NO PLACE TO RUN
Local Realities and Global Issues of the Bhopal Disaster
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CONTENTS

INTRODUCTION

ONE. BHOPAL: A NIGHT OF FEAR GOES ON AND ON ......................... 1
  A Night of Fear ....................................................... 1
  The Government Response ........................................... 3
  Who is to Blame: The Company? ................................... 6
  The Government's Responsibility ................................. 10

TWO. ANATOMY OF A MULTINATIONAL .................................. 11
  MIC: The Link from Bhopal to the Rest of the World ........... 11
  Beyond MIC: Union Carbide World Operations ................. 14
  Third World Record .................................................. 15
  U.S.A. Record ....................................................... 19

THREE. ISSUES FOR THE WORLD ........................................ 25
  Management and Control of Hazardous Industries and Products .... 25
  Lifestyles ............................................................. 29
  Strategies for the Future, Demands We Can Make .............. 31
  International Reactions and Responses to Bhopal .............. 33

APPENDIX. UNION CARBIDE'S WORLD-WIDE OPERATIONS .............. 37
INTRODUCTION

The industrial disaster at the Union Carbide plant in Bhopal, India has shocked and numbed people across the world. An unknown number of people, certainly in the thousands, died from the gas leak from a Union Carbide factory there, hundreds of thousands were affected. Across the world, people have taken action to protest against Union Carbide and to show solidarity with the suffering people of Bhopal.

Following the disaster, we made efforts to establish linkages with concerned groups and activists across the world. An existing relationship between the Society for Participatory Research in Asia (PRIA), New Delhi and Highlander Research and Education Center, Tennessee, U.S.A. was activated after the disaster. Highlander sent information on aspects of the disaster to PRIA, as there was complete control over information in India.

Highlander also wrote to numerous other groups and organizations across the world to seek information on the Union Carbide record in their area and on local struggles and response. Many people responded enthusiastically and sent a lot of useful information. In the meanwhile, PRIA's collaboration with the Center for Science and Environment (CSE), New Delhi was strengthened by their involvement in the actions following the Bhopal disaster.

This report is a joint product of these three organizations: Highlander, PRIA and CSE. It describes the events at Bhopal, exposes the record of Union Carbide worldwide and analyzes issues that emerge from this disaster. It is aimed at activist workers and community groups, organizers and popular educators.

Though much has been written since the disaster, we felt that there is value in a document that puts the facts and analysis together in a popular form in one booklet, and that draws on information both from Bhopal and other countries. This report is also an example of international collaboration around a concrete issue and pulls together information, analysis and perspectives from across the world: India to New Zealand, Scotland to Japan, Chile to U.S.A.

We hope the report will be a contribution towards building awareness among citizens and workers, mobilizing and energizing activists and promoting collective action worldwide to confront the issues so starkly posed by the Bhopal disaster.

May 1985
ONE

BHOPAL
A NIGHT OF FEAR GOES ON AND ON

The worst industrial accident in history took place on a cold December night, in a city close to the center of India. Some 200,000 Bhopal residents, a quarter of the city's population, were affected by the leak of poisonous MIC gas from the Union Carbide pesticide plant there. At least 2,500 people were killed, but local medical and relief workers put the toll much higher, from 5,000 to 15,000 dead.

A NIGHT OF FEAR

Neighbors of the Union Carbide plant had become accustomed to gas escapes. Ramnarayan Yadav, a city corporation driver, said that he started smelling this gas at around 11.30 p.m. on December 2. He did not leave the area for at least another 45 minutes, because "this much gas used to leak every 8th day, and we used to feel irritation in the chest and in the eyes. But finally everything used to calm down." This night there was to be no calming down. Most people began to wake up between 12.30 and 1.00 a.m., coughing violently, with eyes burning as if chillies had been thrown into them.

As the irritation grew and breathing became impossible they ran, some with their families, many without. Some got onto whatever they could—cycles, bullock carts, buses, cars, autorickshaws, tempos, trucks and mopeds. Those who had nothing just ran on foot. Women with children in their arms, unmindful of how they were dressed. Small children, old men and women were pushed in handcarts or carried by their family members.

The gas that spewed out of Carbide's high-technology factory spread over an area of some 40 sq. km and it affected people seriously as far as 5-8 km downwind. The railway station lay close to the factory and smack in the path of the gas cloud where it created a horrendous drama. Passengers in waiting rooms, porters and conscientious railway staff who stayed on, died. The worst effect was on the poor who lived in the colonies surrounding the plant.

The first patient arrived at Bhopal's Hamidia Hospital at 1:15 a.m., complaining of eye trouble. Within five minutes there were a thousand, and by 2:30 a.m. four thousand patients crowded the 1200-bed hospital struggling to breathe. By sunrise, hundreds, thousands of people lay dying or dead in the streets, in outlying villages where they had fled, or in their houses. 2,000 were dying in the hospitals as doctors and medical students struggled to find a treatment for them.

What Happened in the Plant That Night?

Exactly what happened in the Union Carbide factory that fateful night is still not fully known to the public even six months after the disaster. While thousands slept in their huts around the pesticide factory a skeleton staff of 120 workers inside the factory ended its evening shift around 10:45 p.m. and a new shift took over around 11:00 p.m.

The MIC production unit had been shut down
since October, and a large amount of MIC was stored in large underground tanks at the plant, waiting for the Sevin pesticide production unit to use it up. The Sevin unit had been restarted a week earlier, although it was operating at far below capacity.

The New York Times reported that workers had tried, but been unable, to get MIC out of tank 610 to make pesticide during the week. During the evening shift, the paper says, the supervisor called one of the MIC unit workers to clean out a pipe. The worker, Rahamann Khan, was told to open a nozzle on a pipe and put a water hose in to clean the inside. He followed orders, although he noticed that the closed valve leading to the MIC tank had not been sealed with a slip blind as it should have been. Valves were notorious for leaking at the Bhopal plant, workers said. It is possible that water got into the tank by this means, and started a chain reaction. Water continued flowing into the pipe for three hours.

Workers first noticed at 11:00 p.m. that the pressure gauge on MIC tank No. 610 had risen from 3 pounds per square inch to 10 psi. At first they thought that the gauge was faulty, as was often the case at this Carbide plant. About 11:30 p.m., workers started to detect an MIC leak: not through any instrumentation, but because their eyes started to tear. They said they detected at least one leak a month at the plant by this method, even though the MIC production manual says that “stringent precautions must be taken to eliminate any possibility of human contact with methyl isocyanate.”

Workers told the New York Times that they found a drip from the MIC tank, and informed their supervisor, who told them he would deal with it after the next tea-break—scheduled for 45 minutes later (12:40 a.m.). According to the company’s own report on events, based on interviews only with supervisors and plant managers, not with workers, the supervisor did investigate and found no source of a leak at this time.

It was soon after the tea-break that the scale of the leak became apparent, both because of the choking fumes and because the temperature and pressure gauges for the tank rose rapidly. Within minutes, the concrete over the tank began to crack and split, and gas shot out through the stack.

The factory had two sirens: a loud, continuous one for the public and a muted one over the public address system meant for factory workers alone. The public siren was put on around 1:00 a.m., probably 30-60 minutes after the gas had started spreading. It sounded only for a few minutes. After that the muted siren took over. This company procedure had been devised to avoid alarming the public around the factory over tiny leaks. But in this case it was gross negligence, as it was known that the gas was escaping in large quantities. Most residents around the factory woke up because of the irritation caused by the gas, not the siren.

The fire brigade arrived soon after the alarm, to turn on a water curtain around the escaping gas. But the water reached only about 100 feet high, and gas was flowing from the top of the stack, 120 feet in the air.

Another worker turned on the scrubber which was designed to pass the gas through a caustic soda solution, to neutralize it. The scrubber had been out of order and apparently had no caustic soda solution in it; it is not clear whether it had any effect.

About 1:00 a.m., workers told the New York Times their supervisor telephoned the assistant factory manager, who told him to turn on the flare, which was designed to burn off escaping gas. The supervisor passed this instruction back to the workers, who pointed out that to turn on the flame with such a cloud of MIC gas in the air could cause a tremendous explosion. Then the supervisor remembered that a piece of pipe was missing from the flare anyway; it had corroded and was supposed to be replaced. Another safety device was out of commission.
How to Treat the Victims?

It was within an amazing environment of ignorance and even disinformation that doctors in Bhopal were asked to treat the thousands of dying victims. Firstly, they did not know what had happened at the plant and why the leak had taken place. Second, they did not know what gas had affected the people. Thirdly, they did not know what was the treatment, if, in fact, it was MIC.

Union Carbide officials kept insisting that MIC is only an irritant and not lethal. Textbooks said precious little about MIC and its effect on human beings, particularly when exposed to large concentrations. Doctors had no experience of treating patients with methyl isocyanate. What then was the gas that was killing so many people?

The view gained ground in the early hours that the killer gas could be phosgene, an extremely dangerous gas that is also manufactured at the Bhopal plant for the manufacture of MIC, one that was known by local doctors because of earlier leaks from the plant. This view was reinforced by the company's insistence that MIC was not lethal.

The confusion over the responsible gas and its treatment meant that each symptom was dealt with separately: eyedrops for the eyes, steroids against inflammation, antibiotics to prevent secondary infections, antacids for the stomach, and oxygen respiration in acute cases. This treatment did not prove to be very successful and in some cases it could have had adverse consequences, as was later learned. For example, patients were adminstered Lasix to contain edema and inflammation of the lungs. The effect of Lasix on the patient was devastating. Exposure to MIC generated intense heat in the body. Every patient talked of the intense heat and thirst that resulted from exposure to the gas. Lasix increased the dehydration.

One confusion and controversy continues even now: whether methyl isocyanate could break down into cyanide in the body, and if so whether the cyanide antidote, sodium thiosulfate, should be used. Dr. Heeresh Chandra conducted autopsies that convinced him there was cyanide poisoning. He met with strong resistance from his colleagues, and from Union Carbide officials. Heeresh Chandra argued it was worth trying, that they could not wait for conclusive scientific tests while hundreds were dying. He was laughed at, although sodium thiosulfate was tried on 100 patients by a German doctor, with promising results.

THE GOVERNMENT 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 team from the Criminal Bureau of Investigation (CBI). The district magistrate ordered closure of the factory on Monday and arrested five officers of the company in Bhopal. The next day two teams of chemical industry experts and of environmental experts were flown in from Delhi.

But apart from these pedestrian and routine bureaucratic responses, the state or central government did precious little. Except for the Army, there was no help coming to the thousands who fled from their homes that morning.

The government's centralization and lack of initiatives, so visible on ordinary days, became such a heavyweight around it in those critical days that it collapsed under stress. Individuals within the administration did work themselves to the wall but there was no overall planning. In those first few hours, reports suggest that there was complete con-

HOW MANY DIED, HOW MANY WERE AFFECTED?

The Dead

The official Indian government figures say that about 1,700 people died.

The press reports that 2,500 people died.

A conservative estimate by local relief workers suggests that 5,000 may have died. They note that 1,000 or more died outside Bhopal, in surrounding villages after they fled.

The truth may never be known. Many of those who died have no official record: no ration book, no permanent address. Who can count the dead who never officially existed? And when whole families died together, there was no-one to register their deaths.

The Affected

That night, 200,000 people, a quarter of the city's population, were affected by the gas. Now, some months after the disaster, the government claims there are no long-lasting health effects, but doctors estimate that some 50,000 people have been seriously affected. Many of these are poor people, with no means of survival beyond their ability to do daily manual work. Now they cannot work, and they have nothing.
fusion. 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.

Equally disorganized was the administration’s response to people’s queries. The government began to put out news bulletins over All India Radio on the second day that the situation was fast returning to normal and that everything was safe. Journalists told the chief minister they sounded much like the pronouncements of Carbide officials. The people had many doubts. They were suspicious about the air they breathed, the water they drank, and the meat, atta, fish and vegetables they ate. They 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 coming from the government’s medical and scientific experts: “The water is safe, but boil it before drinking; vegetables and fruits are safe but wash them well before eating.” “The fish is safe,” they said, but then they closed down the meat and fish markets. “The air is safe” but they were not prepared to tell anyone about the tests that had been conducted.

**Operation Faith—or Fake?**

In the days following the leak, two major problems confronted the government: how to neutralize the remaining MIC in other tanks at the Carbide plant, and how to neutralize the growing anger and protests that were beginning to build in Bhopal. People expressed their growing resentment in various ways. Youth in various gas-affected localities began to gherao medical teams. On December 9, there was even a demonstration in front of the Chief Minister’s residence. Whether deliberately or not, the government solved both its problems in one stroke in a move they called “Operation Faith.” Local activists called it “Operation Fake.”

The government had turned over the problem of disposing of the 15 tons of MIC left at the plant to a team of senior scientists, led by Dr. S. Varadarajan, director-general of the Council of Scientific and Industrial Research (CSIR). The team had four options to consider: neutralizing it, incinerating it, packing it into containers and shipping it off to Union Carbide somewhere else, or starting up the factory again and turning it into pesticide.

All the options had risks. However, Union Carbide was strongly recommending the last option—turning MIC into pesticide—and was using it itself in its other plants. Carbide had reportedly tried to reopen its Bhopal plant for this purpose just four days after the leak. But staff were turned back by the district administrator in charge of the plant.

It should perhaps be no surprise that Carbide’s point of view won. The Chief Minister of Madhya Pradesh had to eat his own words of only a few days before, that the plant would never operate again. Operation Faith would be launched on December 16: the plant was to run to convert MIC into Sevin.

By that date the area within a 4 km. radius of the plant had turned into a ghost town. In desperation and fear, people again fled. The poor pawned whatever they could—a goat for Rs5 (40c.); pots and pans to buy a bus ticket out of Bhopal. The growing wave of protest disappeared with the general exodus.

