

SUBTERRANEAN LEAK

PHOTOGRAPHS: SAKSHI BHALI/CFE

+ DOW CHEMICAL = ENVIRONMENTAL POLLUTION
FRONT MAHILA STATIONERY KARMACHARI SANGH 588215, GOUT

- High amount of pesticides and heavy metals found in soil and surface water inside the plant
- Groundwater outside the factory premises also contaminated with pesticides and heavy metals
- The profile of chemicals found inside and outside the factory matches
- For more than 25 years UCIL factory is contaminating Bhopal's groundwater

THE STUDY

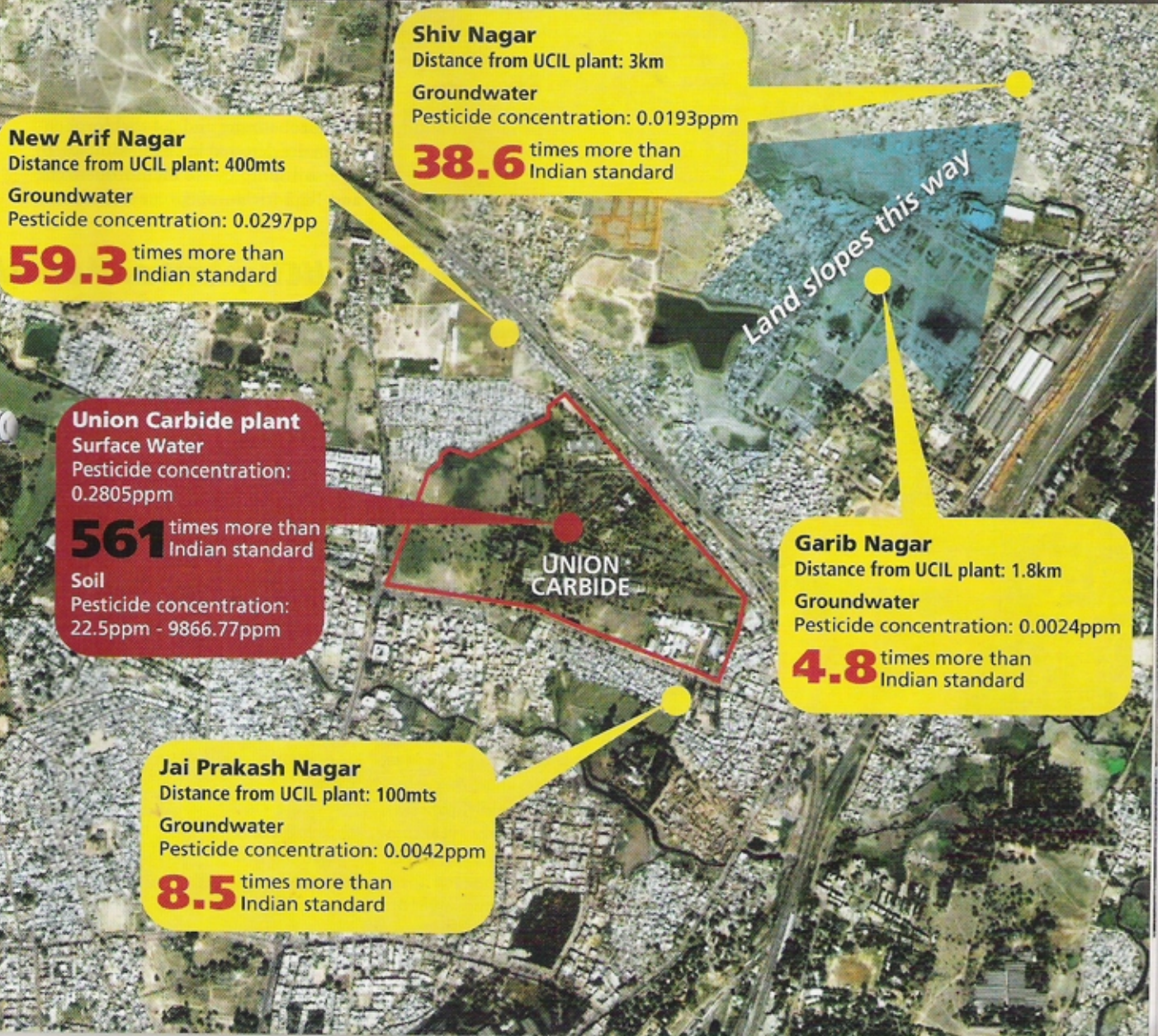
Centre for Science and Environment's Pollution Monitoring Lab (PML) tested water and soil samples from in and around the Union Carbide India Limited (UCIL) factory for the presence of toxic chemicals

