Factfinding Report

(7-8 July, 2004)

Industrial Fire at Hindustan Insecticides Ltd

Udyogmandal, Kerala on 6 July 2004

Team Members

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"At 2.30 a.m. on 6 July, 2004, Thanal received a desperate call from V.V. Purushan, an Eloor resident and member of the Periyar Malineekarana Virudha Samiti (PMVS), a community environmental group. He said HIL's endosulfan plant is on fire, and people are running away and that many are stranded at Eloor Ferry, unable to cross the river. "What do we do?" he asked.

We called up officials from regulatory authorities who had no clear idea on how to react to the crisis either. Legally mandated disaster prevention and anticipatory emergency response mechanisms were clearly not in place. The fire was treated as a regular fire, rather than a major incident involving toxic chemicals and a potentially explosive situation.

Eloor residents are already besieged by pollution problems, and live in constant fear of a catastrophic incident. Despite repeated demands by residents for disclosure of factory-specific emergency plans, no such information has been made available. Such requests have been ignored by regulatory authorities or projected as anti-worker and anti-development by factory management.

Thiruvananthapuram-based Thanal and New Delhi-based The Other Media constituted a fact-finding team to enquire into the incidents leading up to and following the industrial fire at Hindustan Insecticides' Ltd. The factfinding report enclosed here contains lessons for preventing and responding to chemical industrial disasters in the future.

Sincerely,
The Fact Finding Team

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Introduction

On 6 July, 2004, a little after 2 a.m., residents living downwind of the Hindustan Insecticides Ltd (HIL) pesticide factory in Eloor, Kerala, were alerted to a fire in the factory's endosulphan plant. Based on varying accounts, the fire raged for between three and four hours and gutted most of the five-storey endosulphan plant. Twelve fire tenders, including units from Fertilisers And Chemicals Travancore (FACT), the Indian Navy, the State Fire Department and Kochin Refineries, were deployed and the fire was brought under control using large amounts of water.

A westerly breeze carried the thick grey smoke plume over at least 250 dwelling units in Pallipuramchal and all the way across the river to the Varapuzha panchayat. Smoky conditions prevailed in Varapuzha as late as 7 a.m., well after the fire was put out.

Neither HIL nor the district authorities initiated any off-site emergency response procedures. HIL also had no onsite emergency response, and fire control did not begin until the FACT fire tender arrived at 2.35 a.m. As will be outlined in the report below, Hindustan Insecticides Ltd is guilty of negligence on several counts. The Eloor Police has, however, registered a simple case of "fire occurrence." No action has been initiated against the company for negligence.

The Eloor industrial area hosts about 250 industries, of which more than a dozen, including Hindustan Insecticides Limited, are large chemical factories.

The authorities – particularly, the Kerala State Pollution Control Board and the Factories and Boilers Inspectorate — have sought to treat community demands for information about the hazardous chemicals and processes as unnecessary interference rather than legitimate concerns. Repeated requests for information on emergency preparedness, and for the building of a bridge across the River Periyar at the Eloor ferry point to escape the island during emergencies have fallen on deaf ears.

The absence of emergency response procedures, the casual attitude of the district authorities and the industry, and the lack of appreciation of the magnitude of the incident and what it embodies is a shocking reminder that no lessons have been learnt from the 1984 Union Carbide disaster in Bhopal.

Twenty years after the world's worst industrial disaster, communities and workers continue to operate in complete ignorance when it comes to the hazardous substances stored and processes deployed in their neighborhoods. Throughout India, if more communities are not being wiped out by chemical disasters, that is not because of the legally mandated precautions or policing by regulatory authorities, but by sheer chance, favourable wind conditions and the communities' good fortune.

The Factory

Hindustan Insecticides Ltd is a public sector undertaking fully owned by the Government of India and it operates four plants at Eloor, Udyogmandal, Kerala. The plants produce:

Pesticide	Capacity
DDT Technical	1344 tpa
DDT (Formulation)	2688 tpa
Endosulfan Technical	1600 tpa
Endosulfan 35 EC	1910 kilolitres/year
Dicofol (Technical)	150 tpa
Dicofol EC	600 kilolitres/year
Mancozeb (Technical)	1000 tpa
Mancozeb (Forumulation)	1800 tpa

HIL is the sole producer of DDT in the country, and has cited DDT's criticality to the National Malaria Program to secure temporary postponement of DDT phaseout from the United Nations under the Stockholm Convention. HIL manufactures DDT at its plants in Udyogmandal and Raigad district, Maharashtra. The DDT plant at Udyogmandal was inaugurated in 1957.

General State of the Factory

The factory is generally poorly maintained. The condition of the effluent treatment plants and the incinerator are appalling. The incinerator is little more than a furnace. Oily liquids are stored in open sumps at two separate locations near the incinerator. At least one was identified as furnace oil for the incinerator.

