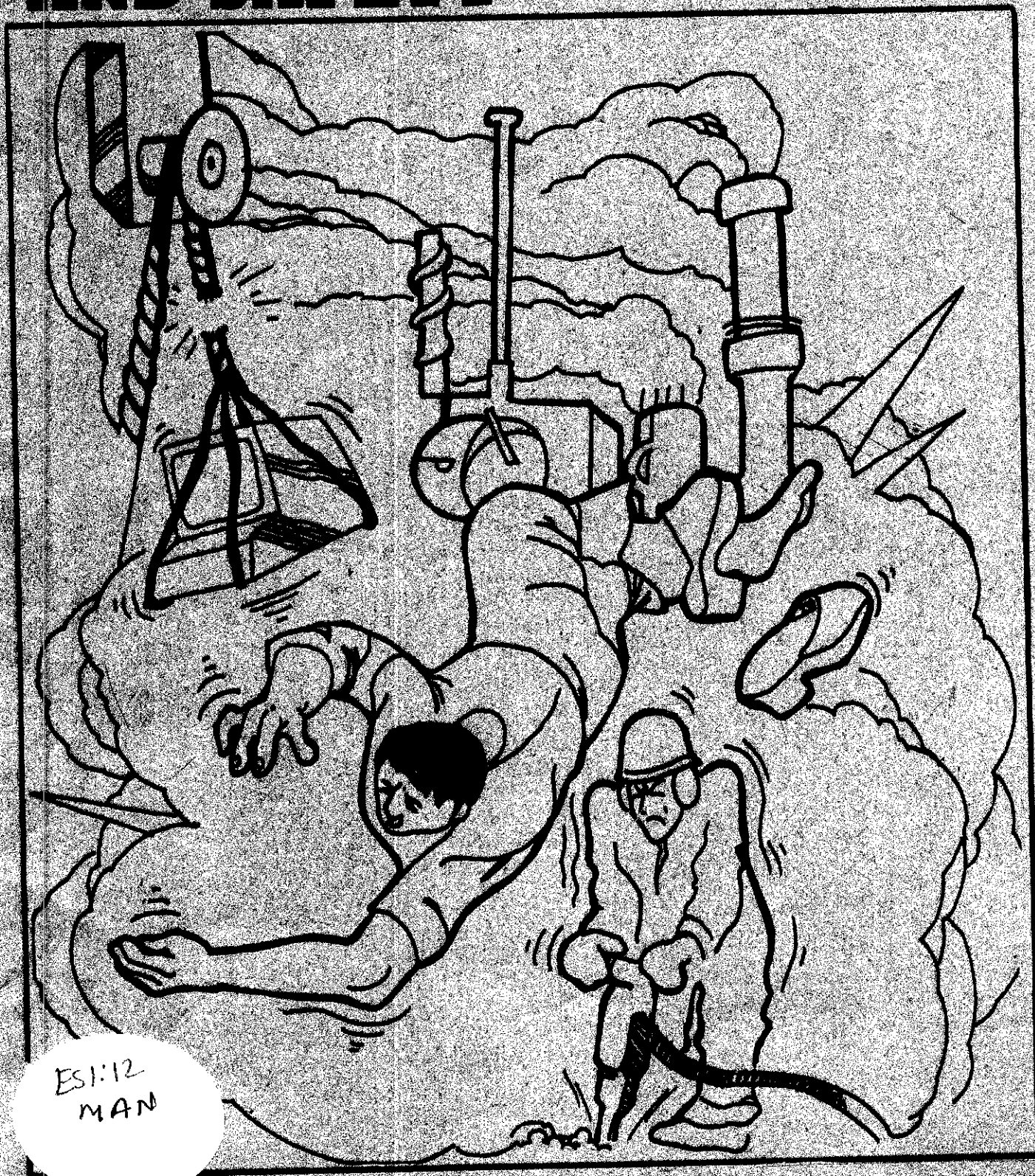


23PF

# OCCUPATIONAL HEALTH AND SAFETY



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A Manual for Activists

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## **Dedicated to the thousands of victims of the Bhopal Gas Leakage Tragedy**

On December 3rd 1984, the residents of Bhopal city (in Madhya Pradesh) experienced the worst disaster in the world resulting from the leakage of a highly toxic chemical gas—MIC. MIC is used in Making pesticides in the American multinational company Union Carbide.

Besides the thousands dead, several thousands are suffering from a wide range of effects—from blindness to cancer. Cattle, plants, vegetation—every living organism has been severely affected.

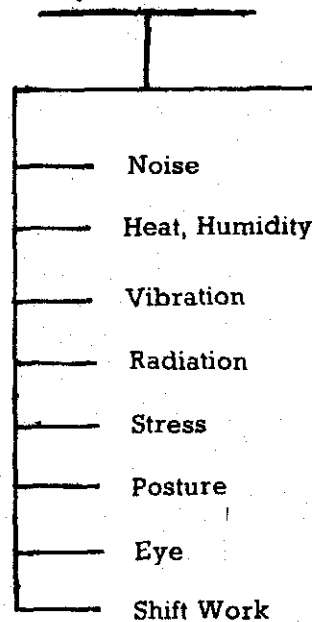
Perhaps, this massive tragedy will open our eyes and enhance our collective resolve to the increasing health hazards of various products, processes and technologies. Workers involved in the production process are as much at risk as those around it.

This manual, we hope, can increase our knowledge about some of these hazards.

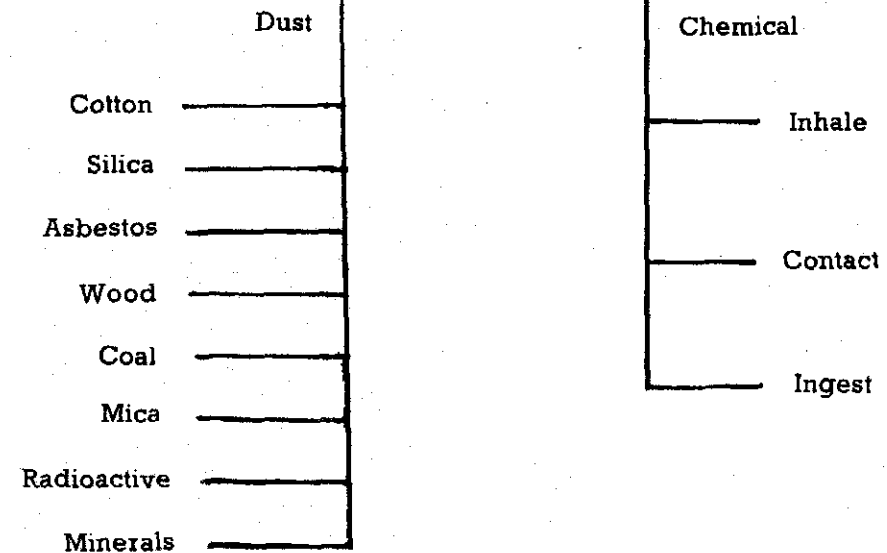


# OCCUPATIONAL HEALTH AND SAFETY

## Physical Hazards



## Occupational Diseases



# INTRODUCTION

With growing industrialisation in India, problems of Occupational Health and Safety have also surfaced. Every year, lakhs of accidents take place and thousands of workers die while working. The poorly maintained official statistics show that more than 60 accidents take place per thousand workers in the country, many of them fatal. The rate of industrial accidents is about eight times more than that in the industrialised countries. Moreover, this situation has become worse over the last three decades.

It is now well known that several categories of workers suffer from various types of diseases and health disorders which are directly caused by the production process itself. These arise from dust, humidity, temperature, noise, chemicals, etc.

It is estimated, for example, that about three lakh textile workers in India suffer from respiratory disorders related to cotton dust. Thousands of workers suffer from chemical exposure at the work places. Because of these unsafe working conditions, a large number of workers are dying a slow death and many become crippled at an early age. Yet, there is very little that is being done in our country on this issue. The managements and owners are hardly interested in such problems. They are exploiting the labour surplus situation in the country to avoid making any efforts towards preventing the incidence of occupational injury and ill-health. Managements often put the blame for these high injury and ill-health rates on "careless" workers. But workers know better. Unsafe working conditions which include unguarded machinery, slippery floors, insufficient lighting, excessive noise moisture and heat, exposure to dangerous chemicals without

adequate provision of safety precautions—all these greatly contribute to occupational injuries and diseases.