**Relief and Rehabilitation**

The government was found even more wanting when people’s concern began to turn to long-term medical treatment, relief and rehabilitation measures.
Most of the affected people are poor. They are suffering from the effects of MIC even weeks and months after the exposure. They feel dizzy walking even one kilometer in the sun. Many of the sick people are not in a position even to get up from their bed. Most of them are daily wage earners who now cannot work. They are not getting anything to eat. Even if they could buy food grains, their women folk are not physically fit to cook their meals. The moment they sit near the fire, their coughing increases.

Women continue to be plagued by blinding headaches, dizziness and cannot focus on anything for long. Bringing water from the nearby well or tap tires them out for the whole day. Many women have lost their sons and husbands and now it is impossible for them to survive, as they cannot work in their diseased condition.

The Nagarik Rahat Aur Punarwas Samiti, a local relief group, reported in January 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 past six weeks...so far 112 cases of abortion and 22 cases of stillborn babies have been reported by the Sultanpur Janana Hospital."

In a desperate bid to get themselves cured, people sit in long queues before the mobile clinics, dispensaries and polyclinics set up by the government in the affected areas, and a dozen other dispensaries set up by local hospitals and voluntary agencies. At these centers, they get the same treatment, antibiotics and a few other drugs. Those unable to bear their health problems try to seek the assistance of the big hospitals but from there they invariably get turned back.

Others simply lie at home in bed. These people need financial support and medical treatment now, and cannot wait for the long compensation battles in the U.S. and Indian courts to be resolved. But the government and the medical community in Bhopal are now arguing that the worst is over. They say that most of the problems people are now experiencing are mainly the result of diseases like anemia and TB, rampant in these slums. The people have found themselves caught between a callous multinational and a highly inefficient and equally callous government.

The government has not attempted any documentation of the extent of injury and the new symptoms emerging. No effort has been made to take x-rays, collect and analyze blood, sputum or urine samples, and keep people under observation. Even worse, the entire area has been shrouded with total secrecy. Even as people complain of various ailments, the government is trying to suppress all information.

Even six months later, relief and rehabilitation efforts are not effectively organized. Medico Friends Circle estimates that some 50,000 people have permanent health damage and will need long-term care and assistance. Instead of focussing on this long-term care, the government, doctors, scientists and Union Carbide plead ignorance and doubts of any long-term health effects of MIC exposure.

**Long-term Effects**

The confusion over treatment, and the restrictions on information about MIC and its immediate effects have been carried over into the debate about long-term effects of the gas poisoning. From day one of the disaster, scientists in India and abroad have had little knowledge of the short- and long-term effects of MIC on the exposed population in Bhopal. They point out that as there are no previously known cases of such extensive and severe exposure to the gas, it is extremely difficult to predict long-term effects.

Union Carbide, both the parent corporation in the U.S. and its Indian subsidiary, has said little on the subject, although Carbide is known to have more knowledge of the effects of MIC than anyone else. Experts of international agencies like W.H.O., U.N.E.P., and I.L.O. whose job is to monitor dangerous chemicals, have also stated that there are no known long-term effects of the gas.

The general attitude of experts flown in by Union Carbide and by international agencies has been to say that only eye and lung damage, if at all, can be expected in the long run, as suggested by the published literature. Dr. K. W. Jager, a W.H.O. expert who visited Bhopal within a week of the disaster said that the possibility of gas-affected persons suffering from paralysis or kidney and liver complications was ruled out. He also claimed that there was no basis for fearing that there will be any damage to unborn babies.

Dr. Hans Weill, an American chest specialist brought in by Union Carbide, stressed the need for long-term studies. But from experience of similar

The government solved both its problems in one stroke in a move they called "Operation Faith."
gases, he claimed full recovery was the rule rather than the exception. Dr. M. Thomas Petry of the University of Colorado, who came in at Union Carbide’s expense said that nearly every gas poisoning victim he had examined was recovering rapidly from exposure to the gas. As regards to long-term effects, he said, “It is distinctly possible they will have something like asthma, because the nature of this isocyanate is to be an irritant and to be sensitizing.

But the effort to play down the extent of damages that have occurred is countered by the health effects that people are still experiencing. The ongoing symptoms are not being adequately studied and treated. Still no systematic testing and medical monitoring is being carried out. Treatment is still limited to the symptoms rather than addressing underlying problems.

Although knowledge of MIC’s effects are indeed limited, what is known about it and similar compounds suggests that long-term effects should be expected. Phosgene, for example, whose effects are similar to MIC in many ways, causes permanent lung damage due to scarring and fibrosis (hardening) of lung tissue.

If nothing else, leading U.S. toxicologists have warned that the survivors of the tragedy will become more susceptible to common respiratory diseases because of their damaged lungs, and could still die in the weeks and months to come, as an indirect effect of their exposure to MIC. As most of the affected people live in poor, unhygienic and malnourished conditions, their chances of developing other infections are high, and now their resistance is low. If medical, food and other forms of relief are not brought to these people efficiently and fast they could be even more severely affected.

There has been no published testing of MIC as a cancer agent. However, according to Tom Connors, head of the British Medical Research Council’s Toxicology Unit, any highly reactive agent such as MIC which can react with DNA and proteins in cells can cause cancer.

Meanwhile, Bhopal has become a laboratory for the rest of the world. It was said at the height of the disaster that chemical warfare experts flew in from NATO to study the effects of MIC on the population. Later the U.S. State Department said it was trying to send a team of technical experts to Bhopal. Such a visit, they said, would be strictly to give the government “an important and interesting laboratory” to study health and safety effects of lethal chemical releases, equipment failures and emergency response methods. Human guinea pigs have taken the place of testing on MIC.

WHO IS TO BLAME: THE COMPANY?

Several things are clear from press interviews with workers at the plant and from Carbide’s own report. Behind the tragic accident at Bhopal were poor design, poor management and faulty maintenance, and inadequate government monitoring and regulation. Several safety features that had been designed for the MIC unit were in place at Bhopal, but were not operating.

- The storage tanks should be refrigerated to keep the gas at low temperature so that it would not undergo a rise in pressure.
- The refrigeration unit had been shut off for some time, and the chemical was warmer than allowed by the plant’s operating manual;
- There were so many unreliable gauges at the plant, that the workers took no notice of the initial rise in pressure;
- the scrubber which was designed to neutralize escaping gas had been turned off for maintenance;
- the flare tower which had been designed to burn off any remaining MIC was also turned off, because a corroded pipe had not been replaced;
- the water curtain designed to neutralize escaping gas failed to reach the height of the flare tower, from which the gas was flowing.

Beyond the widely-shared assumption that the runaway reaction of MIC was caused by water contamination in the storage tank, not much is known of the initial cause of the disaster. In its own report, Carbide tried to excite the press with the possibility of sabotage, noting that water had been introduced “whether inadvertently or deliberately.” It was not able to deny that all the safety features which should have contained, if not prevented, the accident were out of operation.

The first response of Union Carbide India Limited (UCIL) was to issue a press release. On December 3 the company said, in what is probably still its only press release on the subject, that the plant had safety features installed on the tanks. Within minutes of detecting the abnormal pressure level, the plant
personnel took remedial measures. But because the leakage was unprecedented, a part of the gas remained unneutralized and escaped into the atmosphere. Finally, the plant was shut down.

Two questions have remained uppermost in people's minds: firstly, was the company safety conscious and did it take adequate safety precautions to prevent such an incident, and secondly, were the safety systems actually designed to contain the kind of runaway reaction that took place in the killer MIC tank that night?

As events unfolded, it became immediately clear that the company and the central and state governments all had been adequately warned that such a catastrophe could happen. None had taken adequate steps to prevent it.

**Early Warnings**

In May 1982, a team of three experts from Union Carbide, U.S.A., came to Bhopal to look into the safety arrangements at the plant. Their report entitled “Operational Safety Survey” was alarming. Among the concerns they listed:

- It appears possible to contaminate the tank with material from the vent gas scrubber...it appears possible to back react quantities of water vapors and other gases from the scrubber to the feed tank when it is depressurized.

- There is some question about the adequacy of the tank relief valve to relieve a runaway reaction or fire.

- Manual control of filling of the tank, with no instrument backup, creates a possibility of accidental overfilling.

They found a number of possibilities for serious personnel exposure to toxic materials during routine maintenance or operating situations. These included:

- Leaking valves which reportedly have been fairly common, compounding problems... A considerable number of valves were replaced in March 1982, but the problem still exists, though to a lesser degree.

- There is no fixed water spray system for fire protection or vapor cloud dispersal in the MIC operation or storage areas. Such systems have proved to be of considerable value in the event of fires or vapor releases in such areas.

One of Carbide's Indian managers was reported to say that he was not even aware that the gas had such lethal effects. Said the manager: "We did not know that such a small amount of gas as leaked had the capacity to destroy human lives to this extent.

The lethal properties were not known. We thought our safety controls were adequate, so did not do any community education! Did Carbide headquarters fail to tell the Indian management about all the dangers?

**Worker Complaints**

Later in 1982 the union at Carbide Bhopal sent a series of letters to government officials warning about conditions in the factory. They asked for a high-level government inquiry to study the plant's production process, and its effects on workers and people living close to the plant. The union wrote as a last resort appeal, having petitioned the company in vain. There was no response from the government.

The plant's workers allege that the 200-page safety manual was hardly followed in Bhopal. Moreover, the plant's safety manual does not specify all the necessary emergency or safety procedures. For instance, there is no mention of what measures to adopt in case the MIC storage tank pressure or temperature build-up. Says a *Times of India* report, "The relevant portion is blank."

**PREVIOUS ACCIDENTS IN BHOPAL PLANT**

The history of Union Carbide's Bhopal plant is chequered with accidents:

- The alpha-naphthol storage area had a huge fire on November 24, 1978 which could only be controlled after ten hours; it resulted in a loss of about Rs 6 crores ($5 million).

- Plant operator Mohammed Ashraf was killed by a phosgene gas leak on December 26, 1981.

- Another Phosgene leak in January 1982 caused 28 persons to struggle between life and death for several months.

- Three electrical operators were severely burned while working on a control system panel on April 22, 1982.

- On the night of October 5, 1982, methyl isocyanate escaped from a broken valve and seriously affected four workers. Several people living in nearby colonies also experienced burning in the eyes and breathing trouble due to the exposure.

- Plant operator Shabbu Khan's hand got caught in a conveyor belt on October 14, 1982.

- Two similar incidents were also reported in 1983.
Maintenance engineers complained of shortages of critical spare parts. Leaking pipelines were allowed to leak until discharges increased to unbearable levels. Safety practices were short-circuited even though workers had already been affected, and there was one death (in 1981).

The intensive training program which all new recruits had to undergo was diluted, and staff from the abandoned alpha-naphthol plant arbitrarily posted to vital positions in the MIC plant. Many of these workers, including supervisory staff, did not undergo rigorous training in operating the considerably more dangerous MIC plant.

In 1983, Union Carbide introduced an hourized system for blue-collar workers, which extended the cuts in the personnel operating the plant. In the MIC plant, each of the three rotating shifts were to be run by just six operators instead of the original 11. Over the next two years the number of blue-collar workers fell from 850 to 642. In the MIC control room, there used to be two operators. At the time of the accident there was only one, who found it virtually impossible to look after the 70-odd panels, indicators and controllers on the console and keep a check on all the relevant parameters, should an emergency arise. During shutdowns (which was the case when the accident took place), the degree of undermanning was even higher.

Around half of the skilled engineers who had worked in the plant had left by 1984. One of the supervisors had arrived in Bhopal only two months before from Union Carbide's battery division in Calcutta. At least three key supervisors, including one trained in West Virginia, had been transferred over the past two years to other Union Carbide plants. Dr. Rajnarayan, an occupational health expert, also trained in the U.S., had also been asked to quit "because the management just didn't like the popularity he enjoyed among the workers," a worker said.

**Under-designed Plant**

A crucial question is whether the plant was designed properly. A Union Carbide U.S.A. official claimed that the parent company, though responsible for production and safety standards, was not responsible for the detailed design of the plant and for decisions regarding construction and materials used at the plant. This, he said, was the responsibility of the Indian subsidiary.

Yet in a sworn affidavit, Edward Munoz, who was assigned by Union Carbide headquarters to various positions, including Managing Director of Union Carbide India, claims that it was the Engineering Department of Group 1 in South Charleston, West Virginia, who did the conceptual design, all flow diagrams, and monitored detailed engineering and construction of the Bhopal plant. South Charleston personnel trained the Indian employees who were to start up the plant.

Over and above the sloppy maintenance, the fact that many safety features were not operating at the time of the accident, it is clear that there were design problems. A critical safety device in the plant was the scrubber. It is designed to handle a normal feed rate of only 86 kg per hour, at the fairly low temperature of 35 degrees centigrade. The normal operating pressure is only marginally higher than atmospheric pressure and even the maximum allowable working pressure is only about 20 pounds per square inch [psi] at 120 degrees centigrade. When contrasted with the rate of 20,000 kg per hour at which the gas rushed into the scrubber on that night, these design specifications are clearly inadequate. What is even more surprising is that the maximum allowable pressure for the scrubber is less than the minimum pressure (40 psi) at which the safety valve of the tank is expected to open.

There is every reason to believe that even the second critical safety device, the flare tower, if operating, may not have worked. Union Carbide's Indian works manager, J. Mukund told the Times of India, "The flare tower is not designed to handle anything but a small quantity of MIC, such as perhaps a few hundred liters an hour. It could not take 40 tons 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."

Even when it came to indicators and instrumentation, the plant was badly designed and equipped. When dealing with such dangerous materials, a factory is expected to have accurate instruments, with sufficient back-up duplicates and automatic shutdown devices in case of emergency. This plant had inaccurate instruments and apparently no automatic shutdown devices.

**Scenario for a Disaster**

The disastrous event at Bhopal had been foreshadowed not long before, in a Carbide engineers' team report on its sister MIC plant at Institute, West Virginia, in the U.S.A. In an internal report the engineers laid out a major concern: "the possibility of
Between 1:25 and 2:10 a.m. he got through three times to the plant. Twice he was told: "Everything is OK." Once he was told: "we don't know what has happened, Sir," before the phone was banged down at the other end.

