20. The banks had to seek special permission to open accounts for those poor families who did not even have the initial deposit of Rs 20.

Resentment and relief

People expressed their growing resentment in various ways. Youths in various gas-affected localities began to *gherao* medical teams. Less than 10 days after the disaster, an *Economic Times* reporter was taken to houses by angry youths to assess the situation for himself. "Almost every houses gave the appearance of a hospital ward," he said in his report. "Almost everybody was coughing constantly, having pain and irritation in the chest. Nobody had turned up to provide these people with medicines or to examine them for the last two to three days. Many of the sick people were not in a position even to get up from their bed. Most of them are daily-wage earners. They were not getting anything to eat. They had no resources to purchase foodgrains. Even if they purchased foodgrains, the women were not physically fit to cook their meals. The moment they sat near the fire, their coughing increased. These people generally belong to an economic class which suffers from malnutrition. If they are denied meals in such a shattered physical condition, they would have no resistance left." On December 9, there was even a demonstration in front of the chief minister's residence.

Most of the affected people were poor, manual, daily-wage workers and they found themselves suffering from the effects of MIC even weeks after the exposure, the chief one being persistent breathlessness. Manual labour became impossible: they felt dizzy even walking one km in the sun. And out of work and money, they found themselves even more diseased, weak and hungry, virtually on the verge of starvation. The entire episode left the survivors, their health and their economy totally shattered.

Describing a typical situation, 30-year-old handcart puller Sabir Ahmed said that he had ventured out to work nearly three weeks after the gas leak. But this breadearner of a five-member family had to return home soon feeling ill. Porter Bilal Ahmed was in a similar situation: he had received treatment on December 3 at Hamidia Hospital, but nothing after that. And he was still experiencing irritation in the eyes, chest pain and nausea, and was finding it impossible to work. Shravan Singh, 34, a lathe operator, now found his earlier occupation which used to fetch him some Rs 25 a day so tiring that he had to turn to selling roasted gram as a pavement hawker, earning less than Rs 10 a day to feed his family of four.

Women often found themselves in a worse situation. They continued to be plauged by blinding headaches and dizziness and could not focus on anything for long. Cooking before the fire brought about exposure to woodsmoke and increased the irritation in their eyes, making it impossible to cook more than two *chappatis* at a time. Bringing water from the nearby well or tap tired them out for the whole day. Many women had lost their sons and husbands and now it was impossible for them to survive, especially as they could not work in their diseased condition. Many of the women living in J P Nagar opposite Union Carbide, are bidi workers. Said one bidi worker: "We cannot see the bidi thread after a while; our eyes burn. And unless you make a sizeable number of bidis and sell them each day, there is no profit." Some bidi workers found that the person who used to purchase bidis from them was dead and, therefore, there was nobody to sell bidis to even if they could make them. The mass death of animals like buffaloes also meant hardship for many people who had lost their sole occupation.

Long wait

In a desperate bid to get themselves cured, people sat in long queues before mobile clinics, dispensaries and polyclinics set up by the government, and a dozen other dispensaries set up by voluntary agencies. At these centres, they got the same treatment, antibiotics and a few other drugs, which after a while began to create more side-effects than benefits. Those unable to bear their health problems tried to seek the assistance of the big hospitals but from there they were invariably turned back.

Others simply lay at home in bed. But with the government and the medical community in Bhopal arguing in less than a fortnight that the worst was over — that most of the problems people were now complaining about were mainly the result of common diseases like anaemia and TB rampant in these slums — the people found themselves caught between a callous multinational and a highly inefficient and equally callous government.

Voluntary agencies working in the affected settlements reported innumerable health problems. Said the Nagrik Rahat aur Punarwas Samiti organised by film-makers Tapan Bose and Suhasini Mulay: "Our women volunteers have found that almost

every woman exposed to MIC is suffering from severe disorders of the reproductive system in addition to respiratory and gastric complications. They complain of up to five menstrual discharges during the last six weeks with moderate to heavy bleeding. Most women are complaining of abdominal pain, and highly acidic vaginal secretions which cause burning and pregnant women are facing even greater problems." The government did not pay any heed to the committee's suggestion that five properly equipped diagnostic and therapeutic centres be set up in the affected areas.

The government itself did not attempt any serious documentation of the extent of injury and new symptoms emerging. No effort was made to take X-ray, collect and analyse blood, sputum or urine samples and keep people under observation. Even worse, the entire affair was shrouded in total secrecy. Even as people complained of various ailments, the government consciously tried to suppress all information. According to one report, the dean of the Gandhi Medical College in Bhopal even called a meeting of representatives of private medical practitioners in mid-January to demand that they disclose no facts pertaining to MIC poisoning to anyone but the state government.

Public protest

By early January, the mood turned angry and resentful. On January 1, the Nagrik Rahat aur Punarwas Committee organised a *chakkajam* (stop the wheels) programme by squatting on the main thoroughfare of the city. On January 3, the

The breathless aftermath

Carbide's constant refrain from day one has been that MIC cannot lead to permanent damage or long-term effects. Said UCC's chairperson Warren Anderson in a letter written one month after the disaster to a group of Japanese protestors; "We sponsored visits by leading medical authorities here in the US to visit Bhopal… We are pleased that their experience in Bhopal and the news reports from there corroborate the beliefs of our own medical people, that those injured by methyl isocyanate are rapidly recovering and display little lasting effects."

This has definitely turned out to be one of the most fraudulent statements of the century. Carbide has dismissed long-term effects even while it has professed total ignorance of the effect of high doses of MIC on human beings. For weeks after the disaster, every effort was made to play down the possibility of long-term effects by all and sundry: by Carbide, by Bhopal's doctors and even by experts of supposedly impartial international agencies like WHO. K W Jaeger, a WHO expert who rushed to Bhopal after the disaster, claimed that there was no basis for fearing that there will be many cases of paralysis or even of damage to unborn babies. In their press conference in Bhopal in December, UCC experts were at pains to explain that MIC could not be absorbed by the blood and, thus, cause long-lasting physiological changes because of its high reactivity with water and conversion into harmless products thereafter. *The New York Times* on December 20 even headlined a major story: "Few lasting health effects found among India gas-leak survivors."

Of all places, disinformation has been at its peak in Bhopal, where a doctors' lobby has been reported to be close to the UCIL establishment. As reports of lung ailments and acute breathlessness continued to pour in, N P Mishra, head of the department of medicine at the Gandhi Medical College in Bhopal, told a journalist, "There are mostly previous diseases which get accentuated in winter. In fact, they're known as 'winter bronchitis' — people believe it's MIC." State government officials even tried to spread the word that the gas-affected people were living in poor, unhygienic colonies and were suffering from a high incidence of TB.