This situation gets further aggravated as most trade unions and their leaders, most of the times, do not take up these questions. They find themselves continually preoccupied with daily struggles around wage issues. Even when occupational health issue finds a place in their charter of demands, it is mostly in the form of compensation to the affected workers, rather than for any preventive efforts.

Ordinary workers are not fully aware of the sources and causes of occupational injuries and diseases. They are made to believe that many of these injuries and illnesses are necessary components and



inevitable constituents of their work. Besides, they think that any solution to these problems would entail high degree of technical expertise and large financial investments.

This thinking and approach needs to be radically changed and the beginning to be made by the workers themselves. The common saying that "knowledge is power" is apt and applicable in this sphere also. And the workers need to have the knowledge of the risks and hazards at their work places.

Occupational injuries and illnesses are by and large preventable. Many of the preventive measures and their effective implementation do not require high technical expertise or financial investment. It is only through awareness on the part of the workers and their active involvement that such solutions can be identified and successfully implemented. It is the workers who know, often much before the scientists or the government, that an industrial material is toxic. They are the crucial front line of defence against occupational hazards and accidents. And they are in the unique position to ensure that. Ensuring occupational health and safety is not merely a technical question, but also a political one. And hence workers' knowledge and struggles become necessary for that.

This manual is designed to increase workers' knowledge of occupational health hazards and safety and the ways to control them. While keeping the

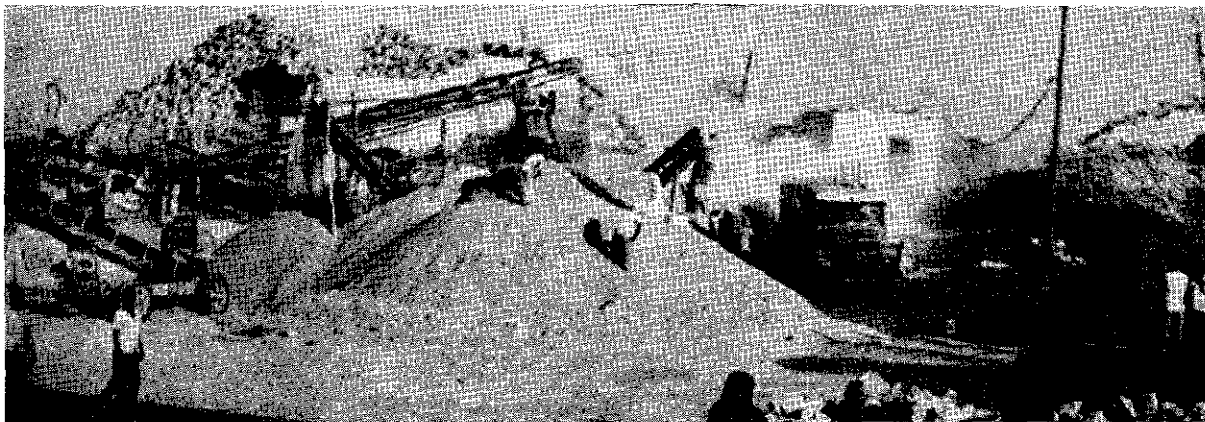
technical details to the necessary minimum, it provides information about causes and symptoms of various occupational hazards and accidents, and suggests ways to prevent them. It briefly presents the legal aspects of such problems and gives a list of further resources for information.

In fact this manual is a small beginning towards making union leaders and worker activists more aware of these issues. Hence it is not designed as a comprehensive document. The focus of this manual is primarily on the industrial sector.

The experience across the world shows that occupational health and safety issues have always been raised by the workers themselves. They have been forced to collect their own concrete informations, educate themselves and organise struggles on these issues in order to create a safe working environment.

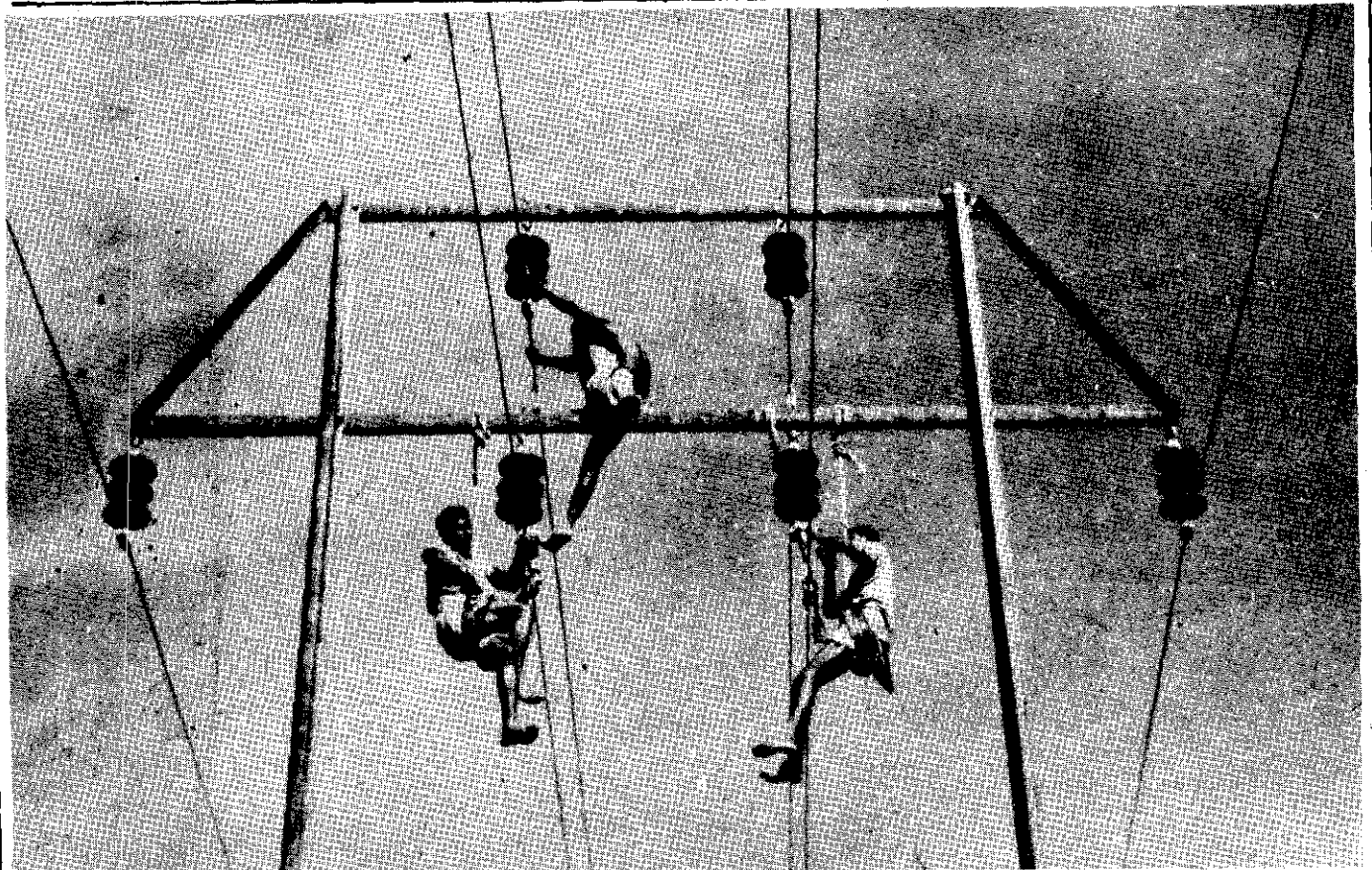
This manual can be a small contribution in that direction.

One can use this manual in many ways. Firstly, union leaders and worker activists can keep themselves informed about these issues. Secondly, the manual can be of help in informing ordinary workers of the risks and hazards they are exposed to in a particular industry. Finally, it may help in catalysing discussions, debates, inquiry, analysis and actions among ordinary workers.