Chlorinated wastes, among other things, are burnt in the incinerator. Ashes are reportedly stored in drums onsite. The exhaust is carried through a pipe from the incinerator house to the endosulfan plant about 20 metres away, and then runs along the wall of the five storey building to the chimney stack.

According to proponents of incineration, dioxin formation can be minimised , among other means, by quenching the exhaust gas rapidly to below 250 degree Celsius to reduce the time the exhaust gases spend in the opitimum temperature window for dioxin formation. Viewed even from the unsatisfactory approach to dealing with the deadliest chemical known to science, the HIL incinerator's exhaust pipe and smokestack are virtual dioxin factories. The poor upkeep of the area surrounding the incinerator does little to inspire confidence in the technology or its proponents' faith in theoretical conditions.

The factfinding team observed sludge dumped in a three-walled structure without a roof near a wastewater lagoon. Empty chemical drums and sacks lie strewn around near the incinerator site. Open, rotting drums of tarry wastes were found carelessly dumped on the roadside in at least one location.

The Fire

In its press release dated 6 July, 2004, Hindustan Insecticides Ltd states that "At about 2.45 a.m. on 6.7.04, a fire was noticed by the workers on the 2nd floor of the plant building."[1] However, reports by local residents, the police and people involved in firefighting contradict HIL's assertion. They peg the time of start of fire at around 2 a.m.

Eloor police station sub-inspector Abdul Rahim says he received information about the fire at 2.44 a.m, by which time the fire had already reached the 5th floor.[2] Mr. O.T. Verghese, plant safety manager at FACT, says he received word of the fire around 2.30 a.m.[3]

Based on extensive interviews with residents living around the HIL factory, the Fact Finding Team was able to ascertain the following facts about the drift of the smoke plume, and the reaction of residents.

The smoke plume was not very wide and blew across in a west–southwesterly direction across the river Periyar. The smoke was felt by people resident in a triangular area flanked by the two Eloor ferry roads, which joined at the ferry terminal due west of HIL. This area is a wetland with houses located in clusters on the dry stretches,

Photo - N.Jayaraman

-Disasters aside, HIL's poor housekeeping poses an ongoing source of pollution to the general environment.

"Empty chemical drums and sacks are strewn around near the furnace oil tank fueling the incinerator."

or along the two main roads and along the *Kuzhikandam thodu*. The *Thodu* is a natural stream that now carries the combined toxic effluents from FACT, HIL and Merchem factories to the River Periyar.

In 1990, a large-scale toluene spill into the *Thodu* caused a fire in the stream that left several people living adjacent to the stream with serious health effects. The toluene spill was reportedly from Hindustan Insecticides Ltd.

Residents recall that on July 6, 2004, the smoke left the factory at a height, blew westwards and downwards for between 500-750 metres before settling down in the residential area of Pallipuramchal. Residents of this area were either awakened by the siren or by their neighbours. Some of them–approximately, one in three houses visited by the Team — in four streets in the Pallipuramchal area and alongside the *Kuzhikandam thodu* were not aware of the incident, and had slept through the fire with all doors and windows closed.

Some men went to the HIL plant to verify the details of the fire accident and were uncertain as to whether people should evacuate immediately.

Many families with children decided to flee the area and crossed the river to the Varapuzha Panchayat by ferry. Residents at the farthest point (ferry point) had not heard the siren or felt the smoke. Between 100-200 people may have crossed over in three ferry trips, before the ferry stopped making the river crossing. The first ferry trip was made between 2.45 a.m. and 3 a.m. By the time they had crossed over, the smoke plume too had crossed the river, and people could smell and feel the smoke on the other side.

Families who fled to the ferry invariably had relatives across the river. The elderly and families with no relatives across the river did not leave their houses.

The ferry point was in the direction (west-south-west) in which the smoke from the blazing factory was blowing. Most didn't feel safe to go against the smoke (which would have meant running towards the Factory).

A few families cut across the breadth of the plume to reach the safety of their relatives' houses. Most families started returning home by sunrise when the fire was put out.

Residents in the houses (50-100m) nearest to the factory could see the smoke blowing above their houses and didn't leave. Some said they did not feel any major effects of the smoke. However, the same households also reported soot deposits on vegetation and inside the houses.

Endosulfan Production

The fact-finding team was permitted to tour the facility and take pictures on 8 July, 2004, despite the lack of prior appointment. HIL's deputy production manager Vincent D. Paul, escorted the team around the facility and the scene of fire, and was knowledgeable, open and helpful in explaining the production process and filling in the details of the incident.