At about 1:45 a.m. — 45 minutes after the gas leak was confirmed—the Additional District Magistrate got through to J. Mukund, the company's works manager at home. Mukund was not even aware of the gas escape from his plant. He simply 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."

Fifteen days after the disaster, with thousands dead, Mukund was still defending his statement that "MIC is only an irritant, it is not fatal." He told a reporter, "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. We know that at 20 ppm concentration, some people have found it intolerable, unpleasant to stand around. But I didn't know the concentration or the extent of the release here... I was not aware of the size of the gas release... nobody said anything to me about how large the quantity was and how large the number of people affected.

The parent company, Union Carbide Corporation (UCC) of the U.S. has not given much better information. The immediate reaction of the company was to deny that safety systems installed in Bhopal were in any way inferior to those at the Institute plant in West Virginia, the only other place where UCC produces MIC. Said the company's safety director, Jackson Browning, "The standards in effect in this country and in Bhopal are the same."

The company's chairman, Warren Anderson, went on record to say that the company "put in India the same kind of safety facilities that we would put in (Institute), not just with this particular business line, but any business line we are in."

Its own investigation of the plant confirmed what workers and the press already knew: that safety standards were not "in effect" at its Bhopal plant.
But its own investigation of the plant confirmed what workers and the press already knew: that safety standards were not "in effect" at its Bhopal plant. Despite the warnings of the union there and its own team of investigators, more than two years before the accident, Carbide headquarters had not attempted to enforce process safety standards or improve the production process at Bhopal. It was widely rumored in India that the plant was to be sold, and Union Carbide would shift its pesticide production to Indonesia. Perhaps this was behind the multinational's indifference to the running of its Bhopal facility.

THE GOVERNMENT'S RESPONSIBILITY

The central Indian government and the state government of Madhya Pradesh must also share in the blame for not preventing the Bhopal tragedy. Not only did they not respond to the warnings of the chemical workers union in 1982, and the city's own administrator, M.N. Buch in 1975, but from the time the plant was first built government officials had exercised little oversight.

Only a few weeks before the accident, the state pollution control board granted the plant an "environmental clearance certificate". Annual renewals of its industrial license were granted without action on reports of safety problems and accidents. Although the two Factory Inspectors based in Bhopal did visit the plant, especially after accidents, they were trained as mechanical engineers, and had little knowledge of chemical hazards. The best they could do was urge the company to follow its own operating procedures more closely.

A letter of intent—the first stage of an industrial license for the manufacture of 5000 tons of methyl isocyanate (MIC)-based pesticides was granted in 1971, the license itself in 1975. The issue of an industrial license requires the scrutiny of technical officials in agencies of both the central and state governments. Since the official records have been impounded for the government's enquiry, we do not know what Carbide said about the hazards of MIC production, or what investigations the agencies themselves performed. We do know that the license was granted two months after Bhopal's development plan had been issued, requiring all "noxious industries" to locate downwind of residential areas. Bhopal was then only just emerging as an industrial center and had only the Bharat Heavy Electricals Ltd factory and an old textile unit to boast about. The coming of Union Carbide must have been welcome to the local politicians. Being a multinational, it would bring high paid jobs to the city.

If officials had investigated the production processes they would have been much more aware of the potential hazards involved. Perhaps their actions could have forestalled tragedy.

The combination of design faults, careless management and maintenance, and inadequate—almost nonexistent—government monitoring and oversight led to a disaster at Bhopal. What has given Bhopal such an impact in the rest of the world is the suspicion that these factors may not be unique to this one disaster. In the next section we will look out from Bhopal to the rest of the world: to MIC production and Union Carbide operations elsewhere. And we will see that the suspicion that Bhopal is not unique is justified. We should all be concerned: Bhopal is a lesson for us all.
ANATOMY OF A MULTINATIONAL

It would be a serious mistake to treat Bhopal as an isolated incident, a freak tragedy to be equated with natural disasters like earthquakes and tidal waves. If an incident like it is not to recur, if more people are not to be killed, we must look carefully and learn from the accident itself and from common problems elsewhere. In this section we will take one step out from Bhopal:

to trace the anatomy of Union Carbide corporation, and especially the health and safety record of its products and facilities elsewhere in the world. In the final section we will look even more broadly at the underlying issues which suggest that Bhopal is neither just a problem for India, nor for Union Carbide, but an issue for us all.

MIC: THE LINK FROM BHOPAL TO THE REST OF THE WORLD

The chemical which leaked at Bhopal, methyl isocyanate, (MIC), is not unique to Bhopal or to Union Carbide. It is manufactured and used in other parts of the world, primarily to make carbamate-type pesticides. These became particularly popular after DDT and other types of pesticides were banned in the USA because of their long-term effects on the environment. In one recent estimate, 18 million kilos (39.6 million lbs) of MIC were used around the world in 1980 for pesticide production. As the dimensions of the Bhopal disaster became apparent, people all over the world began looking for MIC plants in their own countries. In particular, attention focussed on the only other place in the world where Union Carbide manufactured MIC, in a plant identical to the one in Bhopal, only ten times larger — Institute, West Virginia in the U.S.A.

Institute, West Virginia

The first Carbide plant at Institute was built in 1941 to make synthetic rubber for the war effort. Now the plant uses a deadly item from the inventory of chemical warfare, phosgene gas, to make the intermediate chemical, MIC, and from it the pesticides Sevin, Larvin and Methomyl. MIC is also shipped from Institute to other Carbide plants: to Woodbine, Georgia, to make Sevin and Temik, to Beziers, France and Cubatao, Brazil, and to pesticide plants of other chemical companies, like Du Pont and FMC.

Carbide moved quickly to restore its corporate image in the United States after Bhopal. It shut down MIC production at Institute, and for the first time allowed press and citizens to tour the plant. Its manager boasted of the MIC unit's "17 years of safe operations" and of its "skilled, dedicated, trained and experienced" employees.

However, residents in the small, predominantly black, town which crowds close to the plant, remembered frightening incidents at the plant, including an explosion and evacuation of the community in June 1954. Workers recalled a series of fires, explosions and leaks, and their own exposures to MIC gas.

The plant has also routinely emitted quantities of other toxic and cancer-causing chemicals into the air. Carbide recently told the state Air Pollution Control Board, that in 1981 its Institute plant discharged into the air about 2,000 tons of pollutants from its process vents and 9,077 tons of combustion products. Among these pollutants are known and suspected carcinogens. (see chart)

Bhopal made regulatory agencies take a closer look at Carbide's Institute plant than ever before. EPA found from the company's own records that it had leaked MIC 28 times during the five years ending in 1984, mostly in small quantities. Carbide later admitted 62 leaks of MIC.

Is There a Way Out? Meanwhile, the primary concern of Institute residents after Bhopal was with evacuation. Crowded into the narrow, steep-sided valley be-
side the plant, hemmed in by the river, a fenced Interstate highway, and mountains, there are few ways out of the town. Many residents did not know of the existence of an evacuation plan, and had not been told of the signals to be given by the plant when an emergency took place.

The head of a Rehabilitation Center for disabled people situated almost at the plant fence, asked for an alarm in the school to be directly connected to the plant. They practiced getting all the disabled students inside one building, and closing off air intake. Plans were made for students to be evacuated from that building in special airtight busses, with police cordoning off roads to give them priority. Adequate plans for evacuating the teachers—and Institute residents—are yet to be made.

Re-opening MIC Production: The attention of the regulatory agencies and the shut-down of the MIC production unit pending investigation at Bhopal went some way toward reassuring local residents. But in February, before the company had completed its investigation of what happened at Bhopal it announced it was preparing to restart MIC production at Institute. The company pleaded the shortage of supplies of the chemical to its customers, and the disruption of its own pesticide production. Carbide's largest outside MIC customers, Du Pont facilities in West Virginia and Texas, had already announced their intention to manufacture their own MIC in the future. Carbide was obviously getting worried.

Even though the company said it was not sure how the accident had happened at Bhopal, Carbide began to introduce a number of additional safety features at the Institute plant, including enlarging the capacity of the scrubber to deal with a runaway escape. They also said they would no longer store several rail tanker cars full of the chemical at the plant site, as had usually been the case, because they would not be transporting MIC to other plants. Instead they would convert it into "Aldicarb," a pure carbamate, to be formulated elsewhere into pesticides for commercial use.

They still did not install a closed loop system for production and immediate use of MIC which would have removed the need for large storage tanks. Nor did they announce any changes in production methods of other very dangerous chemicals at the plant, including the lethal chemical warfare agent phosgene.

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1981 EMISSIONS TO THE AIR FROM UNION CARBIDE'S INSTITUTE PLANT

Carbide's report to the West Virginia Air Pollution Board shows that it routinely discharges into the air 71 different chemicals from its process vents, totaling 1999.5 tons per year (TPY). Many of these chemicals are slightly or moderately toxic, and we list here some that are highly toxic and/or carcinogenic.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>lb/hr</th>
<th>TPY</th>
<th>Toxic effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>acrolein</td>
<td>0.92</td>
<td>0.56</td>
<td>highly toxic and explosive</td>
</tr>
<tr>
<td>acrylonitrile</td>
<td>39.15</td>
<td>3.36</td>
<td>highly toxic, suspected carcinogen, reactive and explosive</td>
</tr>
<tr>
<td>aniline</td>
<td>1.15</td>
<td>0.02</td>
<td>highly toxic, causes cancer in animal experiments</td>
</tr>
<tr>
<td>benzene</td>
<td>72.07</td>
<td>10.09</td>
<td>known carcinogen</td>
</tr>
<tr>
<td>carbon monoxide</td>
<td>5.24</td>
<td>0.36</td>
<td>highly toxic, explosive</td>
</tr>
<tr>
<td>chloroform</td>
<td>22.00</td>
<td>50.12</td>
<td>causes cancer in animal experiments</td>
</tr>
<tr>
<td>ethanol</td>
<td>11.82</td>
<td>1.02</td>
<td>causes cancer in animal experiments</td>
</tr>
<tr>
<td>ethylene oxide</td>
<td>443.34</td>
<td>110.56</td>
<td>causes cancer in animal experiments</td>
</tr>
<tr>
<td>formaldehyde</td>
<td>86.57</td>
<td>1.46</td>
<td>suspected to cause lung and nasal cancer</td>
</tr>
<tr>
<td>isopropanol</td>
<td>584.62</td>
<td>485.14</td>
<td>moderately toxic, some studies of workers show increased sinus and pharyngeal cancers</td>
</tr>
<tr>
<td>isopropyl carbitol</td>
<td>4.43</td>
<td>0.25</td>
<td>causes cancer in animal experiments</td>
</tr>
<tr>
<td>methanol</td>
<td>133.14</td>
<td>48.58</td>
<td>cumulative poison to nervous system</td>
</tr>
<tr>
<td>methyl isocyanate</td>
<td>11.74</td>
<td>0.14</td>
<td>the Bhopal poison gas</td>
</tr>
<tr>
<td>nitrogen dioxide</td>
<td>11.59</td>
<td>25.60</td>
<td>long-term exposure is believed to increase susceptibility to infections, increase mortality</td>
</tr>
<tr>
<td>phenol</td>
<td>1.17</td>
<td>0.02</td>
<td>highly toxic, causes cancer in animal experiments</td>
</tr>
<tr>
<td>phosgene</td>
<td>1.77</td>
<td>4.03</td>
<td>the WWI poison gas, highly toxic to lungs</td>
</tr>
<tr>
<td>propylene oxide</td>
<td>252.00</td>
<td>17.46</td>
<td>causes cancer in animal experiments</td>
</tr>
</tbody>
</table>
On April 27, with 24 hours notice to the community, MIC production was restarted. Within a week, truckloads of MIC were on the West Virginia highways again—transported this time by one of Carbide’s customers, the FMC corporation, to its pesticide plant in New York.

**Is There Another, Safer, Way?**

As questions began to be raised about whether MIC can be produced safely, or should be produced at all, information began to emerge about alternative, and safer, processes for handling it.

The French government does not allow Union Carbide to manufacture MIC, but the chemical is stored at the Carbide plant at Beziers, in southern France. The liquid MIC is not kept in large tanks like those used in Bhopal and Institute, but in small stainless steel drums, holding only 213 kg (468.6 lbs), stored in a specially built concrete warehouse. If there were to be a leak, it would be of a much smaller magnitude than 40 tons of MIC which leaked at Bhopal. There is a computerized system to detect the gas in air as low as 0.3 ppm. If there is a leak, or if the temperature of the gas rises toward its low boiling point, an automatic sprinkler system floods the drums with water at the rate of 125,000 litres per hour.

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**GENERAL EVACUATION PLAN, INSTITUTE, WEST VIRGINIA**

(quote from official evacuation plan)

1. **FIRST STAGE WARNING ALERT**
   A. **Communications Statement to Public**

   1. At the first signal of the plant emergency whistle, you are to go indoors, close all windows, doors, vents, and turn off air conditioners.

   2. Tune your radio to WCAW, 680 AM or your television to WCHS, channel 8. The following is an example of the type of announcement you will hear:

   At 10:00 this morning, the West Virginia State Police reported an industrial plant accident involving hazardous materials. The accident occurred at Union Carbide’s Institute Plant at 9:50 today. All residents near the Institute Plant should stay indoors, close all windows, doors, vents, turn off air conditioners and stay tuned for further instructions. The next report will be given in five minutes.
A German chemical company, Bayer, also makes MIC although without using phosgene, and takes special safety precautions. It stores little MIC, and its safety measures include a high-priced mobile chemical emergency unit which can flood a leaking tank with neutralizing foam within 8 minutes.

Japan's Mitsubishi Chemical Industries Ltd. uses a continuous process in which MIC is immediately converted into pesticide, thus avoiding storage of MIC. Monsanto engineers made a risk assessment of a chemical much like MIC, and recommended a closed loop manufacturing system as being not only safer but also cheaper, when liabilities for damages as a result of an accident are taken into account. The system they recommended would save Monsanto $10 million in capital costs. Du Pont has taken up the idea in its new MIC manufacture in Texas, to replace the MIC once purchased from Union Carbide at Institute.