# DO YOU KNOW ?

- \* That more than three lakh textile workers in India suffer from byssinosis due to cotton dust.
- \* that the rate of accidents at work places in India has increased by half during the last twenty years; and this is eight times more than in developed countries."
- \* that more than two thousand Indian workers die every year due to accidents in factories, mines and railways alone.
- \* that noise levels in our work places are nearly always more than the safe prescribed limits.
- \* that thousands of workers are slowly dying of chemical poisoning.
- \* that many chemicals that workers inhale while at work, cause impotence and cancer.
- \* that several materials produced in India are banned in other countries for manufacture (e.g. 2-naphthyl amine and sodium nitroprusside, etc.) as they cause serious health problems among workers.
- \* that half of the 20,000 asbestos workers in India are estimated to have lung cancer; in USA alone, more than a lakh of asbestos workers are likely to die of lung cancer.



# SAFETY

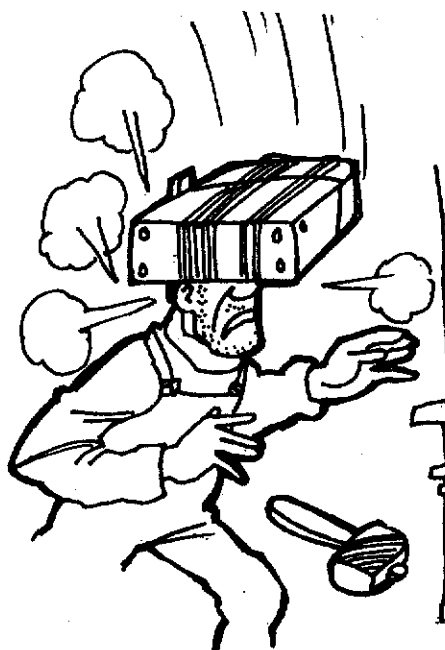
This chapter deals with safety. It describes the extent of accidents in the country, the causes for accidents, and how these accidents can be prevented and controlled.

## Growing Accidents

According to government data, every year, in India, 3-4.lakh people are injured and about 800 of them lose their lives due to industrial accidents.

A review of the last few years indicates that every day 1126 persons were injured and 3 persons lost their lives due to industrial accidents. In Maharashtra alone, one fatal accident occurs, on an average, every 2 days, while in Uttar Pradesh, one in 3 days. Thus industrial accidents every year kill more workers than some recent wars.

Accidents cause an absence from work due to temporary disablement. In 1980, accidents resulted in the loss of 33



lakh mandays due to disablement. This means that there is a daily absenteeism of 11,076 workers due to accidents. On an average, it takes 10 days for a person to recover from an accident.

The above figures pertain to industrial accidents occurring in factories only. If we include mines, railways, ports and docks also, then 5 workers die daily and 1228 workers are daily injured.

## Is this the full picture ?

The above figures for industrial accidents give only a partial picture. This is due to several reasons.

Firstly, for compilation of the above statistics, only reportable accidents (those resulting in more than 2 days disablement) are included. According to one estimate for an engineering factory, only about 1 accident in 10 is reported.

Secondly, these figures have been compiled by the Labour Bureau, based on reports received by the Factory Inspectorates all over the country. These in turn are based on reporting of accidents by the various factory managements. Many factories (according to one estimate about 35%) do not submit annual returns to the Inspectorate at all. Of those that do, there is under reporting of accidents to avoid payment of compensation as well as to avoid prosecution for negligence under various acts.

Thus there is every reason to believe that these data represent only a small part of the problem.

According to a recent study, accidents have been rising over the last 30 years.

Fatal injuries rose by over two hundred percent in the last thirty years; and non-fatal rose by four hundred percent in the same period.

This growing rate is also reflected in the comparative position of India in the world today. In India, the rate of accidents is more than twice that of the developed countries like USA and UK.

### What is an accident?

It is important to examine in detail, and get some clarity about, what an accident is. Examples of common industrial accidents are - slips and falls - trapped between moving parts of machinery or in rotating machinery - collapse of structures - fall of persons from height - fires - explosions etc. The list can go on. The consequence of an accident can be severe for the person injured, from a minor injury to a permanent disablement, and in the worst instance, a fatal injury. On the other hand, accidents also cause damage to plant/machinery.

The word "accident" connotes a chance occurrence. In fact, this common sense meaning constitutes a widespread misunderstanding that accidents happen by chance, they are nobody's fault. On the contrary, we want to **emphasise** that accidents do not happen by chance.



This means that there are causes, reasons behind every "accident," which can be identified, and more important, anticipated and predicted. This anticipation of causes makes it possible to prevent "accidents".

While the particular moment at which an accident occurs is unpredictable, the continued existence of certain unsafe conditions create the potential of an accident and in this sense cause it. An example will clarify. Consider a press operator getting his finger crushed between a die and ram on a power press. The continued operation of the press without a guard can be said to have caused the accident, while the fact that it occurred at a particular time (i.e. 7.30 p.m. on 26th March) is what gives it its unpredictable character.

We often think of an accident and an injury as synonymous. Yet injury is only one of the consequences of an accident. An accident can take place without causing an injury. Thus, many accidents may not result in injuries at all, but from the view point of safety, it is important to be aware of such non-injury accidents also.

One expert analysed several accidents to find that out of 330 accidents, only 30 cause injury, one of which is a major injury.

What is the implication of this finding? A particular type of accident, can result in different consequences of which, in a majority of cases, no injury will occur. Thus, these numerous non-injury accidents provide us occasions to determine the causes of accidents and to take corrective action. Thus such accidents should be observed, noted and reported, so that the corrective action can be taken before the same type of accident results in a more serious injury.

### What causes an accident?

**Causes** of accidents can be identified at two levels:-

- a) Immediate causes.
- b) Underlying causes.

The following questions can help in identifying the immediate causes of an accident.

i) What was the agent of injury?

What was the object which came in contact with the body and resulted in the injury? Answers could be: moving parts of machines, chips or sharp edges of objects being handled, toxic or corrosive substances, flames or hot objects, or liquids and gases at high temperature and pressure.

ii) How did it happen?

We need to understand why the body came into contact with the agent of injury. Answers could be: unguarded or inadequately guarded machinery, failure or non-operation of safety devices; deviations from safe methods of working, non-provision or non-use of personal safety equipment.

Answering these questions helps to identify the immediate causes, thus suggesting the immediate preventive measures to be taken.

Very often the causes and solutions are not immediately evident. It often helps to study the pattern to uncover underlying causes. Grouping of accidents, occurring from the same shop, or on similar machines or jobs; or according to injuries to the same part of the body, or involving workers of the same trade in different shops; will often uncover underlying causes. The problems may be related to faulty layout of equipment and machinery in the shop, bad planning of material handling facilities, improper job description and work designation, lack of skill or training, and even intensity of work. Looking at

such patterns and causes can help to identify issues on which long term action needs to be taken.

The condition of the work environment, like, inadequate lighting, excessive heat and load, bad ventilation, dust or fume filled atmosphere, high level of noise, increase the risk of an accident.

A common misconception is to place the cause of most accidents on the carelessness of workers. As explained above, an unsafe system of working can be seen to cause most accidents.



In the first place, we must differentiate between ignorance and carelessness. There are certainly some accidents caused by ignorance - especially those involving contract labourers. In such cases, they are not properly trained and oriented. This is particularly true of construction workers, and casual labourers.

Sometimes, workers do use 'shortcuts' and behave carelessly. But there are also reasons for the same. Pressures from supervisors, high speed to earn more incentives etc. are also responsible for such acts.

### Accidents can be controlled

Safety at work can be improved, and accidents prevented, if the underlying

causes of accidents are tackled. This can be done in three ways:

1. ELIMINATION

The accident causing process or material is eliminated.

2. ISOLATION

The accident causing element, part, or machinery is either kept away or kept properly enclosed.