For every ton of Endosulfan technical that is manufactured, raw material in the following approximate quantities is used:

Raw Material	Quantity Required (Theoretically)in tons/ton of Endosulfan tech	Quantity Charged in tons(1.5 x required quantity)
Hexa Chloro Cyclo Pentadiene (HCCP)	0.78	1.17
Butene diol	0.25	0.375
Thionyl Chloride	0.34	0.5
Toluene	0.1	0.15

Source: Vincent D. Paul, Dy Production Manager, Endosulfan plant, HIL, Udyogmandal.

Toluene, a petroleum derivative, is used as the medium for the reactions. Going by the consumption figures, it appears that for every ton of endosulfan produced, approximately 1 ton of waste is generated.

All reactions are carried out in two reactors each for Het diol, endosulfan and for recovery of mother liquor. Roughly 1.7 tonnes of endosulfan technical is produced per batch.

Endosulfan is manufactured through a two-stage reaction.

Stage 1: HCCP + Butene Diol = Het Diol (Intermediate)

Stage 2: Het Diol + Thionyl Chloride = Endosulfan

As and when endosulfan is manufactured, it is piped out to a unit outside the production building for further processing. Similarly, only the raw material required for the current batch production is brought into the production unit from the storage units housed in separate buildings.

How the Fire Started

While we were unable to ascertain the source of combustion, HIL Deputy Production Manager Paul's account provides some insight into what fueled the fire and the course of events leading up to and in the immediate aftermath of the fire.

"At the time, the second step reaction was ongoing. The reaction for het diol [Stage 1] was completed in one reactor, and crystallisation was going on. In the other reactor, there was butene diol. Both the endosulfan reactors were engaged. At 2 a.m., a worker on the second floor noticed a leakage from the [toluene] vapour lines. He reported the matter, and the supervisor came there to assess the leakage. Such leakages come up from time to time. Suddenly, the fire started and began spreading. About 20 people were working at that time, and they all ran away."[4]

Eloor Sub-inspector Rahim likened the Toluene release to the pressure release system in a pressure cooker, indicating that the spill within the plant may have been substantial and at high pressure. The FACT plant safety manager, who was the first to send a fire tender to HIL, also corroborates Rahim's account. "Toluene was falling on the floor in a spray," said FACT's Verghese.

It is not known whether safety systems to shut down the flow of toluene in the event of a leak existed. If they did, it is not known whether and when they acted.

Residents living along the fenceline of the factory said the fire started with a series of loud splattering noises. One woman described it as the sound of "water falling on stone;" another person likened it to firecrackers; yet another said it sounded like someone was hammering metal.

The final explosion was accompanied by fire and thick dark smoke that smelled like burnt tyres. Residents living as far away as 300 and 500 metres from HIL reported seeing the flames. As the smoke quickly changed to a narrow plume of thick grayish cloud, the "burnt-tyre" smell was replaced by a cocktail of pungent odours of chemicals, identified by many people as the smell of sulphur. According to one resident, the sulphur smell persisted on her skin for hours after she had fled the smoke plume. Many residents said the smell was a more intense version of the familiar odours characteristic of the industrial estate.

Putting Out the Fire

It appears that FACT was the only agency contacted by HIL for first response. According to Verghese, the FACT fire tender left for HIL by 2.30 a.m. and reached HIL by 2.35 a.m. The tender can carry up to 4000 litres of water, and also has two separate compartments carrying foam and carbon dioxide for special emergencies.

In recounting the day's events, Verghese identified a major safety lapse on the part of HIL: *"We lost time because HIL's hydrant system had failed. There was no current [electricity] coming, and they had no standby for the hydrant. So we had to make three trips back to FACT to refill the tank until HIL was able to get the hydrant pump to work. . .At FACT, the fire hydrant works on a diesel set and is not dependent on electricity."*

By 3 a.m., the sub-inspector of police Abdul Rahim had reached the site. Simultaneously, male residents from Eloor had also gathered at the factory gate to get more details about the disaster and the expected response. Many of them had sent their children and women in the family away on foot to relatives' houses or other safe zones.

Eloor resident and member of the community environmental group Periyar Malineekara Virudha Samiti V.V. Purushan was among the crowd at the gates of HIL. He says:

"No information was provided by the company. People who ran did so without knowing if they were running into danger or away from it. The siren was weird – rather than the continuous siren like an ambulance, the siren from HIL would start, stop, then start again after a few minutes. People were confused.

"Many people woke up because of the siren, then smelled the smoke and ran. Others, nearly 250 people, were gathered outside the factory gate. We didn't know what had happened.

"We wanted to talk to the management. Somebody came and said 'We're busy trying to put off the fire. We don't have time to talk to you now.' Later, the police came from inside and told us there was nothing to worry about, that five fire engines were working inside and more are on their way. By 4 a.m., a fire official came and told us that the fire was under control, but smoke will continue.