PML studied the chemistry of the processes used for producing various pesticides in UCIL and based on it, selected four groups of chemicals for testing soil and water samples. In chlorinated benzene compounds it tested 1,2 dichlorobenzene, 1,3 dichlorobenzene, 1,4 dichlorobenzene and 1,2,3 trichlorobenzene. In organochlorine pesticides it tested alpha, beta, gamma and delta hexachlorocyclohexane (HCH). The two main products of UCIL—Carbaryl and

Aldicarb—were also tested. Five heavy metals—lead, cadmium, chromium, mercury and arsenic—were also tested.

WHY WE TESTED

UCIL used to manufacture three different kinds of pesticides: Carbaryl (trade name Sevin), Aldicarb (trade name Temik), and a formulation of Carbaryl and gamma-hexachlorocyclohexane (g-HCH) sold under the trade name Sevidol. g-HCH was extracted from the technical



grade HCH, a mix of several chemical forms (isomers) of HCH (mainly alpha, beta, delta and gamma HCH). UCIL used to buy technical grade HCH, extract g-HCH and throw the remaining isomers as waste.

Carbaryl and Aldicarb fall under carbamate group of insecticides; both are moderately persistent, highly toxic; highly water soluble and mobile in soils. It is therefore not surprising that PML found both these pesticides in the soil and water in and around the factory.

HCH and its isomers are highly persistent and toxic organochlorine pesticides and presence of different isomers of HCH is because of its processing in the plant, use of g-HCH for Sevidol formulation and dumping of other isomers within the factory and outside in the waste dump site (also called by UCIL as solar evaporation pond).

Hexachlorobenzene (HCB) is an impurity in the technical grade HCH and was also produced as a byproduct of various chemical processes in the UCIL factory.

Chlorinated benzene compounds are highly persistent and were either used by UCIL as solvents or are degradation products of HCH or HCB. For instance, 1,2 dichlorobenzene was used as solvent for producing alpha-naphthol

—a chemical used in the production of Sevin, the main product of UCIL. Chlorinated benzene compounds are also used as insecticides and fungicides.

Heavy metal like mercury was used as a sealant in the Sevin plant and chromium was used as a coolant in the cooling plant of the UCIL factory.

WHERE WE SAMPLED

Scientists from PML visited Bhopal on October 28-29, 2009 to collect soil and water samples.

■ PML collected 8 soil samples:

One sample from the waste stored in the waste storage shed in UCIL. This is the waste that the government is trying to send to hazardous waste disposal site.

Six soil samples were collected from various places inside the UCIL factory. The last soil sample was collected from the solar evaporation pond—place where UCIL used to dump all its wastes.

■ Collected 12 water samples:

One water sample from inside the factory—which is rain water collected in a ditch in the plant premises

Eleven water samples—from hand-pump, borewell and dugwell—from areas around the UCIL factory. The samples were collected from colonies next

to the factory boundary wall to those 3.5 km away from the factory.

WHAT WE FOUND

The contamination inside

The results of the testing of one stored waste sample, six soil samples and one surface water sample in the factory and one soil sample from the waste disposal site (solar evaporation pond) clearly show that the land within the UCIL factory and the waste disposal site is highly contaminated with pesticides, organic compounds and heavy metals.

■ The waste sample

The waste stored within the UCIL premises had all four chlorinated benzene compounds and 6 out of the 7 pesticides. Carbaryl content in this sample was as high as 9856 ppm. The sample also had 4 out of the 5 heavy metals. Mercury content was 1065 ppm.

■ The soil samples

HCH and its isomers, HCB, 1,3 dichlorobenzene and 1,4 dichlorobenzene were detected in all soil samples. In five soil samples 1,2 dichlorobenzene and 1,2,3 trichlorobenzene were found.