3. CONTROL

Where it is difficult to eliminate such process or material, it can be isolated from the worker and controlled.

a) One way is to provide safety features on the machines. For example:-

i) Guard for providing a physical barrier from moving parts of machinery, especially power transmission and drive units.

ii) Electrical and mechanical interlocking between the controls and guards (e.g. lid on centrifuge, gates on lift, guard on press) on machines.

iii) Provision of other safety features like **emergency** stop devices, two hand controls on presses and limit switches.

b) Many accidents happen during handling of materials. To control these, it is necessary to ensure the following:

i) Provision of adequate mechanical lifting machinery (cranes, hoists, forklifts, etc.) and of properly designed lifting tackles, both being safety maintained.

ii) Proper stacking of material, and well-designed and stable pallets, kept in well ventilated rooms and properly segregated.

c) For jobs with a high risk level, a system of issuing permits to work is followed. Jobs of this type are working at heights, working in confined spaces, welding in hazardous areas etc. Here a checklist of precautions is checked before a permit to work is issued for a shift at a time.

It is only after trying all possible engineering control measures that provision of Personal Protective Equipment (PPE) should be adopted as a control measure.

### Personal Protective Equipment

PPE constitute the last line of defence. It does not reduce or eliminate the hazard, but merely sets up a barrier against it. Unless these are constantly maintained in good condition, they can create a false sense of security.

There are two types of PPE:

- Respiratory
- Non-Respiratory

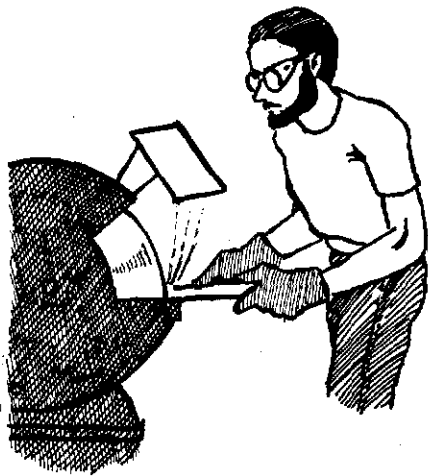
Respiratory PPE are

1) Air supplying type

- air respirator connected to the compressed air line or to a blower;
- self contained breathing apparatus where a cylinder of air or oxygen is carried on one's back.

2) Air purifying type

- mechanical filter which traps dust;
- cannister/cartridge type which protects against chemicals by having an antidote in the container.



### Non-Respiratory PPE

These are classified according to the part of the body protected.

#### 1) HEAD

- Helmet :- against falling objects
- Caps :- against heat, sparks, chips, splashes.

#### 2) EARS

- Ear Muffs :- to reduce noise

#### 3) EYES AND FACE

- Safety goggles :- to protect eyes
- Face shields :- to protect against dust, splashes of liquid, flying particles and harmful radiation.

#### 4) HAND AND ARM

Full sleeved shirt or **separate** sleeves for welder's fettlers, etc.

- gloves :- made of cotton, leather, or rubber - to protect against sharp objects, heat, chips, corrosive chemicals, irritants.

#### 5) BODY PROTECTION

- Uniform
- Aprons :- cotton, rubber or leather protects against heat and chemical splashes
- shirt should be half open T-shirt type with half sleeves as otherwise open cuffs or shirt ends could get entangled in machines.

#### 6) FOOT AND LEG

- safety boots/shoes
- leg guards against splash of molten metal, hot liquid, fall of object on toes or foot, and to protect the sole from sharp objects.

7) Another type of PPE is the Safety Belt, to arrest the fall of a person from a height and into pits. Belts must be used whenever a person is working at heights, especially on construction and maintenance locations.

8) Barrier cream is a cream which sets up a barrier between the skin and the offending agent, controlling the incidence of dermatitis. There is a set of two creams, one acting as a barrier and the other a cleansing cream.

Under the Factories Act, 1948, there is a legal responsibility on the management to provide PPE to workers.



## Specialised Safety Laws

The legal provisions related to safety are primarily covered in the Factories Act, 1948 (see later). However, there are some specialised safety laws like:

1. India Boilers Act, 1923

This Act governs the inspection and repair of Steam Boilers, as well as the procedure for annual certification of boilers by the Boiler Inspectorate.

2. Indian Explosives Act, 1884

This Act regulates manufacture, possession, use, sale, transport, and importation of Explosives. Three sets of rules exist:

- a) Static and Mobile Pressure Vessels Rules, 1981

- b) Gas Cylinder Rules, 1983

- c) Explosives Rules, 1983

3. Petroleum Act, 1934

The Petroleum Act, 1934 and the Petroleum Rules, 1976 classify petroleum into three classes, depending on their flash point. Separate Rules are established for each class dealing with the import, transport, storage, production, refining and blending.

4. Indian Electricity Act, 1910

The Indian Electricity Act, 1910, and the Indian Electricity Rules, 1976, prescribe safety in electric installations, both domestic and industrial.



# HOW WORKERS ARE DYING

## Fertiliser Factory in Bombay

On July 22, 1982 a worker, Mr. John Nathan died while working in the Nitric Acid Plant of the Rashtriya Chemical Fertilizer, Bombay, due to exposure to Nitric Acid fumes. The management claimed that the worker died due to his own negligence. Other workers are being continuously exposed to the process of slow death.

The percentage of Nitrogen Oxide (NOX) officially considered safe is 5 parts per million parts of atmosphere (5ppm). In R.C.F. the recorded figures show the presence of NOX to the level of 40 ppm. The workers are facing problems of dyspnea and cough. Those who have worked for more than 5 years are most affected.



Apart from direct damage to lungs, such exposures may lead to heart attacks and reduced resistance against bacterial infections.

Recently, another worker, Mr. Gupta fainted while working in the NOX mixed atmosphere. His pulse rate had risen to 120 per minute. He had to be hospitalized and only artificial supply of Oxygen saved him.

Apart from NOX and Nitric Acid, other hazardous chemicals present in the production of fertilisers are: Sulphur Dioxide, Carbon Monoxide, Nitrogen Oxide, Hydrocarbons, Oxidants, Phosphate dust, etc.

## Mines

Three labourers lost their lives while working in the sandstone mines of Mehrauli on February 7, 1983. **hundreds** of miners in coal mines die every year.

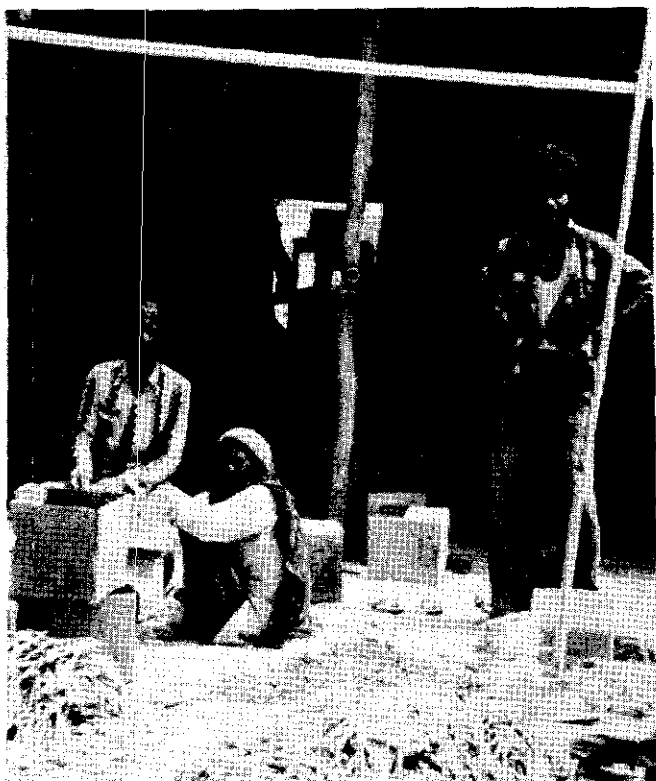
Death is a simple affair in these mines. The workers are forced to work in unsafe mines, where explosions occur and roofs collapse frequently.

More than 100 workers have been accidentally killed in Bhatti mines in recent years. At several places, columns of fragile rocks have been left alone to collapse. Men, women and children often work here in the dark with the help of candles and lanterns.

The Mines Act, 1952, Chapter V, covers the Health and Safety of workers.

## Slate-Pencil in Mandsaur

Mandsaur in Madhya Pradesh is well-known for its slate-pencil industry, as a small scale industry. Even in a small



hut here, you will find a factory running with just two cutting machines. A cutter can earn around Rs. 30/- per day on piece rate basis.

This is the only place in India which produces slate-pencil which children use for writing. This is **the** only industry which kills 13 people in a month. More than 3,000 workers have died in the last 20 years.