"What was alarming is that the HIL security – not CISF, but private – did not have the telephone numbers of any of the fire tenders. The other fire tenders [other than FACT] were called only after the police arrived."

According to HIL, the fire was "totally extinguished by about 5.30 a.m."[5]

The absence of an onsite and offsite emergency plan at HIL is evident from the fact that fireworkers battled the fire without any knowledge about the burning chemicals or the precautions that need to be taken. According to a rough estimate by Verghese, at least 40 fireworkers were engaged in combating the fire. None worked with breathing or other safety equipment.

The statement by Verghese of FACT is revealing: *"When we went in, our priority was to battle the fire. We just treated it as a regular fire and battled it. Fireworkers were stationed all around the unit, and they were drenched in water and soot. Only next day, we knew that there were toxic chemicals. Most of us just wore our kerchiefs to cover our noses. HCCP's toxicity increases when it comes in contact with water. But nothing happened to us. I was there for three hours. Nothing happened to me. However, next day when I went there, I couldn't stay there. There was too much toxicity. . . There was a huge flame. Some chemicals may have been released."*

Fact Finding Team members were invited to inspect the inside of the 5-storey Endosulfan building on 8 July, 2004. However, the team declined the offer because only helmets and no gas masks were provided. At the time of the team's visit, the floor of the Endosulfan unit seemed damp, with fumes rising from the ground. The pungent smell was intense even from outside the plant.

Two out of three team members reported immediate symptoms – throat irritation and headache – that persisted for at least 3 days. One of the members reported spells of dizziness that continued for more than a week. HIL's casual attitude to the deadly chemicals it handles is a serious cause for concern because it may have exposed others who came to inspect the site.

Some HIL staff say that the toxicity of chemicals is highly exaggerated, and that their experience doesn't bear out popular fears. According to Paul, "Workers handle sacks of technical grade endosulfan with bare hands. They're fine. I myself have been working here since 1984. Nothing has happened to me, my wife or children."

The Company's Response

In a frightening reminder of Union Carbide's response in the immediate aftermath of the Bhopal disaster, HIL company spokespersons misinformed the community to allay fears rather than share accurate information and appropriate response to avoid or minimize poisoning of residents.

According to Purushan, initial reports at the factory gate by company staff underplayed the seriousness of the fire and the toxic nature of the smoke cloud:

"They first said that it was only some rubber sheets that burnt down. Then they said it is only toluene that was burnt in the fire, and that toluene when burnt will release only carbon dioxide and steam."

On 8 July, 2004, the Fact-finding Team interviewed HIL senior management including Sivadasa Shenoy, GM, and Dy GMs Venugopal Pillai and K.K. Joseph. Questioned two days after the disaster, the company spokespersons continued to downplay the magnitude of the fire and its impacts on community and the environment. However, neither the company nor the regulatory authorities had conducted any scientific assessment to support their casual response.

Specifically, HIL stated that:

a) there was no endosulfan in the plant at the time of the fire;
b) the raw material HCCP is non-flammable.

However, no mention was made of the toxic thermal degradation products such as phosgene that is released when HCCP is heated, or reactive products such as sulphur dioxide and hydrogen chloride that are released violently when thionyl chloride comes in contact with water. Neither does the concern about long-term contamination by dioxins and furans feature in the list of concerns of the company or the regulators.

When asked about the symptoms of poisoning reported among the people living downwind (west) of the HIL facility, HIL's deputy general manager was very remarkably vague:
"We've not been told by the medical authorities about any problems. Probably, one girl was admitted in a nearby hospital. The district administration took initiative and brought two teams of doctors and examined many people. If there is anything, we'll do whatever has to be done. We're a PSU. Government is party. Our response will be more favorable than private sector. "

However, as is clarified in the sections on health, interviews among the exposed community in Eloor has thrown up substantial evidence of the prevalence of immediate and persistent symptoms among individuals.

Emergency Plans

Section 41B of the Factories Act requires the occupier of a factory to prepare an onsite emergency plan, and to disclose to workers and general public living in the vicinity the safety measures to be taken in case of an accident.

Rule 15 of the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989, mandates the provision of a detailed off-site emergency response plan by the occupier of a hazardous facility to members of the public.

When questioned about disaster management plans and on-site and off-site management plans, HIL GM Shenoy was confused and his response was incomprehensible. "The disaster management plan, the coordinator is the district collector. We don't have anything to do with that. That is for the whole district. It should be there on the website. . . Offsite plans is a new development."

The Factfinding Team was unable to establish whether on-site and off-site emergency response plans exist, or if the management is even aware of this requirement.

In-House Safety Team

HIL has no fire tender. The closest firefighting force is in FACT across the road. However, FACT's Verghese observes that it is imperative for companies to have their own trained safety and firefighting units for immediate response until assistance arrives.

"I don't know about the firefighting unit at HIL," he said. "They probably have something, but how good I don't know."