UCIL plant and nearby

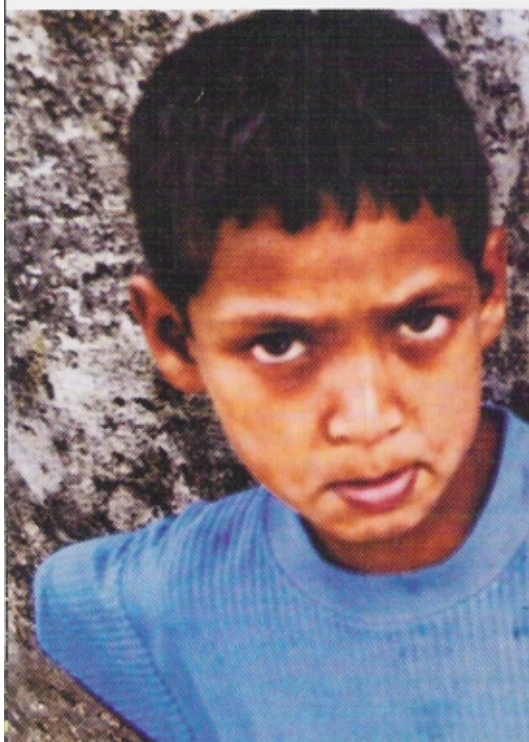
HEAVY METALS THAT PERSIST

Sample Site	Hg (ppm)	Pb (ppm)	Cr (ppm)
Waste storage shed of UCIL—taken from the sack adjacent to the wall marked D/A 24	1064.61	23.22	86.18
From the pilot plant pit (adjacent to the boundary wall) near Temik Plant	74.14	111.78	297.7
From the ground floor of the Sevin Plant	8188.33	84.05	192.13
From Solar Evaporation Pond of UCIL, parallel to the under-construction flyover	18	22.34	1064.57

How we tested

PML, an independent lab with ISO 9001 accreditation followed internationally accepted US Environment Protection Agency (EPA) methodology. High Performance Liquid Chromatograph (Method 8318) was used to detect presence of carbamates (carbaryl and aldicarb). Gas Chromatograph was used to test presence of organochlorine pesticides and chlorinated benzene compounds (EPA Method 8081B).

Presence of pesticides was further confirmed using Gas Chromatograph-Mass Spectrometer (EPA Method 8270 C). To check presence of lead and chromium, analysis was performed in Atomic Absorption Spectrometer (AAS) using flame technique. Similarly, presence of arsenic and mercury were established through analysis using AAS-vapour technique. For the analysis of both soil and water for these heavy metals EPA methods were used.



Aldicarb was found in three soil samples and Carbaryl in one.

The total pesticide and chlorinated benzene compounds content in the samples ranged from 185 ppm (in a pond near the boundary wall at Atal Ayub Nagar side) to 5874 ppm (from Sevidol formulation plant). The gamma-HCH (Lindane) content in the soil sample from the Sevidol formulation plant was 2782 ppm.

Arsenic and chromium were found in all soil samples. Mercury was found in two samples and lead in five out of the six samples. Chromium was found in the range of 18 ppm-298 ppm, the highest concentration near Temik plant.

Mercury was found in two samples and concentrations were very high. In the soil sample collected from the floor of the Sevin plant, the concentration was 8188 ppm. Even now elemental mercury can be seen inside the Sevin plant.

■ The water sample

The surface water sample collected within the factory premises had the highest level of contamination and all compounds tested for were found.

■ The waste dump site

The soil sample contained all chlorinated benzene compounds and organochlorine pesticides. It also had four out of five heavy metals. Chromium content in this sample was 1065 ppm. UCIL was using the chromium as coolant and was throwing cooling water in the solar evaporation pond.

The contamination outside

All 11 groundwater samples collected from colonies around the UCIL factory were contaminated with chlorinated benzene compounds and organochlorine pesticides. Carbamates were found in four groundwater samples.

Concentration of pesticides found in all water samples was 1.1 to 38.6 times higher than the only mandatory Indian water standard, fixed by the Bureau of Indian Standards (IS:14543). The average concentration in all groundwater samples was 0.006 ppm which is 12 times the standard.