All this strongly contrasted with the reports pouring in from voluntary health organisations, individual doctors and journalists' own investigations. Voluntary agencies working in Bhopal reported nearly 200,000 affected people and about 50,000 seriously affected. Breathlessness, sleeping and digestion problems were reported to be so acute in 5,000-10,000 people that they were incapable of performing even light physical labour and would probably never be able to earn a living. Newspapers reported that many survivors were turning to begging.

Women were extremely badly affected. They found it impossible to carry even a pail of water home or cook two *chappatis* in front of the fire: their breathing would become difficult and eyes begin to burn. Said a team of doctors organised by the Medico Friends Circle (MFC), a nationwide network of voluntary health workers, "Even most children find it difficult to play or participate in normal physical activity in the affected *bastis*."

As public consternation grew and newspaper reports continued to portray the acute suffering of the Bhopal people, the state government and the medical establishment responded with a clampdown on information. "Ask ICMR" is all that the medical establishment in Bhopal told *The Telegraph's* news editor, Shekhar Bhatia. Meanwhile, the Indian Council of Medical Research (ICMR) in Delhi admitted that it had advised "individual investigators not to publicise their findings prematurely and individually so as to avoid confusion and panic in the public mind through conflicting statements of the type being witnessed today." But this secrecy only fuelled the confusion.

Said D R Varma — a visiting professor of pharmacology at McGill University in Canada — in a press statement issued to counter official propaganda from Bhopal, "Given the nature of known and serious toxic effects of a compound as dangerous as MIC, the possibility of serious short and long-term adverse effects on pregnant women and their offspring is in my view very, very real." Voluntary agencies announced in anger that they planned to conduct their own health surveys to document the deplorable state of the survivors' health — the Bhopal-based Nagrik Rahat and Punarwas Committee with the help of doctors from the KEM Hospital in Bombay and the MFC through its nationwide network of voluntary health activists.

Finally, two months after the disaster, ICMR broke its silence. V Ramalingaswami, the council's director-general, strongly denied the statement attributed to him that "there is no reason to believe that there will be any long-term effects", and disclosed a multi-project research programme that ICMR had launched to identify the full spectrum of ailments being suffered by the gas victims, the biological mechanisms of the action of MIC, and a proper treatment (see box: Controversial antidote).

The council has since found through its epidemiological studies that affected areas can be divided into three categories: severely affected areas (in which more than five per cent of the community died), moderately affected (where one to five per cent died) and mildly affected (less than one per cent mortality). Over 60,000 people are living in severely and moderately affected areas.

Preliminary data gathered by the council revealed that even two months after exposure to the gas, nearly 40 per cent of those attending local hospitals were suffering from respiratory problems like breathlessness and cough. Another group of patients was suffering from gastrointestinal symptoms like nausea, vomiting and burning in the stomach.

Two ICMR psychiatrists reported that 10-12 per cent of the affected individuals attending local clinics revealed psychiatric symptoms, foremost being anxiety and depression. Many people were suffering from sleep disturbance, 'gas phobia', and a feeling of hopelessness. These psychiatrists, thus, confirmed newspaper stories that children often wake up in the night crying "*bhago, bachao*" (run, save me). As many families were finding it difficult to cope with this abnormally stressful situation in their life, they strongly advised immediate psychiatric care.

In early February, the ICMR launched an extensive survey to cover about 100,000 people (about 21,000 families). By mid-March it had surveyed

Zahareeli Gas Kand Sangharsh Morcha, a forum organised by scientists, social activists and trade union workers, observed a *Dhikkar Diwas* (Day of Condemnation) and a *dharna* in front of the chief minister's house. The day-long dharna turned into a 10-day-long affair and finally got converted into a *rail roko* (stop the trains) programme. But many members of the Morcha were picked up by the police even before they could march to the station and kept behind bars for days. A few days later the chief minister organised his own much-trumpeted *Dhanyavad Diwas* (Day of Thanks). The single biggest ground for resentment was the delayed distribution of ex gratia payments by the government, which had announced that Rs 10,000 would be given to the heir of every dead person, Rs 2,000 to those seriously affected and Rs 100 to 1,000 to those slightly affected. In its initial panic, the government had rushed payments and Rs 36.67 lakh was paid in cash to 5,724 victims. But on December 7, the government suspended the disbursement and announced that it would be resumed later — and payment would be by cheque — only after a quick house-to-house survey of the affected localities. But payments remained suspended well into January. No government department wanted to shoulder the responsibility of sorting the needy from the avaricious, who also wanted to cash in on the tragedy. There were other difficult questions. Who was an 'affected' person? Which was the 'seriously affected area'?

For those who wanted to claim relief in the name of dead relatives, the procedures were frighteningly labyrinthine. The deputy collectors appointed for this work demanded documents.

Results of the KEM College medical survey 100 days after the exposure

	Adults in group I %	Adults in group II %
Respiratory symptoms	79.7	27.6
Eye symptoms	65.6	31.5
Gastrointestinal symptoms	60.3	23.6
Neuromuscular symptoms	54.5	10.5
Gynaecological symptoms	75.5	53.84

Out of 250,000 exposed, population with medical disability:

mild to moderate	43,864
severe	63,385

Note: group I: People residing less than 0.5 to 2 km from the factory.
group II: People residing more than 8 km from the factory.

11,185 people, of which 1,660 were found suffering from lung problems, 1,425 from eye problems and 5,067 from both. The ICMR has also announced projects to study the possible carcinogenic, teratogenic and mutagenic effects of the gas. A cancer registry is to be set up soon in Bhopal. A British expert has warned that a highly reactive agent like MIC which can react with DNA and proteins in cells, could easily lead to cancer.

There has been considerable concern about the effect of the gas on women and, in particular, on pregnant women and unborn children. In a population of 100,000, there should be some 3,000 pregnant women at any time. By mid-March, ICMR had identified 404, 97 of whom had already delivered. Of these five had still births, another 17 had already had abortions and three newborns suffered from birth anomalies. Most of the babies examined were low in birth weight. Mothers themselves were generally malnourished, anaemic and breastmilk was insufficient. The need for monitoring the condition of pregnant women who were in the first trimester of pregnancy at the time of the disaster has been stressed by ICMR. These cases would be due for delivery from June onwards.

Studies conducted by the MFC have revealed an extremely high degree of gynaecological problems. Rani Bang and Mira Sadgopal found that of 114 women they surveyed in the two most affected areas — J P Nagar and Kazi Camp — 90 per cent suffered from leucorrhoea, 79 per cent from pelvic inflammatory disease (which could affect future pregnancies), 31 per cent (of non-pregnant women) from excessive menstrual bleeding and 59 per cent from suppression of lactation, which meant that infants were being weaned without adequate supplementation. All these figures were several times higher than those found in a non-affected Bhopal colony. Said Bang and Sadgopal: "As Indian women in general are shy and are reluctant to seek help for gynaecological problems, what we have found is only the tip of an iceberg."