The mining and cutting of the stones raises silica dust which after persistent and prolonged exposure for several years causes silicosis among workers. The cutters are most seriously affected.

Multanpura village is the most affected area. 70% of the voters list here comprises of women only. It is very difficult to find old men in this village as most men die by the time they reach 40 years of age.

Before 1954, the industry was using hand operated cutting machines. After 1954, when electrical cutting machines were introduced, the workers are dying at a faster rate on account of exposure to a large quantity of dust, which is now raised by the power driven machines.

Nowadays, a cutter dies of silicosis of the lungs at the age of just 32 years. Most of these cutters had started working around 1964-68 at the age of 20-24 years. And now, their children have to work in the same killing industry.

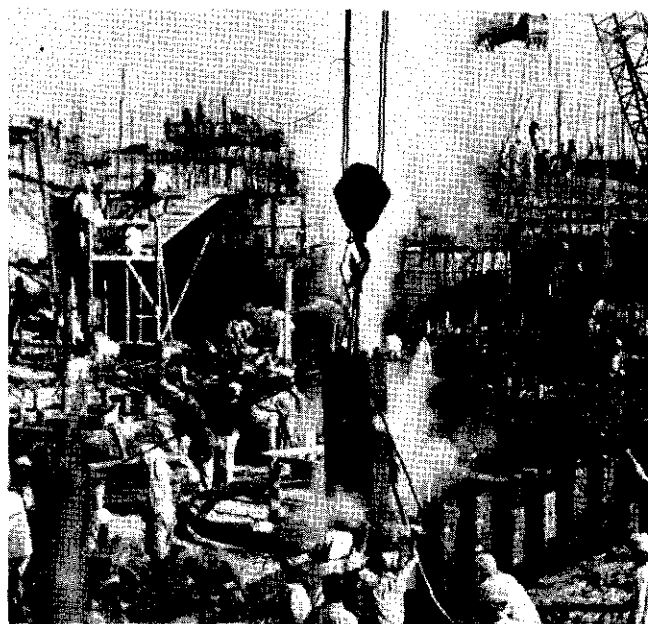
### Construction

Four young labourers were reported to be buried alive on March 10, 1984 when they were digging a deep pit in a Delhi colony for laying sewage pipes.

And many more are dying each day.

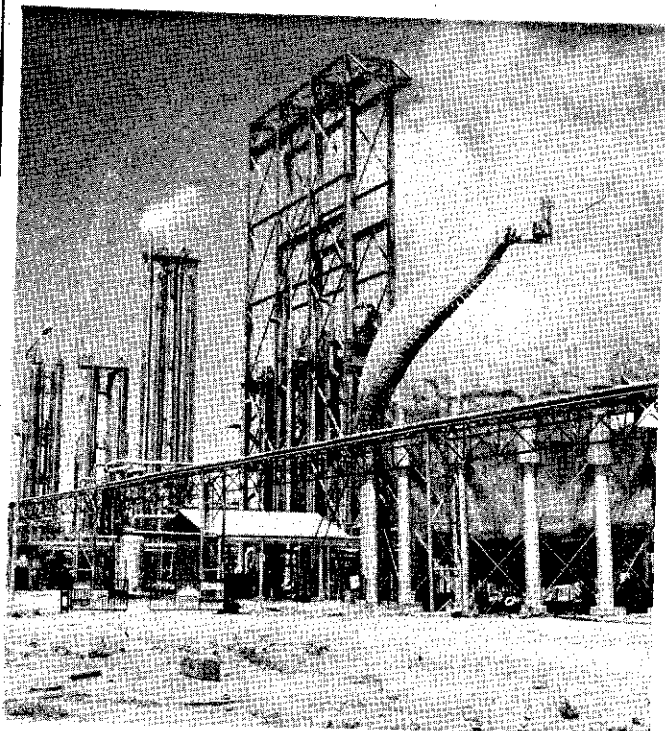
Construction is one of the most hazardous jobs.

Accidents due to falling down are particularly prevalent in building and construction works. Night work on building sites often increases the risk of workers falling into unguarded holes, etc. One very common accident in excavation is the caving in of earth walls.



Besides, most construction work is carried out unprotected in extreme climates -- Heat, cold and rain. And dust inhalation in construction industry causes serious respiratory problems.

As women comprise a majority of construction workers, they are most affected.



### Rayon Factory in Nagda

Gwalior Rayon Silk Mills, Nagda, Madhya Pradesh, is one of Asia's biggest Rayon manufacturing units, directly employing 5,000 people.

The factory is full of toxic gases like - Carbon **disulphide**, Hydrogen sulphide, Sulphur dioxide, Chlorine and mercuric vapours. After a year of work at the factory, the worker starts suffering from giddiness, headache, memory defects, loss of sensation etc. Serious ailments, ranging from paralysis to psychosis, have affected hundreds of workers. In 1982 alone, 23 workers died of mercury poisoning. Many more have become impotent. The suffering continues even today.

The factory discharges about one lakh litres of waste water containing highly toxic chemicals, into Chambal river everyday. The presence of mercury in the water was found as high as 0.25 gram per litre which is 250 times higher than the permissible limit laid down by the World Health Organisation.

### Pesticides

Pesticides are widely used today for plant protection and for boosting farm production. But at the same time, workers exposed to pesticides are dying.

In India, the use of pesticides has risen 40 fold in the last twenty years. At the same time, pesticide poisoning cases are today estimated to be around 3,000 per year.

Pesticide poisoning kills both, workers engaged in its production and farm labour using it for spraying.

National Institute of Occupational Health conducted

a study of five formulation units registered as small scale enterprises and a unit producing phosphate group of insecticides. After examining 160 male workers employed in the units, it was found that 73% had poisoning and 35 percent cardio-vascular and gastro-intestinal problems.

Farm labourers are worst affected from pesticide poisoning as they get exposed for a longer period during spraying operations. Cases of cancer, stunted growth of farm workers' children, deformities, blindness, disease of the liver and nervous system have been identified. Industrial Toxicology Research Centre found in a study that one-fifth of the farm workers have impaired eye-sight following macular degeneration.

Some of the pesticides like DDT are totally banned in Europe and America but they are still used in our country.

## PHYSICAL HAZARDS

This chapter covers those work-related hazards which relate to physical working conditions. These include Noise, Heat (Humidity and Cold), Vibration, Stress, Posture, Eye and Shift Work.



# NOISE

Working eight hours a day in a noisy plant can be annoying and frustrating. Moreover, it can be hazardous to your health.

Noise in industry is now recognised as a major health hazard. The average worker, however, sees noise only as a minor nuisance. This is a mistake, because evidence shows that excessive noise can cause long-term damage to health that had not been suspected before. Hearing loss is not the only health problem associated with noise. High Blood Pressure, loss of appetite, peptic Ulcers, headaches, increased irritability, slower reaction time, asthma and disruption of sleep have all been linked to exposure to high noise levels.

The levels of noise which can cause this harm are quite common in industry. Heavy industry, engineering, manufacturing, construction, transport, agriculture, shipyard and printing press are just some example industries where noise can be a problem. In addition, many offices now have noise problems stemming from the increasing use of office machinery.

Controlling noise is not technically difficult. What is needed is good design and a willingness to spend money on good quality equipments.

## What is Your Hearing Problem ?

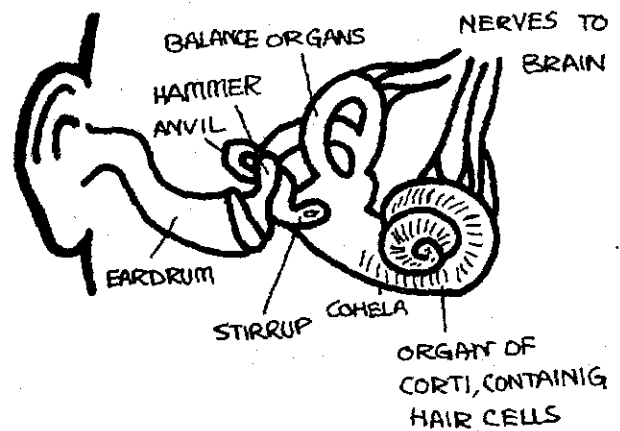
The social implications of deafness are as important as the medical effects.