HEALTH EFFECTS OF CHEMICALS FOUND

1, 2 Dichlorobenzene	Liver cirrhosis, affects blood cells, lungs, kidneys, nervous and reproductive systems
1, 3 Dichlorobenzene	
1, 4 Dichlorobenzene	
1,2, 3 Trichlorobenzene	Damages immune, neurological, reproductive, developmental and respiratory systems
Hexachlorobenzene	Causes liver disease, ulceration, bone defects and loss of hair, neurological changes. Possible carcinogen
Hexachlorocyclohexane (including all isomers)	Potential carcinogen. Damages liver, kidney, neural and immune systems. May cause reproductive and neurotoxic impairment and endocrine disruption
Carbaryl (Sevin)	Damages brain and nervous system. Causes endocrine disruption and abnormal child development
Aldicarb (Temik)	Increases chromosome abnormalities, carcinogenic, adversely affects immune system
Mercury	Neuro toxin. Adverse effects on memory, concentration, language and other skills have been found in children exposed to moderate levels in the womb. Higher incidence of spontaneous abortions
Arsenic	Gastrointestinal effects, anaemia, peripheral neuropathy, skin lesions, causes liver and kidney damage in. "Group A" human carcinogen
Lead	Disrupts biosynthesis of haemoglobin and anaemia, miscarriages and abortions. Disruption of nervous systems, sperm damage, diminished learning abilities in children and behavioral disruptions in children
Chromium	Ulceration and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasms and edema

residential areas are contaminated with a cocktail of chemicals

The water sample from a hand pump near the Chaurasia Samaj Mandir in Shiv Nagar was the most contaminated. It has highest concentration of Carbaryl (0.011 ppm or 110 times the standard), Lindane (0.004 ppm; 40 times the standard) and mercury (0.024 ppm; 24 times the standard). This place is more than 3 km from the UCIL factory.

THE LINKAGE

The profile of chemicals found within the UCIL factory and in the waste disposal site of UCIL matches the chemicals found in the groundwater sample in the colonies outside the factory premises. There is no other source of these chlorinated benzene compounds and pesticides than UCIL. The topography of the area also points towards contamination of the groundwater due to the UCIL. The plant is located at a slightly higher altitude than the residential colonies with a gently sloping terrain.

Carbamates, as a general group, are

considered to be moderately-persistent in the environment. But finding carbamates in groundwater, 25 years since the plant shut down, clearly means that the UCIL plant is acting as a continuous source of groundwater contamination.

For more than 25 years the residents of the area have been exposed to chemical-laced groundwater. And, they will continue to be exposed till the site remains contaminated.

What is also clear from this result is that the entire site is highly contaminated. The waste stored within the factory premises is just a small part of the total contamination present in the site. The focus of the government to just dispose of the stored waste and ignore the site contamination problem is not going to solve the environment problems emanating from the UCIL factory.

The lab study was done by Sapna Johnson, Ramakant Sahu, Nimisha Jadol and Clara Duca

350 tonnes of waste at the factory has been waiting for disposal for two decades



NO ONE IS CLEANING UP

25 years on, thousands of tonnes of hazardous waste is scattered around the Union Carbide factory

Ground zero of the Bhopal gas disaster, the defunct pesticide factory, will soon be opened to the public, says the Madhya Pradesh government. It will be converted into a memorial. A Delhi-based architect's proposal for the memorial—which includes an exhibition gallery, a walking plaza showcasing cast-iron figures of victims, viewing towers and bazaars—has been judged the 'best' in a competition held by the government. The proposal awaits clearance.

"This will dispel the myth that there are toxins left at the site," S R Mohanty, principal secretary of the Madhya Pradesh government, told *Down To Earth*. The city is abuzz with rumours that the site spread over some 35 hectares is prime real estate—the factory is in the city. The city wants the land.

DEADLY DUMP

For over 20 years after the disaster, nobody paid attention to the hazardous waste lying at the now dead and deserted factory. "Long-term poisoning and clean-up came up during the hearing but were not the focus. The focal point was compensation and building a hospital," said Ranganath Misra, former chief justice of India who was in the bench that pronounced both the critical judgements of the Supreme Court—in 1989, when the settlement was made

and then in 1991, when the court agreed to reinstate criminal charges against the company, Union Carbide.