The MFC study teams have also taken to task the local medical establishment for its totally inadequate and unimaginative post-disaster healthcare. One MFC team warned that a large proportion of the MIC-affected population is certain to develop fibrosis of the lungs (development of scars), which will permanently affect breathing and working capacity. Simple breathing exercises could help to reduce this disability but no effort has been made to spread knowledge of these exercises. Another MFC team criticised the local doctors for not giving any advice to pregnant women about possible risks to the foetus. Not only had these women been exposed to an extremely toxic chemical, but they had also been administered a variety of drugs like steroids, which are known to cause foetal deformities. MFC strongly argued in favour of proper health education and provision of facilities for abortions, if necessary. The MFC team also advised all affected people to practise contraception until all symptoms of cyanide-like poisoning had disappeared. The MFC suggestion that instead of hospital-based treatment, a cadre of paramedical workers and medical social workers ought to be created to provide treatment at home for acute symptoms, for identification of serious and chronic cases, for mass health education and maintenance of health records, has also been ignored.

Probably the only bright spot in these surveys is the incidence of blindness. Even though the eyes of over 70 per cent of the people were affected, and thousands were initially expected to go blind, ICMR surveys had not found any case of total blindness until the end of March. However, there were still thousands with serious eye problems needing urgent treatment and ICMR was still stressing the need for careful follow-up studies to monitor any late effects that might occur.

When hospitals were approached, doctors were rude. They considered everyone asking for a death certificate a scoundrel out to make money. Hard-working, proud people who had lost their nearest kin, felt hurt and angry. Even worse, they were made to run around. Looking through thousands of names needed time and hospitals made people come again and again. Those who were too shocked to ask for documents when their nearest were dying, now had to go to their local municipal councillors who had been authorised to countersign compensation claim forms and send them to the police for further investigations.

Equally disorganised and lackadaisical was the government's handling of free distribution of milk and rations. Apart from the 1,000 litres of free milk being given out daily the government had announced in December that all families in the affected areas of the city would be given three kg of wheat and rice per unit, on their ration card, for December. After the protests in the city, the benefit was extended to January, increased to 12 kg a unit for all slum dwellers of the city because of the severe dislocation in city life over the previous month. But the government did nothing to ensure proper logistics. Nearly 21,000 temporary ration cards had to be made almost overnight for residents who had none. No extra staff was appointed for making ration cards and the existing ration shops were expected to distribute these extra rations. The chaos that resulted is obvious. The Bhopal tragedy has amply shown that it would be futile to expect the government to deal with such emergencies with any measure of efficiency. And yet high-risk industrialisation has made this an imperative.

Issues after Bhopal

The Bhopal disaster has raised a series of questions: Where have other hazardous plants been built in India? Why were so many people living so close to the plant in Bhopal? How do we

Gas victims protest official callousness towards relief.
(Gopal Jain/*The Times of India*)

The legal battle

The question of compensation has taken the world by storm. The Bhopal litigation has the potential to become the largest and most lucrative civil legal case in the history of the world. Four days after the tragedy, an American lawyer told the *Wall Street Journal*, "I will bet that half the top personnel in jury lawyers in America are on planes to New Delhi." Indeed, within a week, American lawyers started arriving in droves to sign up clients. Because of the dream sums they promised, people in Bhopal even queued up in the earlier stages.

When criticised in the Western press that they were just "jet-set ambulance chasers", Melvin Belli, the most famous of them replied: "I'd rather be an ambulance chaser than a coffin maker. These other people caused the accident. We are trying to get some compensation." Soon, Union Carbide was facing over 60 lawsuits totalling over US $100 billion on behalf of 148,000 victims.

However, none of this has impressed many Indians or the government. The mood in India soon began to turn against the American lawyers and their Indian touts. A random sample of retainership agreements collected by an Indian reporter found that many lawyers intended to take a cut of 60 per cent of the damages as against the normal US practice of 30 to 40 per cent. Certain contracts, such as the one of Belli, did not even specify the contingency fees. Many people who had signed lawyers' forms in English, had not been told what they were signing nor given a receipt. Some lawyers had also taken away hospital and death certificates. Now these people have no papers to prove that they were affected by the gas tragedy. These people also have no information about who they have hired or what is the address of their lawyer.

The state government soon began to grow restive and urged the people not to enter into individual agreements with foreign lawyers. The government opened legal aid and guidance camps in Bhopal. Forms for filing damage suits against the company were supplied. The forms authorised the state government to file suits on behalf of individuals. Every day there were announcements of how many suits were filed in Indian courts. Promises were made to waive court fees and even to set up special courts.

But as time went by, the government became more interested in taking the case to the US court itself. The Union law minister declared the government did "not want the tragedy to be exploited by foreign lawyers". The Union government promised to "use all channels, even diplomatic ones, if necessary, to ensure that the sufferers are suitably compensated." In early January, the attorney general was sent to the US to consult American courts.

In March, the government pushed the Bhopal Gas Leak Disaster and Processing of Claims Act through the Parliament seeking an exclusive right to represent the Bhopal victims in Indian courts and abroad. Finally, after much dithering and widespread concern that the government may enter into an out-of-court settlement with Carbide, the government filed a petition for unspecified damages in the New York Federal Court in April. The judge hearing the cases collectively ordered Carbide to prepare an interim relief plan by early May — as a matter of "fundamental human decency" — and Carbide in turn announced a US $5 million emergency aid to the Bhopal victims.

Seeking compensation in the US courts has become a matter of hot debate in India. Those in favour list a number of advantages. Firstly, the liability will depend upon proof of negligence in India. In the US, the doctrine of strict liability — the fact that injury has been caused is the proof of negligence — is well accepted. A person who chooses to store a dangerous material is also liable for the consequences of the storage. Secondly, if damages are awarded, recovery could be easier in the US. Indian courts can only pass a decree against the Indian company, whose assets will be limited. This would also mean that compensation will be paid by Indian insurance companies for the ills of a US company. Thirdly, the case may drag on for years in Indian courts. There are over one million cases pending in High Courts and over 1.5 lakh in the Supreme Court. Litigation at the trial court will last for at least five years. In almost all High Courts, the normal

period of pending cases of civil litigations is six to 10 years and in the Supreme Court, 15 years. US lawyers point out that once the Federal Court in the US decides the question of jurisdiction in favour of the claimants, the insurance companies and UCC will seek a settlement. Fourthly, US courts can award punitive damages, while in India such a concept has yet to be established. Moreover, claimants will not have to spend any advance money towards US lawyers' expenses or fees. US courts allow contingency agreements with lawyers. Court fees in India are high and could prevent many people from filling suits. A claim of Rs 1 lakh will attract a court fee of Rs 7,500 and lawyer's fees could amount to Rs 10,000.