It appears that no trained HIL staff were involved either in initial or subsequent firefighting. However, this is an issue that needs to be verified:
1. How many trained safety personnel were present in the plant at the time of the fire?
2. How did the company's emergency team (if such a team existed) respond to fire until the fire tenders arrived?

Environmental Contamination

The potential for short- and long-term environmental contamination from the incident is very real. Besides the air-borne deposit of persistent pollutants at least along the path of the plume, the mode of firefighting and the lack of containment procedures after the fire was put out also means that water bodies and wetlands in the area, including the River Periyar, may have received substantial loads of toxic runoff from the factory site. Given the persistence of these chemicals and their ability to travel through the food

Sacks of material labelled endosulfan were found lying in a pool of water adjacent to the burnt-down endosulfan unit two days after the fire.

chain, it can be safely assumed that the contamination will spread from the originally deposited areas and will, over time, travel far from the source.

Water-borne Contaminants

Initial remediation efforts should involve preventing migration of contaminated rainfall runoff and contaminated leachate from the debris. The former can be done by digging rainfall runoff interception ditches around the site, and the latter by removing and/or covering the fire debris.

The Fact Finding Team documented abysmal conditions inside the factory, both in respect of the site of fire and the general state of the HIL factory. On 8 July, the team found many sacks of material labeled "Endosulfan Tech" lying in a pool of water alongside the burnt down endosulfan unit. ***(See photos)***

Many residents raise milch cattle, chicken and ducks on the island. Many residents live alongside the *Kuzhikandam Thodu* that can be expected to drain the contaminated run-off from the factory.

In 1999,Greenpeace surveyed and sampled the *Thodu*. It found 111 chemicals. Thirty-nine of these were hazardous organochlorine compounds, including DDT and its metabolites, endosulphan and its metabolites, and their respective degradation products.

Air-borne contaminants

Residents in the immediate vicinity said their houses and nearby trees were dusted with soot from the factory. It may be recalled that after the World Trade Centre burnt down, many houses in Manhattan, New York, had to be wiped clean to eliminate health hazards to residents from the soot-, ash- and dust-borne contaminants.

Dr. Mark Chernaik, staff scientist at ELAW-US, places issues of immediate, short- and long-term contamination in perspective:

"Probably a lot more burned during the fire, such as chemical solvents and building materials, than just endosulfan and HCCP. So, the fire would also pose a short-term risk through exposure to excess ambient air levels of particulate matter (especially if the fire is still smoldering) and a long-term risk through exposure to high levels of persistent organic pollutants (such as dioxins) in the soil. These should be monitored as well."

The Kerala State Pollution Control Board is reported to have taken air samples on 6 or 7 July, 2004. However, no details are known as to where the samples were taken from, and what they were analysed for. According to Dr. Chernaik, given the presence of the highly toxic air pollutant phosgene, near-term ambient air quality should be monitored for phosgene using detection tubes.

Health Effects in the Community

A sub-group of the Fact Finding Team led by public health researcher and physician Dr. R. Sukanya visited the affected area within Eloor on 7-8 July, 2004, to:

a) Map the area under the toxic plume, and roughly estimate the number of dwelling units within that area;
b) Document the symptoms manifested after exposure to the toxic fumes;
c) Document the adequacy of medical relief provided to the community.

The Poisons

HIL manufactures several chlorinated pesticides including DDT. The fire consumed or affected material in the endosulfan unit including HCCP, butene diol, thionyl chloride, toluene and endosulfan. From this, it can be inferred that at least the above mentioned chemical pollutants of concern were released.

Name of Pollutant	Persistent in Environment	Symptoms	Target Organs
Phosgene	No	Eye irritation; dry burning throat; vomit; cough; foamy sputum; dyspnea; chest pain; cyanosis	Eyes; skin; respiratory system
Sulphur Dioxide	No	Eye, nose, throat irritation; rhinitis; choking; cough; reflex bronchoconstriction	Eyes; skin;Respiratory system
Hydrogen Chloride	No	Nose, throat, larynx irritation; cough; choking; dermatitis	Eyes; skin; respiratory system
HCCP	No	Eye, skin, mucous membrane irritation; in animals, kidney damage and liver cancer	Eyes; skin; kidneys; respiratory system
Endosulfan	Yes	Skin irritation; nausea; confusion; agitation; flushing; dry mouth; tremor; convulsions	Skin; Central Nervous system; liver; kidneys; reproductive system
Thionyl Chloride	No	Eye, skin, mucous membrane irritation; eye, skin burns	Eyes; skin; respiratory system

Source: Pocket Guide to Chemical Hazards. US Department of Health and Human Services. February 2004

Besides the chemicals in the table above, the most significant long-term threats probably come from the emission of polyaromatic hydrocarbons (PAHs), dioxins and furans. The latter are two categories of compounds comprising some of the most toxic chemicals known to science. Dioxins and furans are inevitable byproducts of combustion involving chlorinated material. These chemicals are

persistent, bioaccumulative and are capable of exerting transgenerational effects. They are known human carcinogens, and their effects target virtually every system in the human body.