In the mid-1990s, some 10 years after the disastrous night, Union Carbide sold the shares of its Indian company. In 1997, Eveready Industries India Ltd, which bought the shares of Union Carbide, commissioned to the Nagpur-based National Environmental Engineering Research Institute (NEERI) a study of the contaminated site. It is still not clear why this study was commissioned, but some say the plan was to set up an electronic factory. The report available with activists in Bhopal shows that NEERI did find pesticides, from Sevin (carbaryl) to lindane and alpha naphthol. NEERI officials confirmed to *Down To Earth* that they had indeed found high levels of toxins and had identified the hot spots of contamination in the factory.

Then in 1999, the global NGO, Greenpeace, conducted a similar study in and around the factory. This report also confirmed contamination on a massive scale. This was also the time when the big sale was taking place: Union Carbide was sold to The Dow Chemical Company, another US chemical giant.

Citing the findings of this report, Bhopal activists took the matter to the New York district court. They demand-

ed relief for personal injury and property damaged because of continuing release of pollutants from the factory. The battle in US courts continues till date. But in 2004, Alok Pratap Singh, an activist in Bhopal, filed a public interest petition in the Madhya Pradesh High Court. He petitioned that Dow be held responsible for the pollution at the site and sought directions from the court establishing the liability of the company for continuing and long-term impacts. His petition also asked for quick clean-up of the site.

WASTE COLLECTED...

Since 2005 the Jabalpur bench of the Madhya Pradesh High Court has issued several directions for the removal of the waste. The first step was to direct NEERI to check the toxicity of the waste and suggest actions for remediation. The contract for the first phase of clean-up was awarded to Ramky Enviro Engineers Limited, a Hyderabad company. It is not clear how the company decided what waste it should collect and then store. But it seems that waste already collected in the early 1990s was

The government denies

repackaged and stored under a 'secure' shed—which leaks. So every time it rains the waste seeps into the soil. The company officials are on record explaining the broken roof: government contractors built it.

...BUT NOT DISPOSED OF

The court also directed that the 390-odd tonnes of waste collected should be treated and in 2007 ordered that the incinerable waste be sent to a private facility in Gujarat. (40 tonnes of the waste has been sent to the Ramky-owned landfill in Pithampur in Dhar district of Madhya Pradesh.) Since then a controversy has been raging about the adequacy of the waste-disposal facility of Bharuch Enviro-Infrastructure Ltd (BEIL) in Ankleshwar in Gujarat (see 'Bhopal to Bharuch', *Down To Earth*, April 30, 2008). Environmental activists have alleged that the facility, which saw a major accident over a year ago, is poorly maintained. Gujarat, which initially gave permission for transport of hazardous waste from neighbouring

Madhya Pradesh, has also refused waste, saying the facility is over-extended and unavailable.

BEIL owner Rajju Shroff's private NGO, the Centre for Environment and Agrochemicals (CENTEGRO) has also intervened in the legal case without disclosing its related interests. A Right to Information application by Bhopal activists found reams of evidence showing how CENTEGRO lobbied with the Union chemicals and fertilizers ministry to allow the waste to be sent to BEIL.

It is only in early 2009 that Shroff, in a letter to the Union government, admitted that his company's facility is inadequate and strained because of existing waste disposal commitments. In light of this "it will be difficult for us to take further waste from outside the (member) industries for incineration", he wrote.

This was after the high court threatened to issue contempt orders against Gujarat for refusing the waste of Bhopal, and the Gujarat government appealed to the Supreme Court. The apex court has stayed the contempt proceedings of the Madhya Pradesh High Court and is hearing the matter: where will the waste

gy (IIC) is looking into ways to dismantle and decommission the plant; and NEERI into preparing a remediation plan cost estimate. These studies are on.

EYES SHUT, NO POLLUTION

The state government would, however, like the world to believe there is no real contamination at the factory. On November 10, Babulal Gaur, the state Minister for Bhopal Gas Tragedy, Relief and Rehabilitation, announced a plan to open the factory gates for sightseeing and disaster tourism. "This is to help people get rid of the misconception that chemical waste inside is still harmful or that the chemicals are polluting the water in nearby localities," he explained.