US lawyers have also argued that the chances of the case being accepted by a US court are good. UCIL's operations are controlled by the parent company in USA. UCC has been publicly distancing itself from UCIL in an attempt to confine liability to the latter. It has been emphasising that the plant was managed by Indians. But the US courts may not be persuaded by UCC's arguments because the specifications of the plant, the operating procedures and safety guidelines — all substantial decisions — were laid down by UCC headquarters in the US.

Even if jurisdiction of US courts is established, there is the doctrine of *forum non convenience*, according to which a case should be heard where it is most convenient. Again, recent case law may go against UCC. A US Supreme Court opinion — in a case involving an airplane crash in Scotland — suggests that an important factor will be whether the victims can obtain meaningful relief in the Indian court system. Victim's lawyers could argue that a meaningful forum may not be available in India. The defendant is an American corporation and may not be subject to Indian jurisdiction. Indian law requires plaintiffs to post prohibitively large court fees in advance. Indian courts have a heavy backlog of cases. In other words, the Indian legal system is poorly equipped for mass tort (wrong doing) litigation and is so slow and costly that it deprives poor victims of meaningful relief.

So widely accepted is the US courts' option that even the Chief Justice of India, Y V Chandrachud, has been quoted by the *Wall Street Journal* as saying: "It is the only hope these unfortunate people have." The Chief Justice even criticised the petition of M K Ramamurthy seeking directions to the Madhya Pradesh government and UCIL to pay Rs 5 lakh to the next of kin of each victim as an interim measure. He described it as "bare of facts" and "a casual petition thrown at the courts". The attorney general even argued that by raising the issue of negligence of the state government, the petitioners were playing into the hands of multinational corporations.

But many Indian lawyers remain unconvinced that simply going to US courts will open up US-level compensation for Bhopal's victims. Punitive damages is still a largely uncharted area even in the US. Juries in the first stages of trial have often made very generous awards, but they have been invariably whittled down by appeal courts. Thus, even if the jury in the initial trial decides that Bhopal victims should be awarded as if they were living in America, appeal courts may scale down the award. And even after this, the victims could get cheated. In the case of an asbestos factory where the courts had taken the paying capacity of a corporation into account and awarded payment of $1,00,000 to each affected worker, they were outwitted by the manufacturer who took shelter behind bankruptcy laws. The victims could thus collect only as much as the liquidated assets of the company could accomodate. There are few cases in which punitive damages awarded by juries in the initial trial have actually reached the plaintiffs.

Indira Jaising of the Lawyers' Collective in Bombay has described the government's decision to go to a court in the US as a mockery of India's sovereignty. "There is no law which prevents Indian courts granting adequate compensation and punitive damages," says Jaising. "If Indian courts have been awarding abysmally small amounts as compensation, it is because their sensitivity to the value of life is dimmed." Instead of taking the Bhopal disaster as an opportunity to advance the legal system in India, Jaising argues that we have the "shameful spectacle of a sovereign nation-state, one of whose prime prerogatives it is to dispense justice, asking for justice from the white man." If tomorrow the disaster occurs in a public sector company, where will Indians then run to?

Several commentators have argued that by going to US courts the government is trying to divert attention from its own criminally negligent role in permitting Carbide to be lax with its safety measures. The act permitting the government exclusive right to represent the Bhopal victims, has since been challenged in the Supreme Court as denying people's fundamental rights. Leading lawyers have asked how the government, a party to the crime, can suddenly become the guardian for victims of the crime. The government cannot pursue litigation in the US on the condition that victims must give up their claims against the local authorities, as is alleged to be the government's scheme.

K N Goyal, a sitting judge of the Allahabad High Court, has argued that victims should not get carried away by the mirage of astronomical damages through US courts, and allow suits in Indian courts to get time barred. Even in India relatives of each dead person could get damages between Rs 2.5 lakh to Rs 3.5 lakh. Adds Goyal: "The government officials who were responsible for ensuring compliance (and who) allowed such neglect or breach to take place also need to be punished through suitable disciplinary or criminal proceedings or both."

P M Bakshi, a member of the Law Commission, has pleaded for immediate legal reforms that would facilitate class action suits in India to provide adequate redress for mass accidents. Former Supreme Court judge V R Krishna Iyer has suggested the enactment of a substantive law of torts, new laws creating strict liability and for standardising compensation for mass application, and the institution of a new division in the High Court called the environment division, which has an adequate number of judges who have gone through courses on environmental law.

But little of all this seems to be happening. Many voluntary groups fear that the government will sooner or later enter into an out-of-court agreement with Carbide. The government has dismissed Carbide's earlier offer of $200 million spread over 38 annual instalments as insignificant and frivolous, but the minister of chemicals and fertilisers has not ruled out an out-of-court settlement. The *Wall Street Journal* has claimed that the Indian government may settle for $500 million. American lawyers, who have filed suits against Carbide, have also expressed fears that the Indian government "may settle too cheaply".

While the US press described the Indian government's decision to file a suit against Carbide as a setback to the company, which was hoping for a speedy settlement, Carbide's chief Warren Anderson has announced he is ready to meet Prime Minister Rajiv Gandhi to sort out the compensation issue. But he also criticised the Indian government for calling the company's offer too low without giving any reason for raising it. The legal claims of Bhopal's victims, thus, remain open even five months after the disaster and all the world's systems of justice have not been able to bring to book those responsible for the mass murder.

develop a policy for siting hazardous factories? Do adequate health and safety laws exist, which might prevent the occurrence of another disaster? Is it true that the benefits of using pesticides are so great that their costs in human lives are outweighed by the lives saved by pesticide use? Do multinationals operate with lower standards for health and safety in their Third World plants than in their home countries? Underlying these are deeper issues, about the controls that should govern the industrialisation process, about who decides, whose needs are met by industrialisation, and how multinational corporations, in particular, can be held accountable.

Indian newspaper editorials and articles, especially the big English language newspapers, have largely demanded legal controls and regulations. They have pointed out the inadequacies of the air and water pollution control laws, laws like the Factories Act which are supposed to control occupational health problems and oversee safety measures, and laws meant to regulate the use of pesticides. A carefully screened register of hazardous chemicals and industries is needed. In France, all companies and installations which can pose a danger to the environment have to get themselves registered by law. Stronger laws together with stricter implementation have been demanded almost uniformly.

Considerable attention has also been given to the siting of hazardous industries. Western commentators have repeatedly asked why were so many people allowed to live so close to the hazardous plant. The area was uninhabited when the plant was built. Most Indian editorial writers also recommended that hazardous industries be set up far away from populated areas. The Central Board for the Prevention and Control of Water and Air Pollution has recommended uninhabited green belts two-three km in all directions around hazardous industries. One newspaper writer suggested that this 12-30 sq km green area could "either be sold to the concerned companies at a low rate (for experimental farms etc) or be kept with the state/local government". As far as slums which already exist around hazardous industries are concerned, it has been demanded that they be removed forthwith. This view that people, not industries, need to be removed has been echoed by numerous industrialists since the disaster.