Deafness will affect the entire quality of your life. It will be difficult for you to join in discussion. Mis-hearing conversations causes embarrassing

wrong replies to questions. Eventually, less people talk to you; you withdraw from company, become isolated and feel miserable. Family life will become more difficult; you will have to turn up the radio or television, you will neither hear the birds anymore, nor be able to listen to music. In short - you will be alone inside your head but you will not be by yourself.

You could also be at greater risk from other hazards at work - you may no longer hear warning sounds and signals.

One serious complication can be "tinnitus" or ringing in the ears. In some cases this can be so loud that it stops you from sleeping. These effects of industrial deafness cannot be cured; hearing aids are not a "cure" -- all you get is the same - distorted sounds -- but louder.



High level of noise may cause:

- \* A maddening ringing in the ear (called "tinnitus");
- \* Common sounds suddenly getting louder (called "recruitment");
- \* Circulatory and digestive problems;
- \* reduced awareness of other hazards.

All this leads to more "sickness absence" and "industrial relations" problems. It also reduces productivity.

### **Have You got a Noise Problem at Work?**

You may not think so - but find out by circulating a basic questionnaire to workers to discover the following:

- \* do they have difficulty in hearing or understanding what is said at home, or at work?
- \* do they need the radio or TV turned up louder than the rest of the family?
- \* do common sounds suddenly seem louder to them?
- \* do they get frequent headaches or ringing in the ears?
- \* do they feel temporarily deaf after work - but not after a day or so while away from work?
- \* do they feel unusually tired or bad tempered by the end of the workshift?
- \* do they seem to get stomach complaints?

If the answer to these questions seems to be "Yes", then the noise in your workplace is very probably to blame for it.

### **Noise and Stress**

Most of us know that certain noises can cause extreme irritation. When road-builders are working outside your house, the noise can cause strain, not just on the ears but mentally as well. It can produce headaches, lack of concentration and short temper. These are all symptoms of tension and stress. The build-up of tension is very noticeable at the moment when the noise stops. Most of us have felt the great relief when something like a compressor stops after two or three hours of continuous running.

### **Facts about Noise**

Not all sound is Noise. Noise is any unpleasant or unwanted sound. The effect of noise on the human ear depends on intensity, frequency and duration.

### **What is Sound**

If we throw a stone into a calm pond, we can see how the waves spread out in a circle from the point where the stone hits the water. The same thing happens if we hit a glass tumbler with a spoon. The impact sets the tumbler vibrating and the vibrations cause the surrounding air molecules to move. When these wave-like vibrations reach our ears we interpret them as sound.

Sound is generated in three ways:

- \* by vibrating surfaces.
- \* by flowing liquids.
- \* by flowing air/gases.

### **Injury to Hearing**

High levels of noise or long periods spent in noisy environments can result in a measurable deterioration in hearing. The ear is a highly sensitive instrument that we must protect.

## Measuring Noise

Noise levels are expressed in units called decibels (dB).

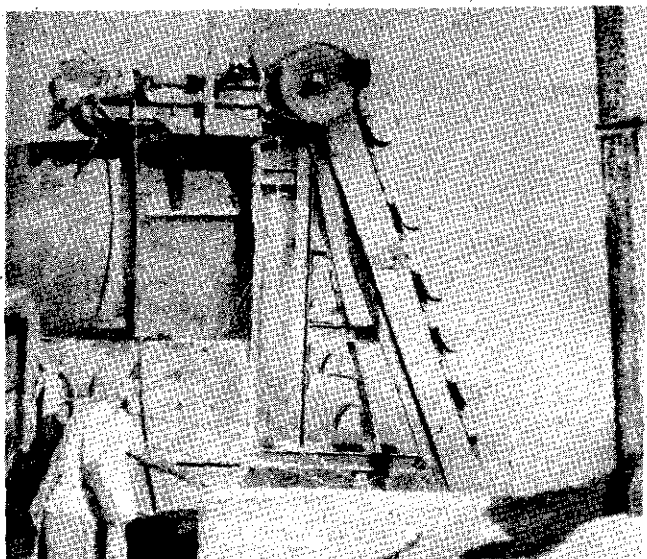
A general rule of thumb when comparing noise levels is that an increase of 10 decibels has ten times the sound intensity and an increase of 3 decibels doubles the sound intensity.

An example is that 93 decibels sound has twice the sound intensity of 90 decibels. Because the intensity is double, it can cause much more damage to hearing than lower noise levels - even though your ears cannot actually detect that the sound intensity is twice as much.

The practical effect of various levels of noise on different work and leisure activities is illustrated in the chart. As shown in the chart, any increase of 10 dB is a ten-fold increase in noise intensity.

Because each increase of 10 dB multiplies the sound intensity by 10, adding 20 dB increases sound intensity by  $10 \times 10$  or 100 - a hundred fold increase.

In practice this means that what seems to be a small increase in the number of decibels, represents a very large increase in noise intensity. A small reduction in dB can be a very big reduction in noise exposure and risk of deafness.



| Unprotected (dB) | Ear            | Sound Intensity     | Typical Sounds        |
|------------------|----------------|---------------------|-----------------------|
| 140              | Deafness range | 100,000,000,000,000 | Jet engine            |
| 130              |                | 10,000,000,000,000  | Pivoting hammer       |
| 120              |                | 1,000,000,000,000   | Hand grinding         |
| 110              |                | 100,000,000,000     | Rock drill<br>Weaving |
| 100              | Risk range     | 10,000,000,000      | Sheet metal shop      |
| 90               |                | 1,000,000,000       | Heavy machinery       |
| 80               |                | 100,000,000         | Street traffic        |
| 70               | Safety range   | 10,000,000          | Loud radio            |
| 60               |                | 1,000,000           | Busy office           |
| 50               |                | 100,000             | Normal speech         |
| 40               |                | 10,000              | Low radio music       |
| 30               |                | 1,000               | Whispering            |
| 20               | Silent range   | 100                 | Quiet town            |
| 10               |                | 10                  | Rustle of a leaf      |
| 1                |                | 1                   | Lowest audible limit  |

So if your employer says:

"It is only a few decibels over the limit".

or

"It's not worth spending money on dropping the level by a few decibels".

remind him that what seems like a small difference in fact represents a very big change.

"Only 10 dB over the limit" means ten times louder than the limit.

Remember that we are measuring noise intensity not "apparent Loudness". A ten-fold increase in intensity may only sound, say, twice as loud to the ear. But it is the sound intensity that damages hearing. So it is not enough to try to judge changes in noise levels "by ear".

Any exposure to **noise** beyond 85dB is legally recognised as unsafe. However, continuous and prolonged exposure even at lower than 85dB levels becomes unsafe.

A noise metre is used to measure the intensity of noise. It is very important for the Union to see that the level of



noise in the workplace is measured.

These are small, inexpensive, portable instruments available in the market for this purpose. If management cannot, or will not, provide these, the factory inspectors should be approached to carry out noise measurements. In case the factory inspectorate seems reluctant to respond to their requests, it will be worthwhile if the workers could themselves contribute to have one such instrument with themselves, which will in turn have far reaching beneficial effects on their working conditions.

### Ways of Controlling Noise

We can identify three basic types of control strategy:

#### Stage 1. Control the Source

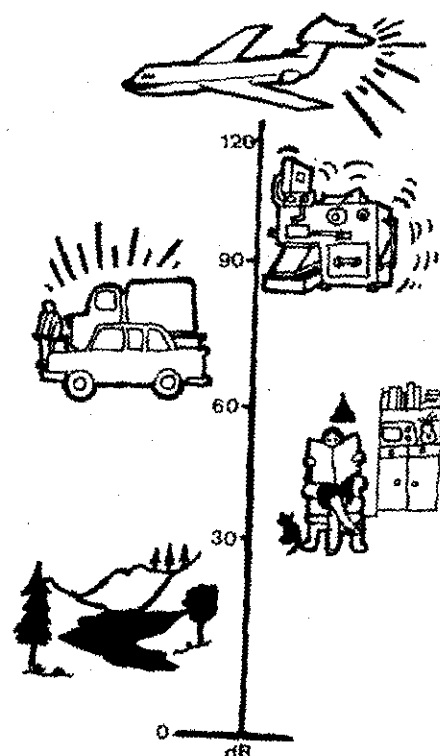
Measures to Control noise should always start with the source of the noise.