Gaur cites as evidence a letter from the Defence Research and Development Establishment (DRDE) Gwalior, which says it found nothing alarming in samples it tested for toxicity in its laboratory. On the contrary, all samples—excavated waste, lime sludge, naphthol tar, reactor residue, semi-processed pesticide and Sevin tar—have low mammalian toxicity, according to experiments done on animals. DRDE director R

Vijayaraghavan explains: "A 70 kg man will not die if he takes 200 gm of the waste orally or eats 100 gm of sevin tar. In fact, the toxicity is less than that of table salt." So the director concludes that the site can be opened to the public. Sarangi's response: "We are now calling all government officials for a scrumptious lunch of the waste."

The state pollution control board has also tested contamination. Over the years it has found varying levels of pesticides in and around the plant. NEERI reports have also confirmed toxins—in places at considerably high levels. But the state government says NEERI has given it a clean chit. NEERI officials clarified to *Down To Earth* that they never denied toxicity of the plant site. They only told the government the site is safe enough for temporary entry.

Clearly, when interests are at work, denial is the best way out. That's how there is still no decision on the 350 tonnes of waste packed and stored. And certainly there is no talk of the thousands of tonnes scattered around the factory, seeping into the ground. This is slow and deliberate murder.

the factory area is unsafe. It wants to open its gates for sightseeing

of Bhopal be disposed of and who will pay? The Bhopal Group for Information and Action, an NGO run by Satinath Sarangi, who has for long worked with victims of the disaster, wants the court to send the waste back to the US. He said in his application India has done this in the past. In March 2003, the Tamil Nadu Pollution Control Board ordered Hindustan Lever Ltd to export 256 tonnes of waste containing mercury to a facility in the US at the company's cost, said Karuna Nundy, Sarangi's lawyer.

AND STUDIES ARE BEING DONE

Acting on the high court's directions, the Madhya Pradesh government asked institutions to prepare detailed plans for remediation way back in 2005. The National Geophysical Research Institute (NGRI) is assessing the level of contamination in soil and groundwater; the Indian Institute of Chemical Technolo-



*Welcome to ground zero.
Government plans a memorial here*

POLLUTER DOESN'T PAY

Dow owns Union Carbide assets, but refuses liability

The Dow Chemical Company says it will not pay for treating the toxic waste lying at the Bhopal factory of Union Carbide Corporation (UCC), which it bought in 1999. The public interest petition for cleaning the site filed in the Madhya Pradesh High Court in 2004 had made Dow one of the respondents.

Through its counsel Abhishek Manu Singhvi—who is also the spokesperson of the Congress party—Dow asked the court its name be deleted from the list of respondents. Reason: it did not own the company at the time of the disaster.

"The waste lying there is from 1978 onwards, much before the gas leak. Since Dow owns assets of UCC, it must take care of the liability as well," said Abdul Jabbar, coordinator of the Bhopal Gas Peedith Mahila Udyog Sangathan. The 2008 annual report of Dow accepts it has taken over US \$2.2 billion liability of Union Carbide's asbestos-related suits. "The question is why when it comes to Bhopal does it refute the liability of the company it has bought," said Rachna Dhingra of the Bhopal Group for Information and Action.

In May 2005, the Union Ministry of Chemicals and Fertilizers also moved the court for directions to Dow to deposit Rs 100 crore as advance for environmental remediation because the court had been stressing on clean-up before fixing liability. This has led to frantic lobbying in the corridors of power.

In November 2006, Dow's chief executive officer Andrew Liveris wrote to Ronen Sen, the then Indian ambassador to the US, urging that the government of India (GOI) should withdraw its application for the payment of Rs 100 crore. The letter referred to assurances given by top Indian bureaucrats regarding the non-liability of Dow at the US-India CEO Forum in New York on October 25, 2006. "Certainly a withdrawal of application would be positive, tangible demonstration that the GOI means what it says about Dow's lack of responsibility in the matter," it stated.