A third point concerns imported chemicals. A number of pesticides and drugs banned or heavily restricted elsewhere are being knowingly imported or manufactured in India. An example is polychlorinated biphenyls (PCBs), used in electrical capacitors and transformers. PCBs have been banned in most developed countries because they are carcinogenic. In many smallscale industries where these chemicals are used, workers are not even conscious of the danger.

The fourth point made is about the choice of technology. For instance, many companies manufacture carbaryl without using MIC and, indeed, Union Carbide itself switched to using MIC only a decade before the Bhopal plant was licensed. Industrial licensing authorities made no attempt to assess the advantages of the alternative route in Indian conditions. They seem to have been carried away with Carbide's offer to bring in the latest technology. On the contrary, France refused to allow MIC to be produced. A caprolactam plant has recently been set up on the outskirts of a south Indian city. This plant uses the same hazardous process used at Flixborough in UK, which suffered one of the worst fires known to chemical industry in 1974, when cyclohexane vapour was released. A safer alternative process could have been used.

Parents burying dead children outside the killer Carbide plant. (N Thiagarajan/*The Hindustan Times*)

A fifth point relates to the transportation of toxic chemicals. MIC was being transported from Bhopal to several locations in India without any regulations. Nearly 100 accidents involving the release of toxic chemicals during rail transport occur in the US every year. Two accidents on an average involve damages of over $1 million. Since Bhopal, many local communities and states in the US have begun passing restrictions regarding transport of substances like MIC. They have refused to wait for adequate federal regulations.

A sixth point takes in the behaviour of multinational corporations, which have repeatedly exported banned drugs and pesticides and even entire factories to the Third World. Asbestos is today the largest single cause of occupational cancer in the US, and experts have calculated that 8,000 to 10,000 Americans will die annually over the next 20 years because of exposure to asbestos in the past. Use of asbestos in industrial nations has declined precipitously — in Britain, by 52 per cent between 1975 and 1982 and in the US, by 60 per cent from 1978. Sweden has virtually eliminated the use of asbestos, the result of a trade union campaign since 1975. But in the Third World, the use of asbestos-cement materials is growing. In Ahmedabad, Shree Digvijay Cement produces 50,000 t of asbestos-cement pipes and sheets per year. Its foreign collaborator, John Manville Corporation, was so heavily sued in the US that it took refuge under bankruptcy laws. In Bombay, Hindustan Ferrodo, in collaboration with the British company, Turner and Newall, manufactures asbestos textiles and brake linings, which are being abandoned in Europe and USA. No attempt has been made by these companies to inform Indian workers or consumers of

Industrialisation is creating a high-risk environment but emergency response systems needed to deal with it are missing. Even trucks ran out of space transporting bodies in Bhopal

the dangers of asbestos.

All these suggestions pose serious problems. Take, for instance, the idea of siting hazardous industries away from human habitation. Zoning is relatively successful in Western countries, where an affluent population has access to efficient transport facilities. By contrast, a sizeable fraction of India's urban population cannot afford even subsidised public transport system. Moreover, Western cities have never faced the kind of rapid growth that Third World cities face today. Slums come up where work opportunities exist, and usually at such a speed that urban planners find them extremely difficult to control. Industrialisation and urbanisation go hand in hand. Industries immediately become focal points for urban growth and accretion of settlements. In fact, many chemical plants even in the US are situated in crowded urban areas, in particular older plants, which came up during the Second World War and before. Union Carbide's other MIC-producing plant at Institute, West Virginia, is a prime example.

Only an extremely strict regulatory regime, which could easily acquire an extremely oppressive character with slums being regularly bulldozed, would work. A zoning policy would work properly only if the government could develop an overall policy for housing all urban residents. Otherwise the urban planners' 'unintended city' will invade all regulated zones. At a time when slums are growing in most Indian cities, such a policy looks like a dream. Only a few months before the disaster, the residents of J P Nagar had received *pattas* (ownership rights) for their house-sites. The most precious thing with which they ran, when the gas wafted into their houses, was the patta.

A siting policy which pushes hazardous industries into 'backward' rural areas could easily become an excuse for displacing rural people. Workers in remotely located plants will also need transport facilities. Unless Indians want to blame the victims for the suffering caused by such disaster, the country must realise that it has only two options for hazardous industries: either such industries are not built at all by adopting suitable technology or lifestyle choices, or if they have to be built, they will have to live cheek-by-jowl with people (especially poor people), in which case safety measures must override all considerations, including economic considerations. And to ensure that safety measures are indeed undertaken, the people must be fully involved and informed about all possible dangers.

Indian social action groups have strongly argued for the people's right to know about hazardous factories, where they are being sited, why and what dangers they pose. Only when people know will there be public pressures for safety and a honest response from regulators. The callousness with which the warnings about the Bhopal plant were ignored shows an unholy politician-industrialist nexus operating in full bloom. As Prem Shankar Jha of *The Times of India* put it, industralisation cannot proceed without Bhopal-type disasters, unless there is political discipline — and greater democracy. Without political discipline, multinationals too cannot be adequately policed.

In the US, questions are being raised about who decides where hazardous plants are sited. Should this only be a matter of concern to industrialists and government regulators, or should the people also have a full legal right to intervene? Equally, shouldn't the plant's neighbours have the right to intervene when a production line is changed from a relatively non-hazardous one into a hazardous one? Such questions are now being asked loudly in Kanawha Valley, where Carbide's Institute plant is located.

A prime example of a government regulation failing to control hazardous substances, in the absence of public pressure, is the Insecticides Act. The Act is enforced by the very agency — the ministry of agriculture — that is promoting chemical agriculture and only public-spirited environmentalists can put pressure on the regulating agency to observe the spirit of the act. In the US, too, the Federal Insecticides, Fungicides and Rodenticides Act enacted in 1947 did little to control dangerous pesticides until Rachel Carson's celebrated book, *Silent Spring*, created an international furore.

The right to know is particularly important in a society like India where most producers of scientific knowledge work for the government or the corporate sector, both of which close information to the public, especially in adverse circumstances. Said D. Banerji, community health expert of New Delhi's Jawaharlal Nehru University, "The Bhopal tragedy has exposed the most deplorable state of the community of scientists of India." Scientific institutions in the developing world have developed mainly under government auspices.

Excessive government control has led to a political and bureaucratic stranglehold over information. Secrecy reached incredible levels in Bhopal after the disaster. Even the Indian Meteorological Department, the government's innocuous weather agency, refused to divulge information about the weather conditions on that fateful night. The Madhya Pradesh health department has consciously sought to suppress all information relating to the health of the victims, forcing voluntary agencies to take up

One down, more to go

The Bhopal disaster has at least spurred some state pollution control boards into action. In two states — Maharashtra and West Bengal — and the union territory of Delhi, surveys of hazardous industries have been undertaken, generating the country's first inventory of hazardous industries. The most interesting thing about these surveys is that they indict the country's blue chip companies of gross environmental negligence and unsafe practices.