PAHs are usually grouped as short-chain PAHs and long-chain PAHs. The former, including chemicals such as naphthalene, are acutely toxic especially in the aquatic medium. Long-chain PAHs include many chemicals that are known carcinogens. PAHs are common emissions associated with fires.

The Symptoms

The Fact Finding Team interviewed residents (ages ranging from 18 to 60) in 15 houses in the area reportedly covered by the smoke plume. Households that did not flee the scene kept their children indoors, with sheets covering them, and buckets of water nearby. Some people covered their faces with wet towels.

Men and women who came out to check the fire and/or remained outdoors reported a "feeling of suffocation" down the throat that was persistent even two days after the incident. This was associated with difficulty in breathing and cough. All these symptoms were exacerbated among the elderly and those with chronic respiratory problems. All interviewed residents reported a burning sensation as if someone were "rubbing chilli powder in the throat and eyes." Many complained of a chest discomfort as "something irritating," "chest pain," "burning sensation in the chest' and 'weight over the chest'.

Nausea and vomiting were commonly reported symptoms. Young adults and the elderly complained of a feeling of fullness of the stomach associated with nausea and vomiting. Persistent headache was also frequently reported.

All residents reported having experienced similar problems, and that the nearby chemical industries emit different types of smoke every night. On July 6, the smoke was thick, the visibility was poor, and the breathing problems, feeling of suffocation and burning of eyes were more severe and persistent. Unlike the symptoms associated with routine pollution, residents said that the intense feeling of burning sensation down the throat was new. This symptom was persistent among many residents even two days after the fire.

At least one 16-year old girl was admitted to the hospital reportedly after she suffered convulsions. However, the Fact Finding Team could not meet her or her family to ascertain the facts and course of events after the fire leading to the patient's hospitalisation. Neither could the Team meet any of the HIL workers or the firefighters who were exposed to the toxic gases to assess if there were any health problems among them.

The acute respiratory and gastrointestinal symptoms reported by people may have been caused by particulate matter or any of the toxic gases from the fire. Headache is a prominent symptom due to the effect on the Central Nervous System.

Medical Relief

A medical team of doctors from the District Medical Office conducted a camp that began in the forenoon of July 6. They provided basic primary symptomatic care for problems reported by people. Around 200 people attended the camp. The few outpatient slips examined by the Team had no mention of any diagnosis or advice of follow-up to the patients. The medical team had been informed that there were 'patients with burns' and had come prepared with huge quantities of dressing material.

The Fact Finding Team visited the Primary Health Centre and met the doctor, who said she was not in Eloor on the day of the incident; she was working in the District Office on July 6. The doctor had not received any feedback from the Medical team and also said that she had not noticed any unusual health problems in the subsequent days. Many people were taking symptomatic medical treatment from the private practitioners for the persistent symptoms of throat burning, difficulty in breathing and nausea.

No attempt was made to address the problem as a case of chemical poisoning, or to assess the need for long-term health monitoring and care. Neither was the area under the toxic plume identified to get a sense of the number of affected people. In the absence of such mapping, any future plans to assess long-term health effects related to the fire incident, would be difficult to implement. It is evident that the medical care accessible to the people is incomplete and inadequate.

The chemicals that are likely to have been released are known to cause a range of sub clinical enzyme changes to overt organ damage of the respiratory (pneumonitis, bronchiolitis), gastrointestinal (elevated liver enzymes to full blown jaundice), genitourinary (proteinuria, oliguria, severe metabolic acidosis to kidney failure) and central nervous systems (headache, convulsions, coma). Contact with the chemicals on the skin could cause dermatitis and skin burns. Absorption by contact with the eyes could also cause optic neuritis. Any damage to the organs could have been detected only by a complete clinical examination and appropriate laboratory investigations.

Some of the chemicals are known carcinogens. The types of delayed health effects due to acute exposure of many of these chemicals are not known. New evidence implicates that "endosulfan exposure may delay sexual maturity and interfere with hormone synthesis in male children"[6].

The fact-finding team has only documented the reported morbidity of the people. The extent of organ injury and the consequences on the health status of the people exposed is not known. There is a grave need for long-term health monitoring and disease surveillance to identify and address the health problems of people exposed to the toxic chemicals.

Conclusion

The HIL fire raises as many questions about the negligence of the company as it does about the complicity, complacency and, ultimately, the total failure of regulatory authorities such as the District Administration, the Pollution Control Board, the Factories Inspectorate and the Controller of Explosives. In enquiring into this incident, investigation into the failures of these departments would be critical to preventing such disasters from recurring.