Sumitomo Chemical Company in Japan produces similar carbamate-type pesticides with other chemical reactions, not using MIC. Indeed, Carbide used to produce Sevin without MIC, until 1973. Carbide says that the alternative process creates other hazards, including greater amounts of hazardous waste. Observers note that the MIC process is cheaper, and hence more profitable.

### BEYOND MIC: UNION CARBIDE WORLD OPERATIONS

Bhopal briefly put the spotlight on Carbide's pesticide production, but this forms only a small part of Carbide's total operations in the U.S.A. and the rest of the world. Pesticides are also relative newcomers to Carbide's arsenal of consumer products.

Founded in 1886 as a carbon company which developed the first dry cell battery—trade-named Eveready—, Union Carbide acquired its name in a merger of four companies in 1917. Successive world wars influenced the company's growth. The First World War moved it from a primarily metals and carbon products company into gases and chemicals. The Second World War led the company into the atomic energy program.

While the company has some consumer products (which have a higher profit margin than industrial chemicals), it is in the bulk chemical market that Carbide is strongest. Its customers are other companies, mainly in the steel industry, and the chemical and plastics industry.

From small beginnings Union Carbide has grown to be the third largest chemical company in the United States, and much more than a chemical company. It owns mines, mills, factories and other operations—some 700 of them in 37 countries around the world. Its international business is a significant part of company operations, accounting for 31% of sales, and 39% of profits in 1983. (The Appendix lists Carbide subsidiaries in 37 countries with city of operation and main product.)
In 1984, Fortune magazine ranked Carbide 37th of the 500 largest industrial corporations in the United States. Like the other big chemical companies it has been going through a rough time in the last few years as the world market for chemical goods has fallen. Its 1983 annual sales of $3 million were the same as in 1979, with less value in real money terms, and net income dropped from $556 million in 1979 to $79 million in 1983.

The diversity of its operations are a source of strength during hard economic times. It has uranium and vanadium mines in Colorado and Wyoming, vanadium and chromium mines in South Africa. It makes consumer products like "Eveready" batteries and "Glad Wrap" plastic wrap. Its Linde division makes industrial gases and other divisions produce a broad range of intermediate chemicals for use by other companies. It supplies gases, chromium, manganese and graphite electrodes to the steel industry, and chemicals like ethylene glycol to the chemical industry. It makes carbon products, molecular sieves for cleaning wastewater streams, and sausage casings.

Carbide has also been closely linked with the USA military industry. It was part of the nuclear weapons game from the beginning, as one of the contractors in the Manhattan Project of World War Two, and the sole contractor manufacturing enriched uranium and weapons components for the federal government at its Oak Ridge operations in Tennessee and Kentucky. It has recently relinquished the contract.

Health and Safety Record

Many of Carbide's operations carry potential risks to the 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 had happened to a company with an otherwise exemplary record in environmental and health matters. Indeed, many U.S. environmentalists were not surprised that a Bhopal tragedy should have happened—only that it happened to Union Carbide, which until the tragedy enjoyed a relatively "good" health and safety image.

Bhopal shattered this image, revealing a situation in India of bad design, poor management practices, and lack of adequate public monitoring and oversight. Our look at Union Carbide's health and safety record over the past 10-15 years in other parts of the world, suggests that these problems are not unique to its Bhopal facility, nor even to its Third World operations.

THIRD WORLD RECORD

Carbide's presence in the Third World is not recent—its batteries in particular have been widely marketed for many years. What is relatively new is Carbide's establishment of key manufacturing facilities out of its home base in the USA. That move has been part of the explosive growth of the petrochemical industry since the Second World War, and the concomitant drive to expand markets. It was an interest in the Asian pesticide market that led Carbide to begin its pesticide plant in Bhopal; low world prices for oil and an expanding "offshore" market for intermediate chemicals derived from petroleum that led to Carbide's great expansion in Puerto Rico in the late 1960s and early 70s.

These operations have been far from the economic boom anticipated by the countries involved. The Bhopal plant never reached production expectations, the $300 million expansion of the Penelas petroleum refinery on Puerto Rico generated no taxes, a relatively small number of jobs for islanders, and was shut down in 1984.

HISTORY OF UNION CARBIDE IN INDIA

Union Carbide has a long history in India:

* Assembly of dry cell batteries prepared in England started in Calcutta in 1924.
* Production of dry cell batteries started in Calcutta in 1940.
* Another dry cell factory was set up in Madras in 1942.
* A flashlight manufacturing plant was set up in Lucknow in 1958.
* An arc carbon plant was set up in Calcutta in 1965.
* Another dry cell plant established in Hyderabad in 1967.
* Setting up of pesticide plant in Bhopal started in 1969.
* Electrolytic manganese dioxide factory put up in Bombay in 1971. During 1983, Union Carbide India Ltd (UCIL) had sales of Rs 210 crores ($180 million), half from dry cells. Chemicals (including pesticides) accounted for one twentieth of this total. After taxes, the company made a profit of about Rs 15 crores ($13 million) in 1983.
CANADA: chemicals, batteries, metals, plastics, pesticides
UNITED STATES: batteries, chemicals, metals, plastics, pesticides
PUERTO RICO: chemicals, gases, metals, plastics
MEXICO: metals, chemicals, gases, batteries, plastics
COSTA RICA: batteries

COLOMBIA: batteries, pesticides
ECUADOR: batteries, chemicals
VENEZUELA: batteries
BRAZIL: metals, batteries, gases, plastics, pesticides
ARGENTINA: batteries

IVORY COAST: batteries
GHANA: plastics, batteries
NIGERIA: batteries
EGYPT: batteries
SUDAN: batteries
KENYA: batteries
SOUTH AFRICA: metals, pesticides
OPERATIONS: PRINCIPAL PRODUCTS

UNITED KINGDOM: metals, chemicals, pesticides
SPAIN: gases, metals
BELGIUM: gases
NETHERLANDS: chemicals
FRANCE: metals, gases, pesticides, chemicals
SWEDEN: metals, chemicals
GERMANY (West): chemicals, gases, plastics
SWITZERLAND: batteries, chemicals
ITALY: metals, chemicals
GREECE: batteries
PHILIPPINES: batteries, pesticides
JAPAN: chemicals, batteries
KOREA: gases
HONG KONG: chemicals

INDIA: chemicals, metals, batteries, pesticides
SRI LANKA: batteries
THAILAND: chemicals, pesticides
MALAYSIA: batteries, chemicals
SINGAPORE: batteries, chemicals
INDONESIA: batteries, chemicals, pesticides
AUSTRALIA: chemicals, batteries, plastics
NEW ZEALAND: batteries, plastics
Neither has the health and safety record in some of these Carbide facilities been exemplary. Much is still not known about many of Carbide’s overseas operations. The world would never have heard of earlier incidents at Bhopal if it had not been for the major accident. But we do have information on some Third World plants.

Puerto Rico

Carbide’s neighbors in Yabucoa, Puerto Rico have been complaining for years about the ill effects of air pollution created by the plant there. In Yabucoa, Carbide manufactures graphite electrodes for the steel industry. The tiny barrio of Ingenio de Yabucoa has a population of approximately 1,400 people, and lies about a mile north of the plant.

Local inhabitants say that the plant has been contaminating the air since its opening in 1969, and even more since its expansion in 1972. 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. From 1975 onwards, local people in Yabucoa struggled to make the company clean up its act, or the government to force it to do so. In December 1980, the Environmental Quality Board finally did fine Carbide—a whopping $550,000, for air pollution violations dating back to 1972, when the plant was new. This was the largest fine the agency had ever levied on any company.

The company agreed to pay the fine, and instituted a $26 million program to improve the facility over the next five years. However, in the year after the fine, there was a fire in the pollution control equipment in the plant’s mixing and grinding areas. According to Jose Ortiz, leader of the citizens’ group, the company rushed to repair the equipment needed for production, but did not repair the pollution control equipment. Pollution in the neighboring areas was greatly increased.

Five hundred and twenty-one local residents brought suit against Carbide asking for $380 million in damages for ill-health resulting from the plant’s emissions. Black flags fly continuously from the homes of these plaintiffs.

A Yabucoa physician in 1980 said that he had “no doubt” that such ailments as asthma, bronchitis, throat disease, fevers, skin irritation and allergies, have increased “enormously” among Ingenio residents since the plant opened. He told the San Juan Star newspaper in 1980 that “I feel that these ailments have been caused by the pollution coming from the plant...You can be sure that these problems are 100% more serious in Ingenio than in other nearby barrios.” A local schoolteacher noticed that on rainy days, when an oppressive foul smell wafts across the field from the factory, children get sicker.

The company’s response has been to hire researchers from the U.S. to deny local people’s experience of pollution episodes, and to launch a campaign in Puerto Rican schools to “clean up the environment” of garbage.

Indonesia

In 1978, at Carbide’s Jakarta factory which makes Eveready batteries, a worker was killed by electrical shock as he stood in water, immersed in a haze of carbon dust, having worked three consecutive overtime days. U.S.A.’s Newsdaysaid in a special report that while the faulty switch was replaced after his death, other, more costly, worker-safety provisions were not brought in so quickly.
Dust collectors in the plant, promised when the new medical officer joined the staff in 1977, took two years to arrive.

The new health officer became so distressed with company policy that she resigned in 1979 after only two years with Carbide. She found kidney disease and respiratory disorders among workers and excessive heat in working conditions. Mercury was in well water supplying drinking water to the workers, and was leaching into groundwater under neighboring rice fields. While the company did substitute bottled water for the mercury-contaminated well water, they refused to allow her to tell workers why. Workers with kidney disorders, whom she had instructed to drink at least 3 liters of water a day, were not allowed to leave their jobs frequently enough to drink this amount of water.

While mercury dust levels in the mixing room were found to be lower than international threshold limit values, these were set on the expectation of an 8 hour shift. Carbide workers were often expected to work considerable periods of over-time. At the time of the electrocution, for example, Carbide had obtained special permission from the Indonesian government to operate a 72 hour work week over a six month period.

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 behavioral problems, and six had to be removed from their jobs. The causes were never ascertained, although many inspectors attributed the problems to severe job-related stress.

The Puerto Rican and Indonesian experiences with Union Carbide highlight some common factors with Bhopal. The company is very reluctant to inform workers, let alone community residents, about potential health problems to which they may be exposed. Sloppy maintenance procedures (encouraged by the drive for profitability) increases risks, and repairs and improvements are slow to arrive.

But such problems are not unique to Carbide's overseas operations. As we turn to the record in the U.S.A. about which much more information is available, we find many examples of workers and communities being exposed to health hazards while management tries to deny the problems.

**U.S.A. RECORD**

**Texas City, Texas:**

A worker in Carbide's chemical plant here developed brain cancer and noticed late in 1978 that there was an unusually high number of brain cancer deaths among fellow workers. The National Institute of Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) investigated, and so did Carbide. Vinyl chloride, manufactured at the plant, was known to be associated with brain tumors in animals, but an exact correlation between workers' known history of chemical exposure and the brain cancers was to prove difficult.

In 1981, Carbide released the results of its own study at the plant: they found 12 brain cancer deaths, a number they claimed was not significantly higher than expected. A Union Carbide spokeswoman announced that "We have no reason to believe there is any correlation between these tumors and occupational exposures...".

Shortly afterwards, NIOSH released the results of its study at the same plant, finding 22 deaths from brain cancer among twenty-year workers at the plant, a rate about three times greater than the national average. Carbide had looked only at white workers and only through the year 1977. NIOSH looked at minority workers as well, and through the year 1980. NIOSH also said that preliminary results of other studies in similar plants indicated

22 deaths from brain cancer among twenty-year workers at the plant, a rate about three times greater than the national average.
brain cancer may be a general problem among chemical workers; and that one such plant is Union Carbide's facility at South Charleston, in the Kanawha Valley of West Virginia.

**Kanawha Valley, West Virginia:**

The Kanawha Valley, including the town of Institute where Carbide makes MIC and other chemicals, is no stranger to the effects of chemical pollution. During and after the Second World War, its chemical industry had expanded greatly, with the explosion of plastics and other synthetic organic chemicals in our lives. In the narrow valley are concentrated a dozen chemical plants, owned by some of the giants of the industry. By the 1970's, the Kanawha Valley was becoming known locally as "Chemical Valley," and was dubbed "Cancer Valley" by some journalists. Cancer rates in the valley are in the top ten percent of the nation for leukemia, lung and endocrine gland cancers.

Residents of North Charleston in particular, downwind of a large Carbide chemical plant, were found in a 1982 State Department of Health study to suffer from cancer at twice the national rate. Who can prove that the cancers are caused by any of the 200 or more chemicals being manufactured at Carbide's upwind factory, even though a number of them are known to cause cancer in humans or animals?

Finding proof of causes of cancer among workers at the chemical plants is equally difficult. Among vinyl chloride workers, for example, at Carbide's South Charleston plant, were found not only six of the 63 cases in the world of angiosarcoma, 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 after this 1976 study, one of Carbide's medical directors was quoted in the local newspaper as saying "to my knowledge there is no evidence on the face of the earth to link incidences of brain tumors to vinyl chloride."

Carbide has strongly resisted attempts by workers to exact damages for their illnesses and such suits have met with little success. In 1982, Carbide faced some $15-20 million in worker compensation claims in the Valley. According to a *Business Week* report most of the claims related to chemical exposures. The company was disputing them in the courts.

Government fines have been in amounts insignificant to a company of this size. In 1984 Carbide was fined a total of $105,000 by two state agencies for various violations relating to hazardous waste including $50,000 for open burning of toxic material (including small amounts of MIC). In 1981 it was fined another $50,000, the maximum fine, for spilling 1,300 gallons of propylene oxide into the Kanawha River in 1980, and 24,300 gallons in 1978-79. The company contested the fine. Despite Carbide's reputation for safety consciousness, the company has been in the forefront of opposition by the West Virginia Manufacturers Association to the state's attempt to introduce stronger air pollution regulations.