The West Bengal Pollution Control Board survey found 55 hazardous industries in Calcutta, six in Howrah and another 20-odd in other districts. In this list were such leading companies as Chloride India, Bata India, Kesoram Rayon, Bengal Chemicals, Titagarh Paper Mills, Reckit and Coleman, Calcutta Chemicals, Shalimar Paints, Guest Keen William, Hindustan Motors, Standard Pharmaceuticals, Wimco, Bengal Distilleries and East India Paper. All these companies were found releasing hazardous effluents into rivers and sewers. At Chloride India's Shyamnagar plant, for instance, the lead in the effluents was 0.4 ppm as compared to the board's stipulation of 0.1 ppm. Bata India's effluents contained chromium and Kesoram Rayon's contained zinc. The board had taken legal action against only five companies and the majority of even the known offenders had gone free.

In Delhi, the administration surveyed 109 companies and found two in particular with safety deficiencies: Shriram Food and Fertilisers and Hindustan Insecticides. The administration also announced the setting up of a special cell to monitor safety measures in these 109 companies, so that these factory inspectors would not get bogged down with routine inspections. One factory was found storing 100 tonne (t) of chlorine and, if safety precautions slackened, a Bhopal could easily repeat itself.

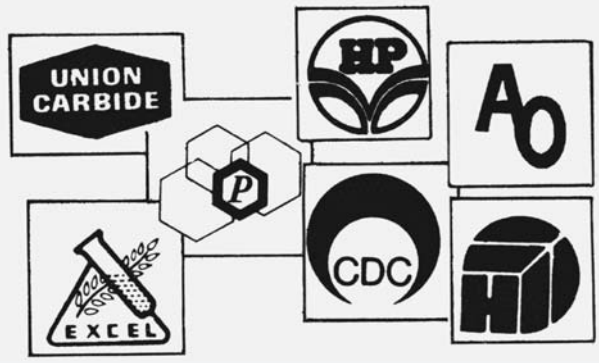
In Bombay, the post-Bhopal days were even dubbed the "chemical scare season" by one magazine. For a fortnight beginning March 3, Bombay's civic authorities were besieged with phone calls from anxious citizens alarmed at obnoxious smells, which they suspected to be leaks from chemical plants. The sources of most of the leaks could not be traced. In one case, the Bombay Municipal Corporation and the Maharashtra Pollution Control Board (MPCB) took 10 days to find an ammonia leak source: the Boots (India) plant in Sion. By that time the company had repaired the damage.

On March 12, gas leaked from the ammonia loading station of the Rashtriya Chemicals and Fertilisers (RCF) plant at Chembur. Air samples taken on the night of the leak revealed that the ammonia concentration in the air was well above the threshold limit (TLV). Then it was found that ammonia had leaked a day before too. Finally, on March 14, the MPCB ordered the plant closed until repairs were completed. The plant came back into operation a few days later.

Again on April 1, a two-metre long crack in a pipe in the RCF sulphuric acid plant sent sulphuric acid fumes and sulphur dioxide into the air. The acid fumes dispersed in 15 minutes after the plant was shutdown — but only after a bout of widespread choking, workers running helter skelter, slum dwellers residing near the plant fleeing from their hutments, and other residents refusing to open their windows for long. RCF chairperson was giving a lecture on industrial pollution at the time of the leak, in which he blamed poor work ethics, infrastructural deficiencies, low maintenance standards, and unreliable testing systems. The company's union, however, blamed the management for not having repaired the pipe properly when it had leaked the first time.

In April, the MPCB also released its report on Bombay's hazardous industries. Over half of the 6,000 polluting industries identified in the state are located in and around Bombay. This figure does not include the thousands that operate illegally. There are around 50 giant-sized companies in Bombay, which handle or manufacture hazardous chemicals, including MIC.

The environmental safety committee set up by the MPCB under R K Garg of the Bhabha Atomic Research Centre surveyed 15 major industrial units. Its report was definitely sobering. Almost every factory it inspected was deficient in safety measures. Except for Calico Chemicals, every company was making good profits consistently and there was no shortage of funds.



The committee reported a series of deficiencies in the RCF's, Chembur factory. It found that shop floor operators were not conversant with safety devices and procedures for handling abnormal operational problems. There was no system for continuous monitoring of hazardous chemicals like ammonia, carbon monoxide and nitrogen dioxide. A number of safety valves and level and pressure indicators were found to be corroded. The committee was promised that steps would be undertaken to rectify this situation.

The sytrene monomer plant of Polychem Ltd in Chembur handles a variety of hazardous chemicals in bulk including alcohol, benzene, ethylbenzene and ethylene, which are also highly inflammable. But the company had no firefighting group, nor a safety officer. The committee was also concerned by the inadequate water supply arrangements for firefighting purposes. The workers were not checked periodically for benzene or styrene exposure. Workers were also exposed to anhydrous aluminium chloride, which they had to feed into the chemical reactor manually.

The Calico Chemicals plant at Chembur was found to be a particularly hazardous place. The plant handles a range of inflammable materials and highly carcinogenic substances like vinyl chloride. The entire safety aspect, including disaster planning, needed a thorough review. The valves, pipelines and storage vessels of the chlorine and caustic soda plant were found to be in such a highly corroded state that the plant was not even safe enough to be operated in its present condition. Workers in the chlorine handling plant had not been given proper masks, emergency kits or breathing apparatus. The vent lines from the hydrochloric acid storage tank did not pass through a scrubbing system, as safety regulations demand. The company also maintained a highly dangerous quantity of vinyl chloride which, according to the committee, should be restricted to a maximum of one day's requirement. It was also found that, in the case of a runaway reaction, the highly carcinogenic vinyl chloride was blown into the atmosphere in the obsolete PVC plant. Mercury leakage was not monitored, nor were workers checked regularly for exposure to mercury and vinyl chloride. The effluent treatment facility was also not adequate and did not operate regularly.

The Carbide Chemicals plant in Chembur both uses and produces a range of highly toxic and inflammable chemicals. In 1979, an expansion programme increased the company's polyethylene production capacity from 9,000 t to 20,000 t. Although the company has a safety officer and a firefighting group, the committee claimed that, "It is not well equipped to cope with a disaster." The workers were not provided with clear instructions for what to do in case of an emergency. The treatment plant was inadequate. Levels of BOD, COD and chlorine in the effluent water were excessive. The vent line from the crotonaldehyde storage tank was left open to the surrounding atmosphere. The committee felt that the company was storing dangerous amounts of this chemical and recommended that it be limited to a maximum amount of process requirement of eight hours. Before shutdown of the plant for repairs and maintenance, it should be ensured that all crotonaldehyde is consumed. There was no monitoring

arrangements for toxic chemicals like crotonaldehyde and benzene in the atmosphere and firefighting arrangements were also inadequate.