The response of the District Administration and regulatory authorities in dealing with medical emergency caused by the fire was ad hoc and uninformed. This indicates that the administration is totally unprepared in terms of medical response in the event of such emergencies. It is also clear that the medical professionals who led the health camp on 6th July had little or no understanding of the special needs of victims of chemical poisoning.

Government departments have done nothing to win public trust. Moreover, they have treated community concerns with contempt and viewed the public as adversaries. It is imperative that in Eloor, any attempts to address the public interest concerns raised by the HIL incident in particular and industrial safety and environmental quality in general has to involve community representatives, environmental groups, workers representatives and labour organizations. Leaving matters in the hands of committees comprising the industry and Government have proven disastrous.

Workers, particularly in factories such as HIL, are fearful of losing their jobs either as a result of closure due to environmental reasons, or as a result of privatisation. The threat of job loss prevents them from fighting for improvement of the environment in their place of work. Worker health and safety concerns at the workplace are closely linked to the health and safety of the community. However, the insecurity faced by today's workers prevent them from fulfilling their responsibilities beyond their own workplace, and often pits them against community residents concerned about the pollution caused and hazards posed by the factories. Corporations take advantage of this divide to go about business-as-usual. To change corporate behaviour, therefore, this confrontation between communities and workers, both of whom are victims of pollution, needs to end.

Recommendations

1. Hindustan Insecticides Ltd and its senior executives should be criminally charged with negligence for having failed to take adequate steps to prevent the fire that injured a yet-to-be-determined number of people and polluted the environment.
2. Criminal action must be taken against the Occupier and Manager under Section 92 of the Factories Act for violating the provisions of the Factories Act.
3. The Central Government should conduct a formal enquiry into the "causes of the accident" and should coopt one or more persons possessing legal or special knowledge as assessors in such enquiry. The Centre can order such enquiries under Section 9-A of the Explosives Act, or section 41-A of the Factories Act.
4. The District Administration, along with relevant authorities and community groups, should establish a system for long-term health monitoring, disease surveillance and treatment of people in the impact zone of the HIL smoke plume. Firefighters, police personnel and HIL staff exposed to the fire should undergo a complete medical examination, monitored on a long-term basis and provided with specialised health care. The company should be directed to compensate at those affected, whether directly or indirectly, by the fire.
5. The Kerala Pollution Control Board should submit a report prepared at HIL's cost, on pollution containment measures, and short-term and long-term environmental monitoring plans deployed by it in response to the HIL fire. (See footnote for more details)[6]
6. The Factories Inspectorate must be asked to submit a report on steps taken by it to assess the adequacy of safety systems in HIL.
7. The District Administration should explain why it failed in preparing people for an appropriate response in the event of such emergencies, and what steps it is taking to avoid a repeat of such haphazard response in the event of future emergencies.
8. Companies that do not have or do not disclose onsite and offsite emergency plans to workers and members of public should be ordered to do so within a set time frame or shut down after presenting a plan for rehabilitating its workers.
9. Infrastructure for mass evacuation from Eloor Island to the mainland at crucial points in Eloor should be set up for use in the very LIKELY event of an industrial disaster.
10. The District Administration should prepare a comprehensive disaster response plan to react to such disasters. The plan should include components dealing with mass evacuation, disaster containment, emergency environmental response, emergency medical response, and short- and long-term medical and environmental monitoring and rehabilitation. Suitable experts should be consulted for the development of each of these components, and the plan should involve significant participation from workers, community residents and community groups.
11. Given the high levels of existing pollution in Eloor, and the incremental burden added by ongoing pollution and incidents such as the HIL fire, the KPCB should develop a comprehensive environmental remediation plan for Eloor and the River Periyar. The development and execution of the plan should be led by workers and residents and be paid for by all Eloor industries each contributing in proportion to their pollution output.

End Notes

[1] Press statement 06 July, 2004, Hindustan Insecticides Ltd, Udyogmandal, Eloor, Kerala.

[2] Interview at Eloor Police Station with Sub-inspector Abdul Rahim. 10.30 a.m. 08 July, 2004.

[3] Interview at FACT with Plant Safety Manager O.T. Verghese. 3.30 a.m. 08 July, 2004

[4] Interview at HIL Endosulfan unit with Vincent D. Paul, Deputy Production Manager, Hindustan Insecticides Ltd. 12 noon. 08 July, 2004

[5] Press statement 06 July, 2004, Hindustan Insecticides Ltd, Udyogmandal, Eloor, Kerala.

[6](Environ Health Perspect 111:1958–1962 (2003).)