**Gauley Bridge, West Virginia:**

Carbide was behind one of the worst industrial accidents in U.S. history, at Gauley Bridge, West Virginia. Between 1930 and 1932 an estimated 476 workers died and 1,500 were disabled, as a result of silicosis during construction of a tunnel commissioned by the New Kanawha Power Company, a subsidiary of Union Carbide. The tunnel officially was to provide hydro-electric power to an impoverished part of the state, Actually the power was for another Carbide subsidiary engaged in steel-making. Contractors for the project, Rhinehart-Dennis Company, did tests which quickly showed that the rock at the tunnel site was almost pure silica, a mineral known to cause disabling and incurable lung disease. Instead of revising plans for tunnel construction to ensure the health of workers, Carbide decided to expand its size in order to use the valuable silica at its steelmaking subsidiary.

Unemployed coal miners in West Virginia knew enough about mining to see how dangerous
conditions were, and quickly left, so the company sent out recruiters to other Southeastern states for their labor-force. The new workers were mainly black, with no experience of mining.

Working conditions were bad. The tunnel was filled with silica dust, often so thick that the workers could not see ten feet ahead of them. Although West Virginia law required a 30 minute waiting time after blasting to allow dust to settle, workers were herded, and often beaten, back into the dust-filled tunnel immediately after a blast. Although the Carbide subsidiary warned its own engineers to wear masks in the tunnel, no one ever told the workers to do so.

Long before work on the tunnel was begun, silica was known to cause the lung disease, silicosis, causing scars to form in the lungs, reducing breathing capacity and eventually choking its victims to death. Death can take up to twenty years. Gauley Bridge tunnel workers began dying after only nine to eighteen months exposure to the dust. The callousness which killed these workers has seldom been equalled in corporate history.

**Oak Ridge, Tennessee:**

In a time when government agencies increasingly rely on corporations for “self-regulation,” the history of Carbide’s operations in Oak Ridge, Tennessee is a timely reminder of how “corporate responsibility” works when the corporation is subject to lax government monitoring and little outside scrutiny.

From the Manhattan project of World War Two until it relinquished its contract in 1984, Carbide was a contractor to the federal government’s nuclear weapons production. The Oak Ridge operations consist of three plants in Tennessee and one in Kentucky which manufacture weapons components, enrich uranium for nuclear power plants and for atomic bombs, and carry out scientific research in nuclear weaponry, energy and a number of other fields. The Tennessee plants were built in the 1940’s on a 55,000 acre “reservation,” adjacent to the new town built to house workers, Oak Ridge.

Unlike its commercial chemical operations in other parts of the U.S., Carbide’s Oak Ridge operations were shielded from the monitoring of state or federal environmental and occupational health agencies. The Department of Energy worked hard to protect its operator. Union Carbide, in its three Tennessee facilities, was able for nearly forty years to discharge toxic chemicals indiscriminately into streams, unlined pits and ponds on the reservation, to contaminate workers and to refuse to tell anyone what they were doing.

In the 1950’s and early 60’s, Carbide was developing processes at Oak Ridge to use mercury for the separation of lithium-6, a vital component of the hydrogen bomb. One third or more of the known mercury in the world was bought up for use in Oak Ridge at this period. The company had little experience in dealing with such large quantities of mercury: and the secrecy and excitement level as the hydrogen bomb was being developed were so great that Carbide took no notice of the advice of electrochemists on how to work with and contain the mercury. A huge quantity of the metal was lost: 2.4 million pounds are unaccounted for, most probably underneath the plant building. Some 475,000 pounds are known to have been spilled into a creek, and some 30,000 pounds are thought to have been lost into the air.

Meanwhile, workers were being exposed to extremely high levels of mercury vapor. Mercury
vapor levels in one section of the bomb plant were almost always above the recommended limit of 0.5 Mg/M$^3$ (milligrams per cubic meter of air), often 50 or 60 times the limit. By the 1950's and 60's, mercury had been known for hundreds of years to cause nervous system disorders: the original "Mad Hatters" had been made so by mercury in the felt.

they handled. The Minamata disaster in Japan, which killed and disabled many people who ate mercury-contaminated fish, happened in the early sixties.

Oak Ridge workers were probably the best tested workers in industry at that time: they had routine health exams and urine and other tests. In 1955, close to 50% of the workers tested had mercury in their urine at levels above the 0.2 milligrams per liter which is considered dangerous. Although they were tested, they were never told of the hazards to which they were exposed, or removed from them. Some workers now feel that they were being used as guinea pigs, experimented on just like the 3,000 or so animals in the genetics laboratory at the plant.

Attempts to change waste disposal practices did not work. Massive quantities of pollutants still migrated into the environment. The S-3 ponds which were made to dump waste oils and other chemicals from Y-12 have been known since 1971 to leak. Groundwater beneath them has been contaminated with PCBs, a highly dangerous chemical now banned by EPA, and with a myriad of other toxic chemicals. The ponds continued to be used until 1983 when the state of Tennessee ordered them closed.

Radioactive waste disposal was little better. Radwastes were plowed into the soil of the hillsides of the Oak Ridge reservation, sometimes incinerated, sometimes discharged into streams and lakes, sometimes dumped into unlined trenches. They never stayed where they were put. Radioactivity has been found in fishes, birds, even the honey produced by the reservation’s bees. It is in the groundwater at levels hundreds of times that allowable for drinking water, and is slowly moving. Some radioactive elements stay dangerous for millions of years, and we still know no way of cleaning groundwater.

In 1983 the cover in Oak Ridge was blown, and for the first time the public learned about some of the pollution stemming from the Carbide plants at Oak Ridge. 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, and that it was getting out of defense contracting because it was not sufficiently profitable.

Despite the cracks in the edifice, Oak Ridge is still a town of secrets. “Share a ride but don’t share secrets,” say the billboards. The fetish for na-
tional security born of the Bomb and nurtured by the Cold War, is alive and well today. It is still used to keep secret the names of chemicals used in the plant, to which workers may be exposed, and which leave with the effluent. It is still used to fight off the attempts by state agencies to regulate the Oak Ridge plants like other manufacturing concerns in Tennessee. Oak Ridge Operations is an object lesson in how responsible corporate concerns are when no-one is forcing them to clean up.

The Carbide health and safety record does not measure up to the company’s pre-Bhopal image. It is clear that a range of problems, from design errors, management and training deficiencies, carelessness to callousness have resulted in real threats to workers’ and neighbors’ lives. But we should not focus only on Carbide. Its official health and safety record in the U.S.A., as revealed by OSHA records, indicates it is one of the best and safest chemical companies. That a Bhopal and the other incidents in its health and safety record could have happened, shows the depth of the problem here. If Union Carbide has such a record, what does this say for the rest of the industry?

If it were just one company or one chemical, the problem would be much easier to control. Instead, we are faced with some fundamental problems in twentieth century lifestyles, and in the international economic order. To confront these problems will take a major effort by many people across the world.
THREE
ISSUES FOR THE WORLD

The problems posed by the disaster at Bhopal are limited neither to Bhopal nor to Union Carbide. Similar industrial accidents have occurred elsewhere in the world (see box,) and many more remain unreported. They occur in developed as well as developing countries, the industries range from coal mining to textiles to chemicals, the companies are multinationals as well as national, private as well as state-owned.

The global character of such problems raises several issues. The first set of issues concerns the management and control of dangerous industries and processes. Given the hazardous nature of so many products, processes and industries, how can they be made more safe? These are issues of regulation, legislation, control and monitoring of production, storage, transportation and consumption. Access to information and public participation are important elements of effective management and control of these hazards.

The second set of issues is broader and more fundamental in nature. It relates to lifestyle and models of development. Do we need these hazardous chemicals and products at all? Are pesticides essential for agricultural production and public health? Is the "chemicalization" of lifestyle desirable? Are there alternatives? Can new development models be evolved worldwide, and appropriate choices of technology made? Given the internationalization of industry, can any one country make such choices in isolation?

Finally, there is the question of what can realistically be done to effect change. What are the strategies, the demands, the actions which concerned people can develop? How can we try to make sure that a Bhopal does not happen somewhere else?

MANAGEMENT AND CONTROL OF HAZARDOUS INDUSTRIES AND PRODUCTS

The tragedy of Bhopal threw into stark relief the urgent need to control hazardous industries and chemicals. The problem is one for the developed as well as the developing world. The pesticides which poison at least 500,000 people in the Third World each year, and kill at least 10,000 per year, also poison and kill in the developed world. Almost all citizens of industrialized countries have traces of pesticides, PCBs and other toxic chemicals in their bodies, and they show up in the groundwater which provides drinking water for millions. The long-term effect of such contamination is still largely unknown, but many people link it with the increase in cancer rates and other diseases in the last 25 years.

When the problem has reached such growing proportions in the developed countries, it is easy to see what the developing countries are facing and likely to face in the future. And when developed countries are unable to manage and control these hazards with all their resources, technology and skills, imagine the fate of developing countries!

Regulation of Hazardous Processes

The issue of an effective machinery for exercising control becomes critical in this. There is no effective and comprehensive legislation in India to deal with such events. The Factories Act deals with some occupational diseases and hazards, the Air and Water Pollution Acts deal with discharges into the air and water. But standards set by these Acts are much more lenient than those set up in the U.K. or U.S.A.

Bhopal also made it clear that not only was Indian regulation of chemical production inadequate to prevent a tragedy, but so also is U.S. regulation. Other countries did apparently exert stronger controls: France, for example, refused to allow MIC to be produced there, although Carbide imported it for pesticide manufacture. In the United States, MIC is not listed in any of the federal regulations of toxic chemicals, and its sporadic emission into the air (as leaks from production facilities) was neither moni-

Do we need these hazardous chemicals and products at all?
tored, nor regulated nor was even known by government environmental agencies before Bhopal.

In most countries, the machinery that implements this half-hearted and inadequate legislation is ineffective. A factory inspector in Madhya Pradesh, India has to inspect about a thousand factories each year. Indian scientists and other officials must develop the necessary skills and resources to check and ensure that safety measures are undertaken. They also need the scientific capacity to determine whether a chemical can be produced by alternative means.

Bhopal has revealed an urgent need for comprehensive occupational and environmental health and safety legislation in India, as elsewhere. Workers and citizens need to demand the right to participate in the implementation of this legislation. The regulatory machinery to implement this legislation also needs to be strengthened.

In the U.S.A. numerous federal and state laws, regulations and agencies have developed over the past 15 years to address problems of industrial pollution and health. Bhopal revealed many loopholes in their coverage of these problems—no regulation of underground storage of toxic chemicals, inadequate regulation of transportation, absence of evacuation plans for communities close to hazardous plants, little monitoring or control of leaks.

Several Congressmen and senators are moving to plug the gaps, but problems remain. Without a comprehensive and unified look at the hazards to humans of toxic chemicals from production to final disposal, there will always be gaps, revealed only by tragic accidents. And without adequate enforcement of the laws on the books, they will be worth no more than the paper they are printed on. Under Reagans leadership, the "alphabet soup" of federal agencies charged with safeguarding the publics health has been defunded, demoralized and greatly restricted in their work.

**OTHER MAJOR INDUSTRIAL DISASTERS WORLDWIDE**

- December 1907 a mine exploded in Monongah, West Virginia. 361 bodies were recovered, more are suspected to have lost their lives.

- In September 1921, a major explosion occurred 50 miles south of Frankfurt, Germany when workers were breaking a 4000 ton fertilizer rock with dynamite. 561 persons died and houses were destroyed for miles.

- Tunnel workers in Gauley Bridge, West Virginia, U.S.A., working for a contractor to Union Carbide, were seriously affected by silica dust. It is estimated 476 died and 1500 were disabled by silicosis.

- An explosion in the Honerick coal mine in China in 1942 killed about 1500 workers.

- An explosion in the liquid gas tank of East Ohio Gas Company in Cleveland, USA, killed 131 persons in October 1944.

- In April 1967, the ship "Grand Camp," carrying 1400 tons of ammonia fertilizer from Texas City caught fire and exploded. A nearby synthetic rubber factory of Monsanto also caught fire and spread fire in the whole city. Another ship loaded with nitrate exploded. 576 persons died and more than 2000 were seriously affected.

- A truck carrying dimethyl ether exploded inside the factory gate of I.G. Farber chemical plant in Germany in July 1948, killing 207 persons and injuring 4000.

- A dynamite truck exploded in Columbia in 1956 killing about 1100 persons.

- November 1968, the No. 9 Consol Mine at Farmington, West Virginia, exploded, killing 78 miners.

- In June 1974, the caprolactum plant of Nepro Ltd. in England had an explosion that killed 38 workers and destroyed all buildings in a 60 acre area.

- An explosion in Chasma coal mines in India in 1975 killed 431 coal miners.

- The leakage of dioxin from a plant in Seveso in Italy in July 1976 affected 4500 acres surrounding it. Thousands had to flee for their lives.

- A propylene truck overturned and caught fire in Spain in July 1978 killing 215 persons, mostly tourists.

- A major fire caused by gasoline leakage from a pipeline in southeast Brazil in February 1984 killed about 500 persons.

- Liquid gas storage tanks in Mexico City exploded in November 1984, killing 452 persons and seriously injuring more than 4000. About 1000 persons are still reported missing.

- Bhopal: December 3, 1984
Transportation and Storage

Regulation of transportation and storage of toxic chemicals is even more inadequate than regulation of production. More than a hundred accidents involving leakage of highly toxic substances in transportation are reported in the U.S. each year. When shipments of MIC cross the country by road or rail, from Institute to other pesticide plants, government regulations do not even require it to be labelled as poisonous, let alone to steer clear of residential areas. The U.S. National Transportation and Safety Board is now considering revising its labelling requirements and standards for containers for MIC, but questions remain for many other dangerous chemicals.