#### Stage 2. Control the noise-path

This could include enclosure of equipment and fitting of sound deadening surfaces to walls, floors and ceilings. These measures are nearly always less effective than tackling the noise at source, but are often worth considering.

#### Stage 3. Protect the receiver

This will involve "enclosing" the worker, by ear muffs, ear plugs or sound-proof booths. These 'personal protection' measures are usually technically less efficient and cause inconvenience, discomfort and isolation. These factors, as we have seen, could in turn lead to higher accident rates. Personal protection should only be acceptable as a short term measure which is a part of a longer-term noise reduction programme.



#### Reducing Noise at Source Replacing Noisy Machinery

The most effective way to reduce noise at source is to buy equipment which is designed, built and installed with noise control in mind. The quietest machinery is often not the cheapest, so some union pressure may be needed to ensure that employers opt for this.

Unions should be on the alert for any new purchases of plant and equipment with a view to pressing for quieter designs. Unions can get an agreement from management that no new equipment is introduced without consultation with the unions.

In some cases, production techniques can be re-thought altogether. Examples might be the use of hydraulic pressure instead of hammering.

#### Modify Existing Machinery

Many modifications and adjustments can be made to existing machinery to reduce noise. We should remember that in

cutting noise levels, we are trying to cut out the vibrations which are the source of the noise. These vibrations could occur because of:

- \* worn parts
- \* badly fitting parts
- \* lack of lubrication
- \* lack of maintenance
- \* bad design
- \* excessive running speeds
- \* vibrating panels
- \* unbalanced rotating parts
- \* parts which 'hit' each other - e.g. gears.

#### Personal Protection

Personal protection against noise is available in the form of:

- \* disposable ear plugs.
- \* re-usable ear plugs.
- \* ear muffs.



This form of reducing the risk of industrial deafness is least satisfactory because:

- \* the hazard still exists, therefore the working environment is still unsafe.
- \* at high noise levels, removing the ear protection for only a few minutes can cause considerable damage to hearing.
- \* ear protection interferes with communications such as warning shouts, sirens, etc. and, therefore, exposes workers to other risks.
- \* if ear protectors are provided instead of tackling the source of noise, then obviously the management is shifting its responsibilities on to the workers - it becomes his or her 'own fault' if deafness occurs.

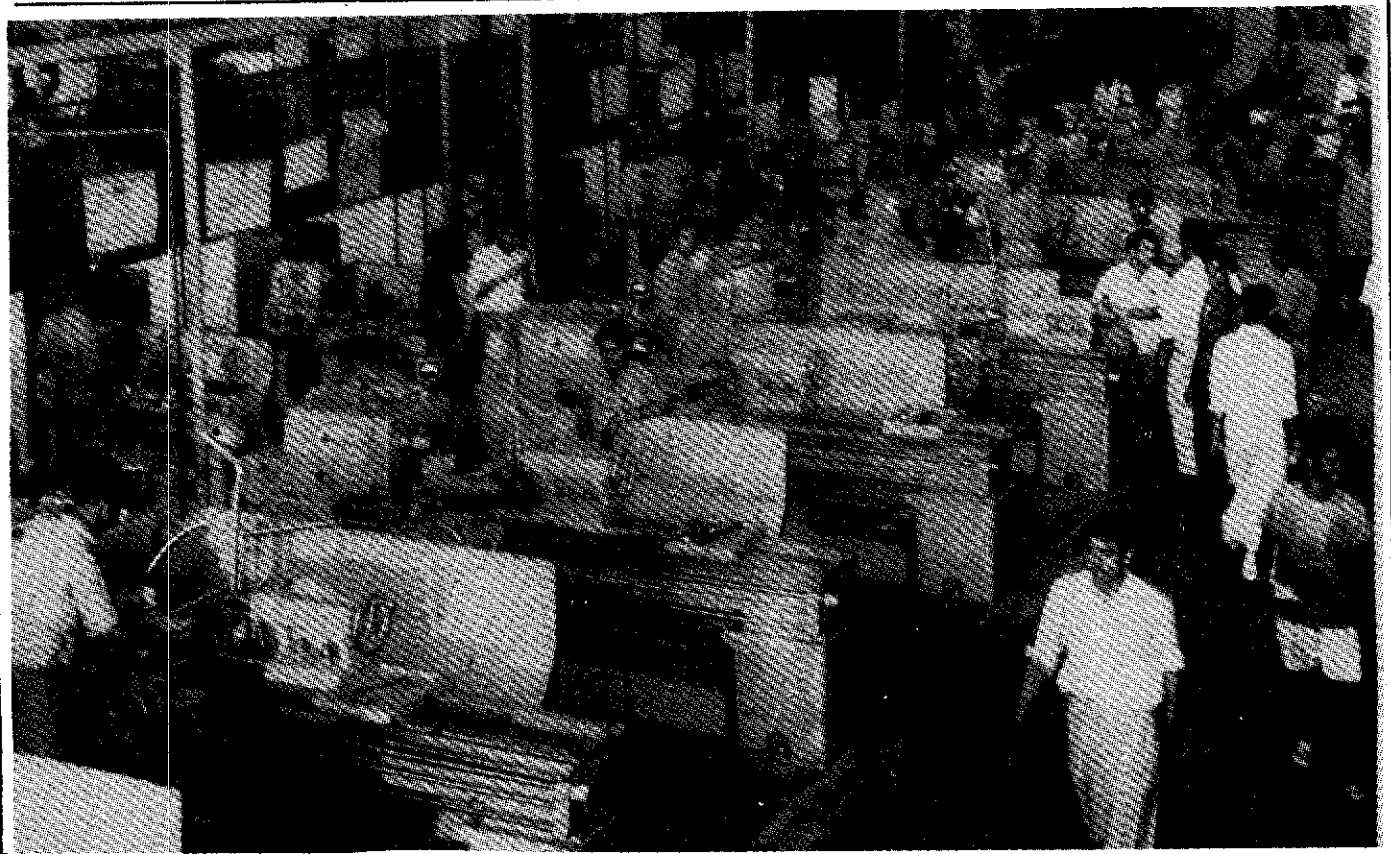
In general, ear muffs are more effective than ear plugs. However, if you wear ear muffs make sure the seal is tight.

Some workers may contract Dermatitis (Skin rashes) from wearing ear plugs. This can be due to poor sanitation (handling ear plugs with dirty hands) or an allergic reaction to the material of which the plug is made. There are non-allergic ear plugs, made of silicone which may be useful.

### Job Rotation

Job rotation is sometimes proposed as a method of reducing exposure. It does not tackle the problem at source, so it does not provide an acceptable solution.

A better alternative would be to rearrange the work rather than the workforce - to ensure that a minimum of operations have to be carried out in the noisy areas.

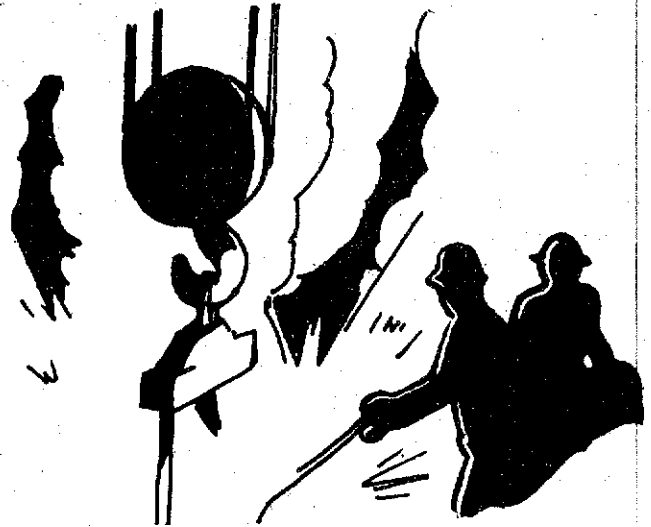


# HEAT

It is common knowledge that accident rate is higher in hot workplaces. Moreover, constant heat at workplaces can have serious effects on the health of the exposed workers.