[7] The following resources may be helpful for developing long-term environmental monitoring programs. "Environmental Follow-up of Industrial Accidents." A report prepared by The Institute of Terrestrial Ecology, October 1997. United Kingdom Department of the Environment, Transport and the Regions. http://www.fraw.org.uk/library/004/indaccid/followup.html

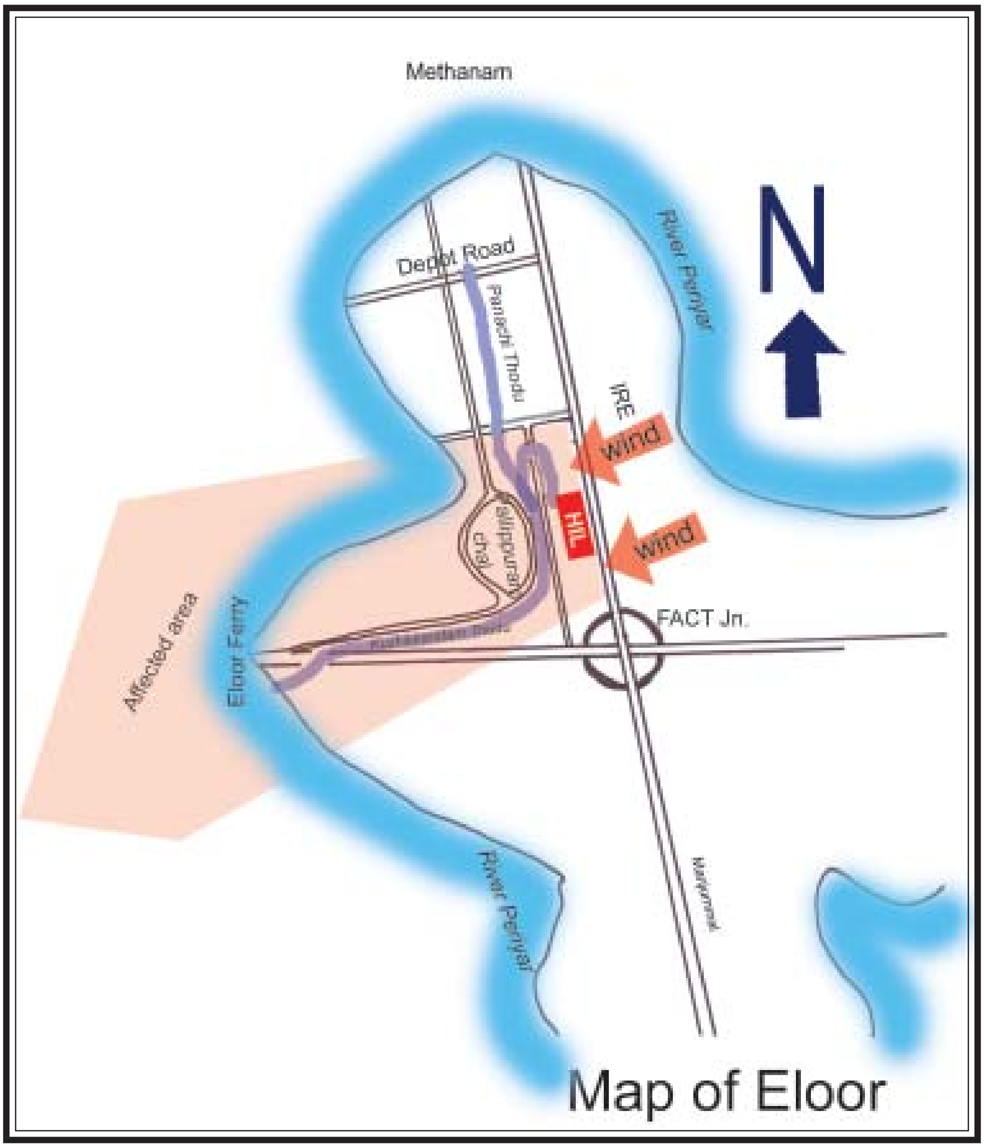
www.fullsense.com/Products/BD9000/9500/GasDetectorTube%5CshortTermGasDetectionTubesP_Z.htm

If local officials would like to liaise with international experts about responding to industrial fires involving pesticides, they may want to contact the following offices:

a) United Nations Environment Programme
Awareness and Preparedness for Emergencies at the Local Level (APELL) Programme
Branch Head: Fritz BALKAU
e-mail: fritz.balkaul@unep.fr

Consultant: Ruth Zugman Do COUTTO
e-mail: ruth.coutto@unep.fr

b) OECD Environment EHS contact
ehscont@oecd.org
Fax: +33 (0)1 45 24 16 75


Methanam
River Periyar
N
Depot Road
Panachi Thodu
IRE
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HIL
wind
FACT Jn.
Affected area
Eloor Ferry
River Periyar

Map of Eloor