In a developing country like India, there is no regulation for transportation and storage of toxic chemicals. And with the bulk of the population semi-literate, labelling does not provide an effective solution. It is, therefore, necessary to look at the entire process of production, storage and transportation of chemicals while preparing comprehensive legislation and an effective implementation machinery.

Registration and Testing of New Chemicals

The licensing and registration of new chemicals is extremely inadequate in a country like India. The Indian Insecticides Act is used for this purpose but its machinery is incapable of testing longterm effects nor does it assess the need for a certain chemical in the production process. MIC is a case in point. Many companies manufacture carbaryl-type pesticides without using MIC. Union Carbide itself switched to an MIC-based production process only recently. Should not the licensing and registration authorities ask whether this MIC process is necessary?

Even in a developed country like America there is a considerable backlog of untested chemicals in everyday use. The U.S. Toxic Substances Control Act [1974] requires each chemical to be thoroughly tested and approved by the Environmental Protection Agency (EPA). But EPA has tested only a very small proportion of chemicals on the market and is unable to cope with the 70 new chemicals registered each day by the U.S. Chemical Manufacturers Association. Testing on MIC itself was very scanty, in large part because the chemical is highly volatile and reactive, making it difficult to handle in the laboratory, and it had a nasty habit of escaping and making scientists’ eyes water. Union Carbide has the best information on MIC toxicity, but they are treating it as a “trade secret.”

Siting of Hazardous Factories

Following the Bhopal disaster, arguments about the siting of Carbide’s Bhopal facility were made by those in the company, and in the United States press, who were looking for ways of “blaming the victim” rather than blaming the corporation. Why were so many poor people living so close to the plant gates? It was said that they were not there when the plant was built. Should the Indian government not have controlled the unauthorized housing development?

Even a cursory look at the siting of chemical plants in the United States makes it clear that the presence of chemical plants in crowded urban areas is not a problem confined to the Third World. In the U.S., older plants in particular, developed during the Second World War and before, are often situated in a densely populated urban area. The Carbide plant in Institute, West Virginia, is a prime example.

The solution now being proposed, to site hazardous industries away from human habitation, looks doubtful. Zoning is a concept that has emerged in the context of developed countries where an affluent population has access to efficient transport facilities to get to and from work. By contrast, even in a relatively affluent city like Delhi, a sizeable fraction of the urban population cannot afford the subsidized public transport system. Moreover, Western cities have not faced the kind of rapid, dynamic growth that Third World cities are today facing. Human settlements experts in the Third World have repeatedly found that slums come up where work opportunities are, and usually at such a speed that urban planners can declare them illegal, but find them extremely difficult to control. Industries immediately become focal points for urban growth and accretion of settlements.

Only an extraordinarily strict regulatory regime, which would acquire an extremely oppressive character, could control such settlement. If governments could develop a human settlements policy that meets the needs of all its urban population, and excellent transportation facilities, then zoning off hazardous industries might work. But otherwise the urban planners’ “unintended city” will invade all regulated

Testing on MIC itself was very scanty…

…it had a nasty habit of escaping and making scientists’ eyes water.
zones. In a country with the population density of India, it would be hard in any case to find really remote places with no habitation around. Such a sitting policy could become a reason for displacing rural people. Nor would such a policy work for the small scale sector which often handles hazardous products.

It would, therefore, be more appropriate to plan for hazardous industries under the assumption that there are only two options open. Either such industries are not built at all or if they are built, they will have to live cheek-by-jowl with people (especially poor people). In the latter case safety measures must override all considerations, including economic and profit requirements.

**Control of Multinationals**

A central issue emerging from Bhopal is the control over multinational corporations. The developed countries are finding it difficult to do so Union Carbide's U.S. safety record, set out above, speaks for itself. And multinationals like Union Carbide have the resources and power to influence governments of the developing countries. Union Carbide's annual sales are more than the gross national products of many developing countries. In addition to financial power, multinationals have access to skills, technology, and information. This is what allows them to function as a global entity, simultaneously operating in several different countries across the world.

It is argued that multinationals bring capital and modern technology, and hence must be welcomed by countries seeking development. However, multinationals also bring political, economic and social control over labor and people. India has withstood the advances of multinationals more than many Third World countries. But even in India the pharmaceutical industry is fully controlled by multinationals, selling unnecessary and even harmful drugs to people. In many other developing countries, large sectors of their economies are controlled by multinationals. Political and social oppression and control is often higher in those countries which are dominated by multinationals.

There is, therefore, a need to question critically the role of multinationals and to control their operations more closely. How do we prevent multinationals from impeding self reliant growth? What can be done to keep a close watch on them? What are the alternatives?

**Controlling Double Standards**

Some hazardous products and processes are banned in the developed world but are openly produced and used in developing countries. For instance, DDT and BHC have been banned in the U.S.A. for over a decade, but continue to be produced, imported and used in India. PCBs (Polychlorinated Biphenyls) are banned in most developed countries as carcinogens, but are widely used in electrical capacitors and transformers in India.

Often, when products and processes are strictly regulated or banned in the developed countries, production and sale shifts to developing countries. Profit-seeking corporations continue to use double standards in treating the developed and developing countries.

The classic example is that of the asbestos industry. As the production and use of asbestos declined sharply in the developed countries because of known health consequences like asbestosis, plants manufacturing asbestos were shifted to developing countries. Several American and European multinationals have set up plants and collaborations in India to manufacture asbestos, asbestos cement, brake linings, etc.

Is life in India cheaper than in America? Can we allow double standards? Should not products known to be hazardous be banned across the world? Should not corporations be asked to set up similar safety standards and procedures irrespective of the location of their plant? Should not government standards of regulation and control be equally strong in developing as in developed nations? Should not preventive measures and emergency procedures be equally applied across the world—in India as well as in the U.S.A.?

**Access to Information**

Secrecy and control of information reached incredible levels in Bhopal after the disaster. While officials were repeatedly declaring that air, water and food were safe, they were not prepared to say anything about when, where or what tests had been conducted. When asked whether the factory would ever start again, they first said, "no" and then started it up again. When asked about the details of what went wrong, they repeatedly pleaded ignorance or that it was not right to say anything "in the public interest."

The worst was the confusion over the line of treatment and over the possibility and nature of long-term after-effects. While tens of thousands of people
continued to complain of serious ailments, central and state government doctors said "there is no reason to believe that there will be any long-term effects." But on what basis? The Madhya Pradesh health department has tried to suppress all information relating to the extent of the damage to the health of the victims.

Union Carbide played a key part as well in controlling information and providing misinformation. Before the accident, it had provided no public information in Bhopal on the effects of MIC, and apparently little to its own workers. But its Material Safety Data Sheet on MIC, issued in the U.S.A., makes it clear that the company knew the chemical to be a poison. After the accident, instead of accepting responsibility outright, Carbide implied sabotage without a sliver of evidence to substantiate their claim. The company has throughout been less than forthright with the Indian people and the American public.

This is not an isolated event. Control over information and knowledge is a major mechanism of controlling people across the world. The right of the people to know is particularly important in a society like India where most producers of scientific knowledge, including knowledge about safety, are under the control of government and private corporations—which can easily turn off all flow of information needed by the public. In India there is no legal obligation to make public government information, as there is in the U.S.A. The tendency to restrict information will be exceptionally high in adverse circumstances, when big reputations and fortunes are at stake. Scientific institutions in the developing world have largely evolved under the auspices of the government. Excessive government control creates the danger of political and bureaucratic control over information.

Access to information is also important in developed countries, even in the U.S.A. with its "freedom of information" laws. In these countries, corporations have a great deal of control over information. They increasingly influence "independent" university research, and using claims of "trade secrets" can even restrict the information which government agencies can make public. People's access to and control over knowledge and information is critical for ensuring any true public regulation and control over hazardous industry. Indeed it is critical for our continued survival—we all need to know!

**LIFESTYLES**

Bhopal does more than raise questions about the adequacy of the regulations of toxic chemical production and use; more even than about the control of multinationals. Bhopal forces us to re-examine some of the underlying premises on which economic development and lifestyles of the late twentieth century are based. We must question the process by which poisonous chemicals, like MIC, have become intrinsic parts of our lives, and whether we need them. We must question the economic system, more and more an internationalized one, which creates the chemicals, dominates their markets, and influences local development efforts.

**Pesticides**

As the chemical industry tries to reclaim the advantage after Bhopal, we hear again the same arguments that the industry made so stridently back in the 1960's, when DDT was banned in the United States. Then, Dow Chemical Company's Dr. Julius Johnson associated his company's biggest selling pesticide with "granaries full and overflowing... a surplus of fiber for clothes... a population where the efforts of one farmer feed 27 of his countrymen." A Vanderbilt University professor, Dr. William Darby, wrote that discontinuing pesticide use would mean "the end of all human progress, reversion to a passive social state devoid of technology, scientific medicine, agriculture, sanitation. It means disease, epidemics, starvation, misery and suffering."

After Bhopal, the theme was being raised again, as newspapers in developed countries counted the tragedy as "the pain of progress."

There is another side to the coin. Opponents of chemical agriculture argue that pesticides have not been the panacea that their producers would like us to believe. Their effectiveness diminishes rapidly as pests develop immunity to them. In the United States, insect resistance is now reported in 428 species. Thirty common annual weeds are resistant to the most commonly used herbicides. While insecticide use has increased eleven-fold

**Control over information and knowledge is a major mechanism of controlling people across the world.**
over the past 30 years, crop loss due to insect resistance has doubled.

Pesticides also carry costs, both to those who work with them, and to the consumers of agricultural products. Oxfam has recently made a conservative estimate that 500,000 people in developing countries are poisoned by pesticides each year. 10,000 cases are fatal. Since the estimates are made from public records, like hospital admissions, and since we know many cases go unreported, the true picture is doubtless even more grim. Pesticides poison farmworkers in developed nations too, especially as farmworkers are among the lowest paid and least protected of workers in such nations. But in the Third World, the dangers are worse because regulation of pesticide use is light, labelling cautions seldom adequate, literacy levels low, and public education and awareness less than in more affluent societies.

In many cases, pesticides which have been banned in countries like the U.S.A. continue to be applied in developing nations. In other cases, pesticides which have been approved for use in the U.S.A., but under strictly regulated conditions, are used in the Third World without those regulations, and with far more serious effects on farmworkers.

For consumers, the hazards of pesticides are less those of acute poisoning, and more those of long-term effects of small amounts. Here we know much more of consumers in the developed world than those in the developing countries where crops are grown for export. We know that in the United States, for example, fat-soluble chemicals like many widely-used pesticides, and other industrial chemicals, are present in almost everyone’s body. The U.S. Environmental Protection Agency estimates that 99 per cent of all Americans have at least one-half part per million of PCBs in their body fat. In a 1981 study of Michigan mothers, 50 per cent had PCBs in their breast milk at levels at or above the government’s safety level. A more recent study of breast milk found 80 per cent of all breast milk samples contaminated with the pesticide dieldrin, 63 per cent with heptachlor and 74 per cent with chlordane. All of these chemicals have been severely restricted for use in the U.S.A.

There are alternatives, and they are being tried. Integrated Pest Management (IPM) combines biological controls (using natural predators of pests), cultivation practices (like crop rotations), and occasional chemical use designed to match specific problems. It reduces the use of pesticides greatly, and has had good results in reducing crop losses. In 1979, the Office of Technology Assessment, the research arm of the U.S. Congress, reported that IPM used on major crops in the U.S.A. “can reduce pesticide use by up to 75%, reduce preharvest pest-caused losses by 30%, and reduce total pest control costs by a significant amount”.

Why is IPM not a central part of agricultural development policy in the United States and all other countries of the world? Because there are economic forces—the chemical industry—which thrive on increased use of chemical products, whether or not they are the best solution to particular problems. The influence of the chemical industry on agricultural research is profound. It operates through universities in the developed countries, and through special research institutes in developing countries. The mainstream thrust of agricultural research is toward more and more technical fixes, and in their wake inevitably come tragedies like Bhopal.

Chemicals In Our Lives

Pesticide activists have been most vocal in raising questions about chemical use and abuse, but the questions can stand equally well for the role of other chemicals in our lives. Today it is widely assumed that ‘development’ means chemical agriculture, industrialization, access to consumer goods manufactured from synthetic organic chemicals—plastics, polyesters, nylon, vinyl and the like. Given such notions about development, we can see why multinationals like Union Carbide are so attractive to developing nations. India invited Union Carbide to build a pesticide factory after its own attempts to develop a pesticide industry in the 1960’s had failed. Carbide could offer technological know-how, capital to invest, jobs, access to raw materials and to overseas markets for finished products.

But Carbide’s Bhopal factory never lived up to its promises. The technology was not as successful as expected: there were many problems in setting up the plant, and it never ran at full production. The jobs benefitted only a few. The end products were expensive, and earned India little foreign currency. And, as so often happens, the technology that was supposed to be transferred, to help the developing nation, reached no further than the Carbide factory gates. It did little to improve the standard of living of the majority.
In the light of Bhopal we must ask the same questions of other aspects of our chemical-based economy as are being asked of chemical agriculture. Do we really need the chemicals that pose health hazards to workers, neighbors or consumers? Are there alternative paths of development, smaller in scale, drawing on indigenous materials, skills and conditions? Can we lessen dependence on western technology and the multinational corporations which are inextricably linked with it?

STRATEGIES FOR THE FUTURE, DEMANDS WE CAN MAKE

In the wake of the Bhopal catastrophe, people across the world have begun to act. Some old efforts have been re-energized, and many new initiatives have been taken. We all have to act — act now — to make sure that a Bhopal will not happen again, anywhere.

Building Awareness

One of the first things that needs to be done is to build awareness among people across the world. Workers and citizens have to become aware of the broader issues that Bhopal raises. Even a tragedy of the proportion of Bhopal has not yet caused the kind of popular mobilization that is needed to press for changes in legislation and regulations. Popular awareness in India, as well as in a country like U.S.A., is still low. The information that has reached people, a few of them, is incomplete and distorted. There is a need to generate and disseminate authentic information to a wide spectrum of people.