In July 2006, Ratan Tata, in his capacity as the head of US-India CEO Forum, also wrote letters to the deputy chairman of the Planning Commission,

Montek Singh Ahluwalia, and the then finance minister P Chidambaram, offering to create a site-remediation fund with contribution from the Indian industry. "Dow has mentioned in their letter that it is critical for them to have the Ministry of Chemicals and Fertilizers to withdraw their application for financial deposit by Dow against the remediation cost as that application implies that the government of India views Dow as 'liable' in the Bhopal Gas disaster case," said Tata in another letter to Ahluwalia on November 28, 2006. "I wanted your assessment as to whether this is possible. My offer for the Tata's to lead and find funding for the remediation of the site still stands. Perhaps it could break the deadlock."

The letters were forwarded to the Department of Chemicals and Petrochemicals. The department said Tata should submit its offer before the high court since the matter is sub-judice.

SO WHO IS LIABLE?

The Madhya Pradesh High Court has not agreed to delete The Dow Chemical Company from the list of respondents. The petitioner has cited provisions of the hazardous waste management rules 1989 that the "occupier or the operator of a facility shall be liable to pay the entire cost of remediation or restoration and pay an advance amount of the estimated costs of the clean-up".

Dow's lawyers in India argue that US company Union Carbide no more holds interest in Union Carbide India Ltd (UCIL), the Indian branch, so the purchaser (Dow) is not responsible. In fact, Singhvi, in his ex-parte opinion, argues UCC was not in charge of the plant at Bhopal at the time of the disaster and in any case UCIL has also ceased to exist.

Singhvi says all claims were settled in 1989 when Union Carbide paid a "full and final settlement"—a sum of \$470 million. But activists contend that the 1989 Supreme Court judgement was

itself reviewed in 1991 and criminal liability of the company reinstated. The waste in Bhopal is not a result of the accident, but of careless housekeeping by the multinational. The company—originally UCC and now Dow—is the polluter and must pay.

AND WHAT WILL IT COST?

Nobody knows. But it is clear if the entire site—35 hectares—has to be decontaminated, the quantity of waste will be huge and so will be the cost. A 2004 study commissioned by Greenpeace, which brought German and Swiss waste experts to the Bhopal site, said there was 25,000 tonnes of hazardous waste to be cleaned. A rough estimate is that the clean-up could cost Rs 500-1,000 crore.

Should Indian taxpayers bear the cost, especially when environmental liability is an established principle? In 1989, oil tanker *Exxon Valdez* struck a reef and spilled 10 million gallons (38



Dow took over \$2.2 billion liability of Union Carbide in USA, not that of Bhopal



started," she said. Despite her frailty Bhagwati has twice marched to Delhi to demand the right to clean drinking water for survivors of the gas tragedy.

People living around the accident site continue to suffer from diseases, from chronic ailments to abnormalities. But nobody knows the cause for sure. No one is certain how much of it is related to the gas release and how much has been exacerbated because of continuing exposure to toxins. That's because a long-term epidemiological research has been terminated and the medical research by the state is poor and disputed.

The Indian Council for Medical Research (ICMR) was asked to conduct these studies right after the disaster. But in 1994 the studies were summarily discontinued. The initial reports suggested long-term and deadly health effects on the survivors. In 1989 the Madhya Pradesh government's Centre for Rehabilitation Studies, which works under the department of Gas Relief and Rehabilitation, was given this responsibility, but its studies are few and unavailable.

In 2006, the Prime Minister's Office (PMO) wrote to the department of chemicals and petrochemicals (nodal for the gas disaster), asking for a long-term medical research on the gas survivors. The department wrote to ICMR, asking it to consider the Rs 1.23 crore per annum proposal of the state government. ICMR expressed reluctance, said the department in its note to the PMO (accessed through an RTI application). The department then threw the ball back in the court of the PMO, asking it to find the money and the agency to conduct the research.

WEAKENED DAY BY DAY

At Shakir Ali doctors said ailments of the eyes and lungs are common among people who visit the hospital. "We get over 50 cases of chronic obstructive pulmonary disorder (in which airways are narrowed and the condition is often irreversible) every day," said Mamta Mishra, a doctor at Shakir Ali.