The Hindustan Petroleum plant at Chembur has a crude oil processing capacity of five million t a year. The plant emits 36 t of sulphur dioxide and 76 t of carbon monoxide every day. The committee felt that not only should these emissions be monitored regularly, but they should also be reduced as they were inordinately high. The oleum storage tank opened out into the atmosphere without an absorption system and there was no dike wall to prevent the spreading of the acid in case of leakage. Leakage of phenol in the coolant water was also not being monitored adequately.

The Bharat Petroleum Corporation refinery at Chembur processes another six mt of crude oil every year. Apart from 3.5 mt of crude oil which is stored at any given time in the refinery, constituting the biggest fire hazard in the area, the natural gas and petroleum products that are produced here are all highly inflammable. The committee found that the refinery's wastewater treatment plant was not functioning up to the mark and both sulphur dioxide and carbon monoxide emissions into the atmosphere were very high. Air and water discharges and their sources were not being regularly monitored for pollutant levels. The scrubber vent on the tetraethyl lead storage tank was also inadequate.

The five electricity generating units of the Tata Electric Company (837.5 mw total) are located in the congested Trombay area. This company accounts for nearly 70 per cent of the nitric oxide released in Chembur. Neither the releases of sulphur dioxide and nitric oxide nor the temperature of the wastewater at the discharge point were being monitored continuously.

The Ahmed Oil Mills situated in the densely populated and residential Grant Road area produces 100 t of edible oil every day. The BOD in the effluent water and the sulphur dioxide emissions to the atmosphere were very high. There was so system for monitoring the plant's effluents. It did not have an effluent treatment plant either. There was no safety training for the workers, nor was there a fire and safety officer. Hydrogen has been stored in a partially open, congested place and no permission had been taken from the explosive department. The company did not have any provision for control of ammonia in case of leakage.

The Bombay Soap Factory, situated next to the Ahmed Oil Mills, also has no effluent treatment plant, despite being located in a densely populated area. The BOD, COD and chlorine levels in the effluent water were very high compared to the set standards. There was no separate firefighting group. The committee noted that the company has a casual approach to safety aspects. Hexane, a dangerous chemical, was stored in large amounts even when the plant was not in operation and the storage area was not properly segregated. The committee recommended that the plant be shifted to a suitable area immediately.

The Hindustan Lever plant at Sewri manufactures various detergent bars, talcum powder, soaps and vanaspati. This company also handles a number of toxic and inflammable chemicals. The committee told the company that it should immediately discontinue its practice of storing monoethanolamine, a highly toxic chemical, in large quantities in drums near the plant. The COD in the effluent water was also higher than the stipulated standard. The emissions from the plant were being monitored only once a quarter. The company was also told not to transport the toxic sludge from the wastewater treatment plant by road, as this was dangerous. Transport by sea was recommended.

Excel Industries Ltd has two plants in Bombay at Amboli and Jogeshwari. It manufactures industrial and agricultural chemicals used as basic chemicals and intermediates in industry and as pesticides and fumigants. Neither of the plants had a separate safety and fire officer as required by safety regulations. The oxalic acid plant at Jogeshwari did not have any standby caustic soda scrubber for nitric oxide. Nor did it have an alarm system to indicate release of excess nitric oxide fumes. The incidence of nitric oxide was very high in the mercuric chloride plant. The flooring of the plant was not proper for collecting any spillage of mercury. The mercury release in the effluent was slightly higher than the standard. Mercury level in the urine of the workers was not being monitored. The committee found that in the Amboli plant, yellow phosphorus drums were being stored in a dangerous manner. The stacks of aluminium phosphate and zinc phosphide plants were not monitored periodically for toxic compounds, nor was the percentage of arsenic in zinc dust checked. The workers were not periodically checked for benzene exposure.

The dyes and chemical plant of India Explosives Ltd in Sewri came in for harsh criticism from the committee. There was no monitoring of emissions and no proper effluent treatment plant had been provided. They was a casual approach in safety measures while handling hazardous chemicals. There was no firefighting group available round the clock. Butanol was being stored near the cyanide handling unit, which is highly dangerous. The committee suggested a number of changes in the storage practices of various chemicals and recommended proper level indicators, vents and scrubbers for all storage tanks. It also recommended that cyanide emissions should be monitored and workers should undergo regular medical checks. The committee passed the following verdict: "In view of the improper storage facilities of hazardous chemicals, absence of proper monitoring system for effluents and emissions, and low levels of awareness of safety measures, the committee feels that it is not safe to operate the plant."

The Burroughs Wellcome plant in Mulund, which manufactures medicines, was found storing highly dangerous and inflammable substances including hydrogen, phosgene and sulphur dioxide. Many of the chemicals and solvents were stored in the open and close to each other. The committee felt the excessive storing of these chemicals should be stopped immediately. The pipe from the phosgene reactor to the scrubber was made of glass, which is fragile, and constitutes a potential hazard. The monitoring of phosgene and chlorine in the working areas was not being carried out with proper instruments. The COD and BOD levels in the effluent waters were also high.

The Hindustan Ciba Geigy plant at Bhundup manufactures several consumer products, dyes and chemicals. The emissions from the plant were not being monitored and there was no temperature measurement system for chloroform in the storage tank. The chloroform tank itself needed to be relocated away from the railway line. The vent of the toluene storage tank was left open to the atmosphere. Acids and various chemicals were being stored together.

From what the committee found it is indeed surprising that Bhopal does not take place every day in Bombay. To what extent its recommendations will now be followed is still not clear. When asked whether chemical plants should maintain only those amounts of chemicals which can be used up in one day, as recommended by the Garg committee, RCF's chairperson Duleep Singh says, "I appreciate the Garg committee's recommendations, but they are a little in the extreme. No factory would keep

Zoning has been unsuccessful in India. Bhopal's slum dwellers ran for their lives, but with their *pattas*. (Ashok Chaddha)

public interest research and epidemiological surveys. For the public, it has been almost impossible to sort out the truth from the lies — especially the technical and medical lies — whether trotted out by the company or the government.

The Bhopal disaster has thus, reinforced the need — and demand — to democratise access to information. It is clear that otherwise every interest group will try to exploit the society's ignorance for its own nefarious ends. Only alert citizen's action groups, armed with legal rights like the right to know and with institutions involved in public interest research, can bring order to an otherwise increasingly chaotic industrial safety situation. The Society for Participatory Research in Asia has suggested that industrial workers' trade unions should take the lead by setting up independent research groups on occupational health and industrial safety. Even in the US, with all its technological capabilities and advanced government regulations, active citizens' groups alone were getting laws implemented and acted upon.