Educational efforts are needed to generate and sustain people's awareness and mobilization across the world. Workshops, seminars, popular documents, audio-visual materials, exhibitions, songs, popular theatre, people's investigation — all the methods of popular education need to be developed and employed to create widespread awareness and to catalyse popular action.

Governments, be they in the developed or the developing countries, will not act with a speed and in the direction that is necessary, unless organized and collective pressure from ordinary citizens and workers is brought on them. The question is who will make the beginning? Are we ready to take the initiative?

Already existing citizen groups and workers' organizations could take the initiative in this process of popular awareness-building and mobilization.

Trade unions, in India, U.S.A. and everywhere, need to take the initiative to inform their own members and other sections of the working class. The existing popular organizations and social movements can provide the leadership in this massive task of people's education and mobilization.

These issues will require a concerted and coordinated effort on the part of many of us. Trade unionists, workers, citizens, women, lawyers, environmentalists, doctors, journalists, students, researchers, rural organizations and activists — all of us need to come together to work towards the evolution and implementation of strategies to confront these issues.

A MESSAGE TO THE PEOPLE OF BHOPAL

We are residents, professors, and college students who oppose MIC production in our community. We do so not only because a disaster similar to Bhopal could happen here, but also out of respect for the victims and survivors in your city. We think it is insensitive and obscene for Union Carbide to resume MIC production here before the Indian government has determined the causes of the disastrous leak at Bhopal. We see Union Carbide’s haste to make profits again from methyl isocyanate as an indication of little concern for what happened to the Indian people, and little concern for the predominantly black community that lives just downwind from the Institute plant.

The lesson of the Bhopal disaster for us is that Union Carbide cannot be trusted to insure our safety. We assume that the people of Bhopal were led to believe for many years that they need not worry about MIC production, that the company had the technology, the management, and the concern to insure safety. If such assurances were worthless at Bhopal, they cannot be depended upon here.

We hold out our hands in brotherhood to you. May our common concern for safety and health bond your community and ours for many years to come.

People Concerned About MIC
Post Office Box 423
Institute, West Virginia 25112

The United States of America

The above message has been sent to the Mayor of Bhopal, the Chief Minister of Madhya Pradesh, the Indian Ambassador to the United States, and to the Bhopal newspaper Dainik Bhaskar.
Regulating Hazardous Industries:
The Bhopal tragedy has already sparked a number of attempts by U.S. Congressmen to close loopholes in environmental and occupational health legislation. The long overdue comprehensive legislation in India is now more urgent than ever.

Regulation needs to cover not only production of hazardous materials but also transportation, storage, use and final disposal of toxic chemicals. In the U.S.A. regulation of some of these aspects is grossly inadequate, in India much of it does not exist at all.

As these legislative initiatives develop, two factors seem especially important. Citizens must be involved in the drafting of the legislation to make sure it serves their interests, and must have a role in continued monitoring and oversight over hazardous processes. Without the oversight of communities and workers it is too easy for government regulators and corporate executives to conspire to avoid stringent regulation.

In some parts of the world, citizen monitoring has been tried, and proven effective. In Denmark, for example, a citizens’ committee is made up of neighbors of a hazardous waste plant. The committee receives regular information about the plant’s operations, and can call in its own experts to help in evaluation. Neighbors and workers have an over-riding interest in safe operations which an over-worked government official based some distance away does not have. They also are there 24 hours a day, and know their local environment and population better than any outsider could.

Controlling Double Standards
As countries, especially in the affluent west, develop better controls on hazardous industries, it is important that these be not at the expense of other, less affluent countries. There must be no havens for dirty factories paralleling the tax havens so beloved by the rich.

In 1978 the U.S. Congress passed legislation requiring that foreign governments be notified when goods banned in the U.S.A. are exported. In 1981, President Carter issued an executive order establishing a comprehensive Hazardous Export Policy. Thirty-four days later the new President Reagan revoked the executive order, and his administration has opposed United Nations’ attempts at international rules on hazardous products. The administration claims that such rules interfere with rights of sovereign nations to act as they will. In fact, a primary concern is that such rules would put U.S. companies—major promoters of hazardous products—at a serious competitive disadvantage.

Developing countries do not have the resources to put into research and testing of chemicals. Nor does it make sense from a global resource perspective for each country to duplicate the other’s research. To share information about hazards, about alternative products, about safety measures that can be taken, seems both fair and reasonable. Activists can begin by exchanging information, and activists in the developed countries have a special obligation to bring pressure to bear on their governments to do the same.

Controlling Multinationals
In many ways it is ironic that this tragedy should have happened in Bhopal. India has been more successful than many countries in controlling the influx of multinationals and limiting their role in the whole economy. There is a large and strong indigenous business sector. Yet even for India, the attractions of capital and high technology which a multinational like Union Carbide can offer are high.

Controlling multinationals has no easy solutions. The elimination of double standards would contribute, as would the development of stronger linkages between workers and communities across national boundaries. At present, they are divided and only the corporation has a concerted goal. Workers in the U.S.A. are played off against workers in Mexico, or India, through the threat of plant closings and runaway shops. Economic blackmail is a common issue for workers and communities in the developed and developing world, and one on which common strategies could be developed. Is there a way to begin linking people across national lines, to develop such strategies?

The Right to Know
An important issue that calls for immediate and concerted effort is right-to-know. Some countries like the U.S.A. already have some provisions to this effect. We need to demand our fundamental right-to-know in India and other countries.

This is of strategic importance because authentic information is critical for effective awareness-building and mobilization. We have seen the harm that control over information and disinformation has already done. In fact, authentic information is crucial for overcoming our own divisions as well. So, we need to generate and disseminate our own information, and we need to demand, acquire, and popula-
rize the information from governments and corporations.

An extension of the demand for access to information is the goal of development of a people-oriented science. It will be no easy task to turn around a science and technology that has grown hand-in-hand with industrialization and the profit motive. But without a science that is humanitarian, that seeks to resolve the real needs of people, and that seeks to incorporate people’s own knowledge, perspective and experience, we will always be fighting rearguard actions around tragedies.

People must be involved and informed about the dangers to which they may be exposed. Human and environmental safety is too important a subject to be left to government and corporations alone. Only when people know, will there be public pressure for safety, and only then will regulators give high priority to it. Otherwise, in the overriding desire for industrial development, and in the desire to make profits through short cuts, safety will be repeatedly overlooked. The callousness with which warnings about the dangers posed by the Bhopal plant were ignored makes it absolutely clear that the right-to-know is our fundamental right. If people have to live with hazards, it must be on the basis of informed choice.

**International Links**

Finally, the struggles on issues of control over multinationals and science and technology, right-to-know, questioning development strategy need to be carried out with an international perspective. The forces we are trying to change—multinationals, development organizations, government—are increasingly international and well coordinated. So, any struggle against a chemical company in the USA may lead to the company shifting its plant to Mexico. Any effort to challenge development strategy from one isolated corner, from one country alone, may never succeed, because the current model of development is an international one, and firmly linked to the international economic order.

The current context, therefore, forces us to seek ways of developing international linkages and solidarity. The issues arising out of Bhopal affect us all, and we need to struggle in our different situations around those issues. But if we are aware of each others’ struggles, if our struggles are based on information provided by each other, if our local and national struggles are situated in an international arena of solidarity, then we have a much greater chance of success.

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**International Reactions and Responses to Bhopal**

The reaction from around the world to the Bhopal tragedy gives hope that much can be done to build international pressure for change. The shock and outrage which so many people felt has been translated into actions and coalitions in a number of countries.

**CITIZENS OF LIVINGSTON, SCOTLAND, CONDEMN UNION CARBIDE**

1,000 people, of this small town of 40,000 inhabitants, turned out at public meetings to oppose Union Carbide’s plan to build a gas blending plant there, and to condemn the company’s actions in Bhopal. Helen MacKenzie of the citizen's group LACE (Livingston Action Committee for an Enquiry into the siting of Union Carbide) writes:

> Many of us in the pressure group were a little surprised at the strength of reaction of most local people. It is unheard of in Livingston that so many people would turn up at public meetings. There can be no doubt that the single unifying factor was a sense of outrage and disgust that Union Carbide would have the arrogance to set up another hazardous plant anywhere in the world so soon after the terrible tragedy in Bhopal. That outrage was further increased by the stubborn refusal of Union Carbide personnel at the public meetings to answer any questions relating to Bhopal — their excuse was that it was a totally different process, and anyway it happened in India!

**Quotes from statements at the public meetings:**

"What will it say to the people of Bhopal and the rest of the world, if two months after the world's worst ever industrial disaster, Livingston allows Union Carbide to set up a factory here? The name on the wall of the factory would be a constant source of anxiety and shame."

"I believe that after what happened in Bhopal, Union Carbide should not be allowed to stay in business anywhere."

Union Carbide should go away and clear up the mess they made in Bhopal— they should not be here — they should be looking after the people who are left."

"Union Carbide aren’t interested in the people of Livingston or this community. They’re only interested in making profits, and if they stopped making profits they’d be away far quicker than they came."
India: Several local and nationwide efforts have come up in response to the Bhopal disaster. It is difficult to name all the groups and persons in this brief note. The following are some of the key efforts.

At the local level, immediately after the disaster, a group of activists in Bhopal and nearby areas formed a front called Zahreeli Gas Kand Morcha (Poisonous Gas Incident Front) which has been struggling for better information, proper treatment and compensation.

Another local level group in Bhopal that has been involved in organizing some relief, rehabilitation, and medical treatment is called Nagrik Rahat aur Punarwas Samiti (Citizens' Relief and Rehabilitation Committee).

Union Research Group, Bombay, has established a Trade Union Relief Fund which is providing relief and rehabilitation for victims.

The Bhopal Relief Trust has been conducting a study on the health situation in Bhopal.

Medico Friends Circle and some doctors from KEM Hospital, Bombay have done preliminary diagnosis of some affected persons.

Lawyers Collective in Bombay and several other lawyers have been looking into the legal issues.

PRIA has published a popular booklet in Hindi on Bhopal and the issues it poses for workers and other activists. Along with the Center for Science and the Environment (CSE) and several other organizations and individuals, PRIA is trying to assist in the evolution of a national coalition of trade unionists, rural organizations, environmental groups, doctors, lawyers, journalists, researchers and others, to act in a coordinated fashion on issues posed by Bhopal.

Japan: A new coalition of 19 consumer, citizen, environmental and women's groups formed soon after Bhopal. Called the "Bhopal Disaster Monitoring Group" the coalition's goals are "to investigate the Bhopal tragedy and to take action to prevent similar disasters from occurring in the future." Several Minimata victims' groups are coalition members. Minimata was Japan's own industrial disaster of the early 1960's, when mercury from a factory contaminated fish and caused severe neurological disorders in people eating the fish.

The group has demonstrated in front of Union Carbide headquarters in Tokyo, wearing black hoods and passing out leaflets to inform the public that Bhopal is a disaster which affects everyone. They presented a letter of protest at the headquarters and wrote to Warren Anderson, head of Union Carbide.

They sent letters of protest to Japanese government officials, and wrote corporate officials about Japan's own multinationals' overseas operations.

Kenya: The Global Meeting on Environment and Development, which brought together environmentalists and development workers from 150 non-governmental organizations around the world, declared March 12, the 100th day after Bhopal, as "No More Bhopals Day." The Environmental Liaison Centre in Nairobi and groups around the world organized actions and press releases on that day.

Chile: Based in Chile, and representing popular educators and researchers from around Latin and Central America, CEAL (Consejo de Educacion de Adultos de America Latina) is coordinating research on the Union Carbide record in that region.

Belgium: After Bhopal, protests mounted against Union Carbide plans to build a European chemicals distribution center on the outskirts of the village of Malle. 25,000 tons of chemicals would be stored there, at least 250 tons of which would be highly dangerous.

Bhopal also prompted Belgian members of parliament to raise questions about the production of toxic chemicals in Belgium.

Netherlands: Consumer organizations and environmental action groups have been organizing protests over the past few months against Carbide's dry-cell battery production. They have raised concerns about the environmental damage from disposal of these batteries.

United Kingdom: In Livingston, Scotland, a local outcry defeated Carbide's plan to build a gas-mixing plant there. Local residents were concerned about the hazards from some of the gases to be produced there, arsenic in particular, but much of the protest reflected feelings of anger about Bhopal, and disgust with Carbide. The protest was all the more remarkable because of high local unemployment, and a real need for new jobs. (See box for some comments from the action group and citizens at the public hearings.)

Canada: Concerned activists held a demonstration demanding that Union Carbide pay compensation.

U.S.A.: In Institute, West Virginia, the only other place in the world where Carbide has made MIC, a local group formed in the mainly black community adjacent to the plant, and among West Virginia State College staff (a once black college, close to the plant,
The response to Bhopal gives us hope that, although the problems of industrial health hazards are very great, and very widespread, there can grow a strong voice across the world for their prevention. It should not take thousands of people to die before we act—but let it not take thousands more before we resolve the issues.

At least two international networks have been actively responding to Bhopal and sharing information and research. The International Participatory Research Network, an offshoot of the International Council of Adult Education, and coordinated from India, has involved members in several countries in preparation of this report and other activities. PAN, the Pesticide Action Network, has also been active in response to Bhopal, and one of its founding groups, the International Organization of Consumer Unions, IOCU, based in Malaysia, is preparing an in-depth report on the lessons from Bhopal.

The Workers' Policy Project of New York sponsored a conference in March, bringing together interested scientists, doctors and academics from India and the U.S.A. Proceedings are to be published later.

The National Bhopal Disaster Relief Organization was formed in April, with chapters in several major U.S. cities. It has raised $200,000 for medical relief, has sent a team of doctors to Bhopal, and has as its long-term goal the establishment of a research/medical institute in Bhopal.