"It is impossible for children in this part of the city to run even 100 metres without panting like a dog," said Santosh Sharma, who runs a paan shop outside Shakir Ali hospital. Behind the Union Carbide factory is Navjeevan Colony. Its resident Rajpatti Bai's daughter was six months old at the time of the

million litres) of oil over the Alaskan coast, killing marine life on a large scale. US oil giant Exxon has paid nearly \$287 million for harm to the environment. It is likely to pay an equal amount for economic harm to commercial fishermen and others. In a Chevron case, 30,000 Amazon basin residents sued the oil giant for dumping toxic waste from oil drilling in their forest in 1994. In this case as well, Chevron had bought over Texaco Inc, which operated the oil drills from 1964 to 1990. Therefore, Chevron had continuing liability from the company it took over. The US \$27 billion lawsuit is in the permanent court of arbitration in The Hague. The oil giant also wants to be absolved of liability. It also wants the Ecuador government to pay.

The ball (and toxic waste) is in the court of the Indian judiciary and government. The question is from where and when the next throw will come. For the victims the tragedy does not end.

NEW VICTIMS

First gas, then waste. The horror continues

Eighty-year-old Bhagwati has acquired a new name in Shakir Ali (Gas Rahat) Chikitsalaya in old Bhopal. "O gaswali," the nurse called out to her. Bhagwati had been admitted for eight days when *Down To Earth* met her. Her abdomen and legs were swollen; she could not walk, eat or drink properly. Doctors told her she had a weak liver and

advised her to get admitted to Hamidia hospital in the city. A resident of Jamal-pura, Bhagwati has been frequently facing this problem for seven years. "Breathing problem has been with me since the night the gas leaked. Now this stomach trouble has





Hazardous waste to walk on and dirty water to drink (bottom) is people's lot

drinking, so people have sunk 80-foot-deep borewells. "The water is dark and bitter. When a fault stops supply from Kolar dam we drink this water," said Mushtaq Ali, a plumber in Arif Nagar.

Mushtaq's mother Aziza Bi jokes that the nearest hospital for gas victims, Jawaharlal Nehru Hospital, is second home to her. "There is nothing I haven't suffered. My right foot has been numb for three years. The doctors have not been able to tell me the reason. I cannot see properly in the evening, have high blood pressure and breathing problem," she said. Aziza Bi's family was moved to Arif Nagar from Bhopal Talkies where a mass burial was created in 1984.



There is no long-term epidemiological research on survivors of the gas tragedy

accident. At the age of 10 she developed vertigo (white spots) and has been losing weight ever since. "She is 25 now and I can't find a match for her because of her condition," said Rajpati Bai. "There is so much disease that poor people cannot afford to spend on treatment."

PIPELINE LAID, BUT WATER?

People have raised the issue of polluted water year after year but to no avail. Most people living around the factory depend on groundwater. Arif Nagar, set up in 1990, gets the municipal water on alternate days. It is hardly enough for

In 1994, the Supreme Court monitoring committee on hazardous waste reported groundwater contamination near the factory. The court ordered clean water be supplied to residents. It was only after two marches—from Bhopal to Delhi in 2006 and 2008—by residents that a pipeline was laid but complaints of erratic supply persist. The state is interested in only adding more people to the list of the affected (see *Relief for everyone in Bhopal*).

DUMPS WIDE OPEN

Right behind the factory is a solar evaporation pond that was used to dump the hazardous waste when the plant was operational. Its plastic lining is torn and the waste has been piled on the sides. In 2007, the state studied people's health near the pond. It found that morbidity among people below 24 years of age was significantly higher than among the same age group in another part of Bhopal. The study attributed the high incidence to poor water quality and socio-economic and environmental standards. "There is no evidence to say that groundwater has become toxic due to percolation of toxics from the Union Carbide disposal area," it concluded.

The tragedy of Bhopal is unending. The shame is ours. ■

Relief for everyone in Bhopal

Compensation received from Union Carbide:	US \$470 million (Rs 750 crore, which with interest increased to Rs 3,000 crore)
Number of people awarded compensation:	574,366 (64% of the city population in 1984)
Compensation disbursed by March 2009:	Rs 1,548.93 crore
Total wards in Bhopal (1984):	56 (894,539 people)
Total gas-affected wards:	36 (559,835)
Medical expenditure until March 2009:	Rs 512.09 crore

The state government now wants the remaining wards to be declared affected (334,704 people) to get the remaining compensation

Source: Madhya Pradesh government, Bhopal Gas Tragedy Relief and Rehabilitation Department

Reported by Ravleen Kaur and K Dinkar