Pattern of industrialisation

Several commentators have also raised broader questions about the very pattern of industrialisation, which generates such a massive demand for toxic substances and which exposes the poor to such hazards.

Western newspapers have quickly reminded the Third World about "a balance sheet of death" as *The Guardian* in London put it, or "the pain of progress", as the *New York Times* put it. Said the pro-industry *Wall Street Journal:* "Of the people killed, half would not have been alive if it were not for that plant and the modern health standards made possible by the use of pesticides." The British science magazine, *New Scientist,* has been equally pointed in its remarks: "Rich nations can afford to forego a little pesticide for fear of spreading a rare cancer. Such arguments mean little in countries where thousands die from hunger." Thus, if pesticides kill, they also save.

In any case, many multinational executives have asked, why should developed countries be responsible for controls on products used by developing countries? Wouldn't that be a kind of 'environmental imperialism'? James Weeks, a commentator in consumer crusader Ralph Nader's *Multinational Monitor* has argued back, "This concern obscures a more fundamental issue: the dictating that is already being done by an international economic system dominated by the same multinationals." In 1981, President Ronald Reagan overturned an executive order by former President James Carter to inform developing countries about export of products banned in the US, because it could affect US exports.

India's ruling elite probably believes in the 'balance sheet of death' argument. Commenting on the fact that hardly any English newspaper had criticised the industrialisation process itself, one Hindi poetess lamented: "There was no anger in any of the newspapers."

There were indeed only a few exceptions. Said Prabhash Joshi, the editor of *Jansatta*: "The benefits of 21st century technology will go to politicians, administrators, scientists and so-called intellectuals. But the people who have to pay the price of this technology with their lives are those who cannot even get enough to eat two times a day. Borrowed technology from the West cannot fill the gap between these two worlds. This gulf is beyond the understanding and resolution power of the West."

The Zahreeli Gas Kand Sangarsh Morcha and several voluntary groups across the country have demanded an alternative development process, which will be based not only on appropriate technological choices, but also on appropriate lifestyle choices. There is no particular reason, for instance, why there should be such a demand for plastics, detergents or polyurethane foam. The demand for these products has arisen out of aggressive marketing policies, whose sole interest is to increase corporate profits.

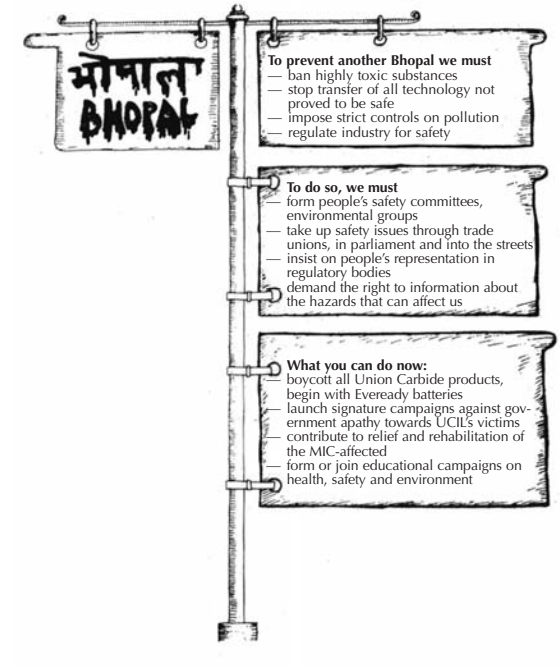
In agriculture, too, there is no real need to rely heavily on pesticides. While insecticide use has increased 11-fold over the past 30 years, crop losses due to insect resistance doubled. Through land reforms, soil conservation measures, building of small water harvesting systems like tanks and ponds, planting of multipurpose food, fuel and fodder tree species, intercropping and use of resistant crop varieties, setting up integrated systems of animal husbandry, crops, orchards and aquaculture, villages can be turned into highly productive, symbiotically-integrated ecosystems of food-fuel-fish-fertiliser-fodder biomass, and the need for chemical fertilisers and pesticides can be almost eliminated.

In the area of public health, India's own scientific laboratories have shown that the town of Pondicherry and villages of Gujarat can get rid of mosquitoes by policies that

The Bhopal disaster hit entire families. Their eyes and lungs badly affected, many of them will never to be able to work as manual labourers again. (N Thiagarajan/*The Hindustan Times*)

help the people to clean up their environment. What is the value of dumping more and more powerful insecticides while mosquitogenic, filthy conditions are being simultaneously created for mosquito-borne diseases to grow?

But a move away from highly toxic, bulldozing chemicals will require a holistic approach to people's problems and people's participation in the management of national resources and generation of technology. This will come about only, as poet Raghubir Sahay has put it, with a culture of *anusandhan* (research and discovery) and not one of *anukaran* (blind imitation). However, several commentators have been extremely pessimistic about such a culture actually being born. They argue that this culture based on modern technology is so seductive that changing it will be an extremely difficult task. Asked one writer from Bhopal, "We may be able to stop the multinational corporation from coming in but can we stop the 'multinational culture'? Is this not the culture that all of us crave for?" As if to prove this point, there was no effect of the Bhopal disaster on the fortunes of the ruling party in the parliamentary elections from Madhya Pradesh. The ruling party also won the seat of Bhopal. Said Rajkumar Keshwani, the journalist who had given warning of the disaster two years before: "I don't see any anger. I only see shattered people. And outside the affected areas, there is only a desire for more of the same."



Five months later, the government still had not taken any steps to prevent the recurrence of Bhopal-type disasters. A proposal to set up an inter-ministerial board on hazardous chemicals had been quietly buried. The ministry of chemicals announced the establishment of a cell, but that too, had not taken off. The department of environment was waiting for the scientific advisory committee to the cabinet to discuss its proposal for a comprehensive Toxic Substances Act. Only some state pollution control boards have started flexing their muscles, basking in all the public attention that they were getting after Bhopal. But what impact their new-found power will have is still not clear.

What is clear, however, is that the government has not even thought of developing any emergency response system to industrial disasters. Industrial disasters involving toxic chemicals occur with frightening regularity even in highly advanced countries like the US, but they kill few people because of sophisticated emergency response systems that exist, in which thousands of people can be evacuated within minutes. Industrialisation is creating a high-risk environment everywhere in the world but more so in the Third World where lack of capital, general inefficiency within the bureaucracy, and the callousness towards the underprivileged bred by the dual society, combine to create an unfortunate situation in which it is even ridiculous to expect a sincere, efficient and concerned response to disasters, natural or human-made. Statistics repeatedly show that an average typhoon kills few people in the US as compared to poor Philippines and few in Philippines as compared to poorer Bangladesh. Indians, caught in the race for industrialisation, can only wonder how a government would ever handle a nuclear disaster. Dealing with it may again be left to the informal sector of social work — the voluntary agencies — and to people to fight for their rights.