Highlander Research and Education Center, Tennessee, prepared a videotape in December and January with communities in the southern United States which are also affected by production of methyl isocyanate or by Union Carbide operations. The tape shows the reactions to the tragedy by people in these communities, and traces Carbide's pesticide production chain in the region. The tape shows the interconnectedness of workers and communities affected by multinationals, and shows that while the chemical industry treats the Third World with a double standard, so too are minority and working class communities within the United States exposed to environmental and occupational risks. (The tape is 60 minutes long, color, and available from Highlander on NTSC 1/2 inch VHS or ¾ inch U-Matic, or on the PAL system from PRIA in India.)

which is now integrated). People Concerned About MIC tried to stop Carbide from re-opening its MIC production unit there, until the Indian Government had completed its independent inquiry into the causes of the Bhopal gas leak. The group also sent a letter expressing sympathy and solidarity to the people of Bhopal. Even though Carbide has now restarted MIC production at Institute, the group will continue to monitor the situation, to press for an improved evacuation plan, and better information for local citizens and health and emergency workers on hazardous chemicals.
APPENDIX

CARBIDE'S WORLDWIDE OPERATIONS

ARGENTINA
Company name and percentage owned by UC:
Union Carbide Argentina SAIIC (100)
Cities/Products:
Buenos Aires — batteries
Cordoba — batteries

AUSTRALIA
Company names and percentages owned by UC:
Union Carbide Australia & New Zealand Ltd (60.02)
Chemos Industries Pty Ltd (100)
Union Carbide Australia Ltd (100)
Union Carbide New Zealand Ltd (100)
Cities/Products:
Milton — plastic wrap and bags
Rhodes — chemicals, polyethylene film
Rosebery — batteries

BELGIUM
Company names and percentages owned by UC:
Matheson NV (100)
Union Carbide Benelux NV (100)
Calix Gas NV (50)
Indugas NV (50)
Cities/Products:
Zwindrecht — industrial gases
Namur — industrial gases

BRAZIL
Company names and percentages owned by UC:
Tungsina Desenvolvimento de Industrias Minerais Ltda (100)
Tungstenio do Brasil Minerais e Metais Ltda (100)
Union Carbide do Brasil Ltda (100)
S.A. White Martins (50.14)
S.A. White Martins Nordeste (100)
Electro Manganes Ltda (55)
Cities/Products:
Aratu — hydroxethyl cellulose
Canedias — graphite electrodes
Cubatao — polyethylene and agricultural products
industrial gases, welding
Currais Novos — tungsten
Itapecerica — manganese dioxide
Sao Paulo — batteries

CANADA
Company names and percentages owned by UC:
Electric Furnace Products Co (100)
Union Carbide Canada Ltd (74.73)
Cities/Products:
Beauharnois — ferroalloys
Calgary — agricultural products
Chicoutimi — ferroalloys
Cowansville — plastic wrap and bags
Lindsay — meat casings
Montreal East — polyethylene, chemicals (closed)
Moore Township — polyethylene
Orangeville — plastic wrap and bags
Walkerton — batteries
Welland — graphite electrodes

COLOMBIA
Company name and percentage owned by UC:
Union Carbide Colombia SA (100)
Cities/Products:
Barranquilla — agricultural products
Cali — batteries

COSTA RICA
Company name and percentage owned by UC:
Union Carbide Centro Americana (100)
Cities/Products:
San Jose — batteries

ECUADOR
Company name and percentage owned by UC:
Union Carbide Ecuador CA (100)
Cities/Products:
Guayaquil — batteries, latex

EGYPT
Company name and percentage owned by UC:
Union Carbide Egypt SAE (75)
Cities/Products:
Alexandria — batteries

FRANCE
Company name and percentage owned by UC:
La Littonale SA (99.96)
Union Carbide France SA (100)
Viscota SA (100)
Cities/Products:
Aigueblanche — graphite electrodes
Bonneville — meat packaging
Beziens — agricultural products
Calais — graphite electrodes
Gaillon — agricultural products
Ste. Etienne — coatings service
St. Lieu d’Esserent — industrial gases
Thaon — meat packaging

GERMANY (West)
Company names and percentages owned by UC:
Union Carbide Deutschland GmbH (100)
Union Carbide industriegase GmbH (100)
Cities/Products:
Aalsdorf — plastic wrap and bags
Bleicherheim — industrial gases
Hosum — cryogenic tanks
Ratingen — coatings service
Wissen — welding products

GHANA
Company name and percentage owned by UC:
Union Carbide Ghana Ltd (66.67)
Cities/Products:
Tema — batteries, plastic bags

GREECE
Company name and percentage owned by UC:
Union Carbide Hellas Industrial and Commercial A (100)
Cities/Products:
Thebes — batteries
HONG KONG
Company names and percentages owned by UC:
- Sonca Industries Ltd [100]
- Union Carbide Services Eastern Ltd [100]
- Union Carbide Asia Ltd [100]
City/products:
- Kowloon — lighting products, latex

INDIA
Company name and percentage owned by UC:
- Union Carbide India Ltd [50.9]
Cities/products:
- Bhopal — agricultural products, research
- Bombay — manganese dioxide
- Calcutta — batteries, arc carbon products
- Hyderabad — batteries
- Lucknow — lighting products
- Madras — batteries

INDONESIA
Company names and percentages owned by UC:
- P. T. Union Carbide Indonesia [100]
- P. T. Agrocarb Indonesia [67.6]
Cities/products:
- Jakarta — batteries, latex
- Surabaya — agricultural products

ITALY
Company names and percentages owned by UC:
- Union Carbide Italia SpA [100]
- Elettrografite Meridionale SpA [100]
- Uniliq SpA [100]
- Unisil SpA [100]
Cities/products:
- Caserta — graphite electrodes
- Forno Allione — graphite electrodes
- Reggio di Calabria — molecular sieves
- Termoli — organofunctional silanes

IVORY COAST
Company name and percentage owned by UC:
- Union Carbide Cote d'Ivoire [100]
City/product:
- Abidjan (Vridi) — batteries

JAPAN
Company names and percentages owned by UC:
- Nippon Unicar Co. Ltd [50]
- Sony-Eveready Inc [50]
- Union Showa RK [50]
Cities/products:
- Okegawa — coatings service
- Kawasaki — chemicals, polyethylene
- Konyama — batteries
- Yokkaichi — molecular sieves

KENYA
Company name and percentage owned by UC:
- Union Carbide Kenya Ltd [65]
City/product:
- Nakuru — batteries

KOREA
Company name and percentage owned by UC:
- Union Gas Co Ltd [86.4]
Cities/products:
- Hwasing-Kun — industrial gases
- Changwon City — industrial gases

MALAYSIA
Company names and percentages owned by UC:
- Union Carbide Malaysia Sdn Bhd [80]
- Union Polymers Sdn Bhd [60]
Cities/products:
- Johor Bahru — batteries
- Seremban — latex

MEXICO
Company name and percentage owned by UC:
- Union Carbide Mexicana SA de CV
Cities/products: various cities —
- metals, chemicals, gases, batteries, plastics

NETHERLANDS
Company name and percentage owned by UC:
- Katalistiks [100]
Cities/products:
- Delfzijl — fluid cracking catalysts
[This company also has a plant in Savannah, GA U.S.A.]

NEW ZEALAND
Company name and percentage owned by UC:
- Union Carbide New Zealand Ltd [100]
City/products:
- Auckland — batteries, plastic wrap and bags

NIGERIA
Company name and percentage owned by UC:
- Union Carbide Nigeria Ltd [60]
City/product:
- Kano — batteries

PHILIPPINES
Company name and percentage owned by UC:
- Union Carbide Philippines Inc [100]
Cities/products:
- Mandaue — batteries
- Mandaluyong — batteries, agricultural products

PUERTO RICO
Company name and percentage owned by UC:
- Union Carbide Caribe Inc [100]
- Union Carbide Grafito Inc [100]
Cities/products:
- Barceloneta — meat casings
- Bayamón — latexes
- Guayanilla — polyethylene, phenols, ethylene glycol
- Gurabo — industrial gases
- Ponce — oxo alcohols, olefins, ethylene oxide and
- glycols, glycol ethers,
- Yabucoa — graphite electrodes

SINGAPORE
Company name and percentage owned by UC:
- Metals and Ores Pte Ltd [100]
Cities/products:
- Jurong — batteries, latex
- Bukit Timah — batteries

SOUTH AFRICA
Company names and percentages owned by UC:
- Ucar Chrome Co [SA] [Prop] Ltd [100]
- Elektrode Maatskappy Van Suid Afrika (Eiendoms) Beperk [50]
- Tubatsi Ferrochrome (prop.) Ltd [49]
Cities/products:
Brits and other cities — vanadium, chrome, agricultural products, graphite electrodes, ferrocrocite

SPAIN
Company names and percentages owned by UC:
Union Carbide Navalcar SA [100]
Union Carbide Iberica SA [100]
Argon SA [50]
Cities/products:
Navarra — graphite electrodes
Verona — industrial gases
others — welding products

SRI LANKA
Company name and percentage owned by UC:
Union Carbide Ceylon Ltd [60]
Cities/product:
Elaia — batteries

SUDAN
Company name and percentage owned by UC:
Union Carbide Sudan Ltd [84]
Cities/product:
Khartoum — batteries

SWEDEN
Company name and percentage owned by UC:
Union Carbide Norden AB [100]
Unionsverk AB [50]
Cities/products:
Trollhatten — graphite electrodes
Svenska Audi — polyethylene

SWITZERLAND
Company name and percentage owned by UC:
Union Carbide Europe SA [100]
Cities/products:
Geneva — coatings service
La Chaux-de-Fonds — batteries

THAILAND
Company name and percentage owned by UC:
Union Carbide Thailand Ltd [100]
Cities/products:
Nondhuri — latex, agricultural products

UNITED KINGDOM
Company names and percentages owned by UC:
Union Carbide U.K. Ltd [100]
Viskase Ltd [100]
Cities/products:
Glossop — coatings service, ferroalloy briquettes
York — agricultural products
Sheffield — graphite electrodes
Southam — coatings service
Swansea — meat packaging
Swindon — coatings service

UNITED STATES OF AMERICA
Company names and percentages owned by UC:
Union Carbide International Capital Corporation [100]
Union Carbide Pan America Inc. [100]
Union Carbide Southern Africa (USA) Inc. [100]
Ucar Capital Corporation [100]

Cities:
Alabama:
Chickasaw — molecular sieves
Theodore — cryogenic equipment

Arkansas:
Hot Springs — vanadium
Osceola — meat casings
Rogers — plastic wrap and bags

California:
Bishop — tungsten
King City — asbestos
Ontario — gaseous and liquid hydrogen
San Diego — specialty gases
Sunnyvale — chemicals
Tipton — latexes

Colorado:
Rifle — vanadium

Connecticut:
North Haven — coatings service

Georgia:
Cartersville — plastic wrap and bags
Columbus — chemicals
Tucker — latexes
Woodbine — herbicides, insecticides

Illinois:
Alsip — latexes, antifreeze/summer coolant
Bensenville — chemicals
Chicago — meat casings
Robinson — calcined petroleum coke

Indiana:
Indianapolis — welding and casting machines, coatings service, cryogenic equipment
Kentland — meat casings

Iowa:
Centerville — meat packaging materials
Clinton — herbicides
Red Oak — batteries

Kansas:
Burchton — gaseous and liquid helium

Louisiana:
Taft — various chemicals, ethylene oxide and glycol, polyethylene, acetone

Missouri:
Kansas City — coatings service
Maryville — batteries
St. Joseph — herbicides
St. Louis — insecticides

Nevada:
Tempiute — tungsten

New Jersey:
Bound Brook — polyethylene, resins
Freehold — antifreeze/summer coolant
Keasbey — specialty gases
Piscataway — welding, special equipment
Somerset — latexes

New York:
Niagara Falls — gaseous and liquid hydrogen,
welding flux, tungsten, vanadium, carbon and graphite products
Tonawanda — air separation equipment

39
North Carolina:
  Asheboro — batteries
  Greenville — batteries
  Shelby — capacitors

Ohio:
  Ashtabula — welding wire
  Cleveland — carbon and graphite products, batteries
  Fostoria — carbon and graphite products
  Fremont — batteries
  Marietta — electrolytic manganese dioxide, polysulfone resins

Oklahoma:
  Paula Valley — meat packaging materials

Pennsylvania:
  Ambler — plant growth regulators
  Southampton — plastic straws and sacks

South Carolina:
  Florence — welding equipment
  Greenville — carbon and graphite products, capacitors
  Greenwood — capacitors

Tennessee:
  Clarksville — graphite electrodes
  Columbia — graphite electrodes, carbon products
  Lawrenceburg — carbon and graphite products
  Loudon — meat casings

Texas:
  Garland — latexes
  Houston — specialized industrial services
  Seadrift — various chemicals, ethylene oxide and glycol, polyethylene
  Texas City — various chemicals, vinyl acetate,

Vermont:
  Bennington — batteries
  St. Albans — lighting products

Washington:
  W ashington — crystals and polycrystalline silicon

West Virginia:
  Clarksburg — graphite electrodes
  Institute — Tergitol surfactants, Carbowax, polyethylene glycol, herbicides, insecticides, intermediates, ketones, alkylbenzene, Polyox resins, Cellosolve hydroxyl cellulose, Ucare polymers, miscellaneous specialty products, catalysts.
  Sistersville — silicone fluids, emulsions, surfactants
  South Charleston — Ucon fluids, brake fluids, miscellaneous specialty products, Niax polyols, ketones, solution vinyl resins

Wyoming:
  Riverton — uranium

VENEZUELA

Company name and percentage owned by UC:
  Union Carbide de Venezuela CA (100)

City/product:
  Maracay — batteries

O: 04-16/L
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(24410)
RAJESH TANDON works with the Society for Participatory Research In Asia (PRIA), New Delhi, India. PRIA works with local, grass-roots organizations and unions in rural and urban areas as a support group in areas of research, training and preparation of learning materials. PRIA has been working on issues of occupational health and safety, deforestation and land alienation, and women's income-generating activities. It is a non-governmental, non-profit organization, registered under the India Society's Act.

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