## The Effects of Heat

Discomfort is not the only problem faced while working in places with high temperatures and humidity. Constant heat can also impair a worker's mental alertness, often increasing the possibility of an accident. When it is very hot, the job of cooling the body becomes more difficult and as a result, serious health problems may arise.



| <u>Heat related problems</u>                                                                                                                           | <u>Symptoms to look for</u>                                                                             | <u>What to do</u>                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Heat rash (or prickly heat) develops                                                                                                                   | Rash, itching, discomfort.                                                                              | take breaks during day and take bath at the end of shift.                                                                                     |
| Heat cramp - happens due to excessive loss of salts from body in sweating                                                                              | Fatigue, headache, Muscle cramps-painful spasms of muscles used in performing job (arms, legs, abdomen) | Frequently drink water with salt in it (one glass of water with 1/2 tea spoon of salt)                                                        |
| Heat exhaustion - caused by simultaneous loss of excessive fluids and salt from body during heavy work in hot and humid work places, through sweating. | Nausea, headache, Fatigue, clammy skin, pale complexion, vomiting.                                      | let the person rest in cool place and give plenty of liquids (lightly salted)                                                                 |
| Heat Stroke - happens when body temperature rises above 105° F.                                                                                        | Confusion, high fever, dry skin, loss of consciousness, chills.                                         | Call an ambulance for medical treatment. As emergency first aid remove the worker to cool area. Drench clothes with cool water. Fan the body. |

## Measuring Heat

Temperature of the air taken with a regular weather thermometer is only one parameter in measuring how hot and uncomfortable the workplace is. Other factors which should also be considered in this connection include:

- \* humidity
- \* whether you are working near hot operation spots, like driers and/or furnaces
- \* whether there is good air circulation
- \* whether you have to move around a lot or do heavy work on your job.

A special thermometer called a Wet Bulb Globe Thermometer (WBGT) must be used to take temperature, humidity and air movement into account. A daily, shift wise, record of these parameters should be maintained.

## Controlling Heat Exposure

Engineering measures are the best means of controlling temperatures:

- 1) Fans increase the speed of air circulation and evaporation of sweat, but are only effective if the air temperature is below 98°F.
- 2) Shields or insulation can isolate operations from other parts of the work place. For example increased insulation on the doors of driers and furnaces can considerably reduce exposure to heat.
- 3) Local Ventilation can draw heat or steam away from the work area and create air flow.
- 4) Air Conditioners (Coolers) in rest areas or lunch rooms help to cool down the body.



## Preventive Measures

- 1) Adjust to heat - New workers or when someone returns from vacation should be gradually introduced to hot workplaces so that their bodies are given the necessary time to adjust.
- 2) Heat breaks - or slowing down the pace of work should be allowed, especially if it is a very hot day or a worker feels even a slight heat strain.
- 3) Rest areas - should be cool and located near the workplace.
- 4) Cool Water - should be easily available. In really hot conditions, workers should drink at least a cup or more every 15-20 minutes.
- 5) Schedules - may be arranged to let workers do hardest work during the coolest parts of the day.
- 6) Salt Solution (one tablespoon of salt dissolved in two litres of water) should be available - but again people with heart problems or with Low-Sodium diets should avoid or reduce its intake.

The best chance for success in prevention is through a strong union action.

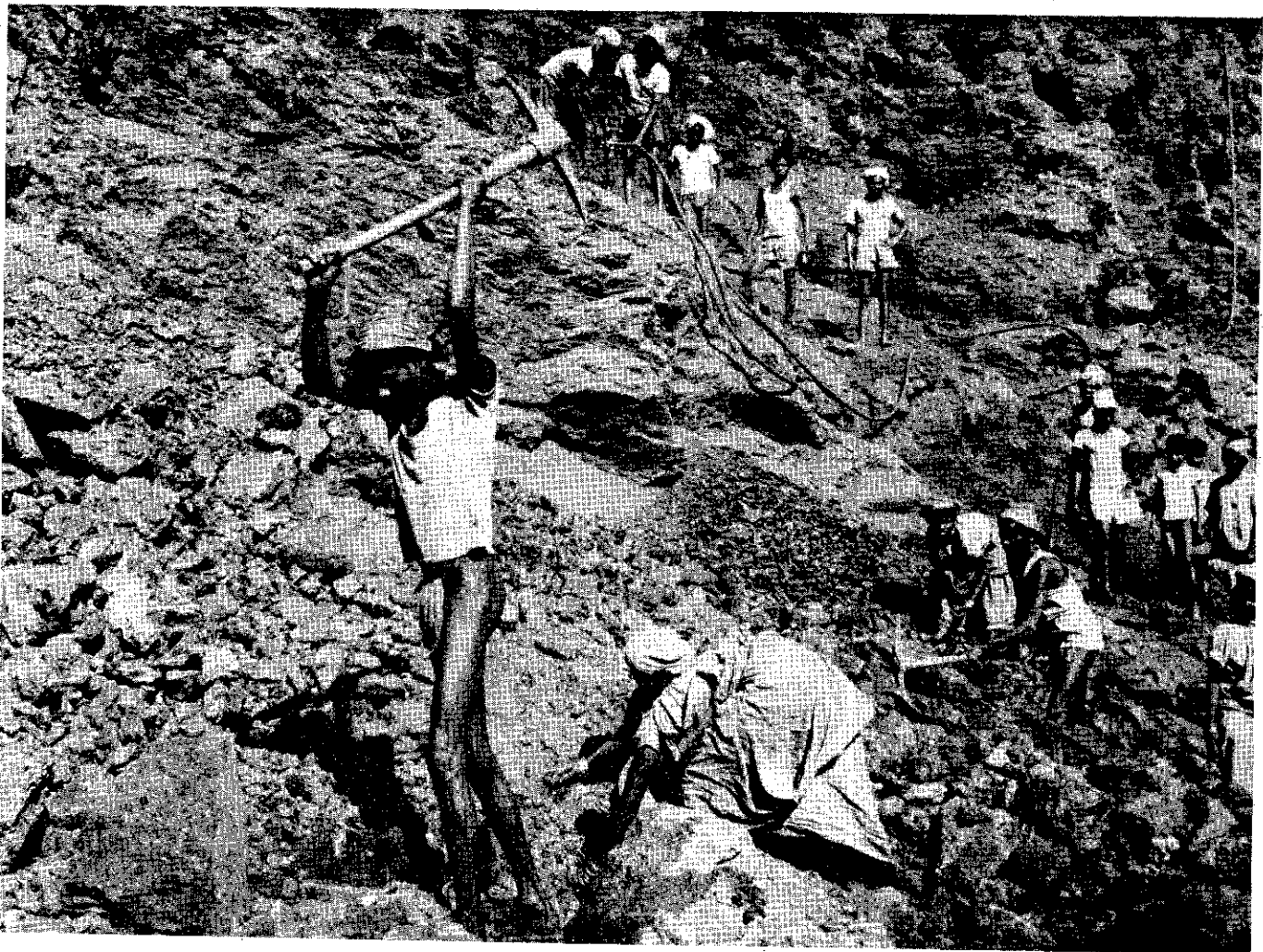
### Methods to Control Hazards

- \* Workers should be provided with good protective clothings and shoes, etc. Two or more layers of light clothing are better than one layer of heavy clothing when trying to stay warm.
- \* Shorter shifts and frequent rest periods at room temperature areas should be provided.

### Cold

The body can tolerate very little exposure to cold without the protection with appropriate clothing.

In extremely cold temperatures, frost-bites, psychological changes and loss of consciousness can occur. Immersion foot can develop when feet are simultaneously exposed to both damp and cold conditions for long periods.



# VIBRATION

## Hazards

Vibration can be harmful if some part of your body is in direct contact with a vibrating surface. When you sit or stand on a vibrating surface for some time, you feel discomfort, giddy or sick. These effects can even be fatal during sustained exposure to intense and regular vibrations.

Vibration of the whole body can cause damage to the joints of the backbone. Drivers of tractors and other heavy equipment often suffer abdominal, spinal and bone damage. A slipped disc is a complication that occurs from damage to the back bone of workers exposed to vibrations. But more frequently they suffer from stomach and digestive problems.

## Finger Injury

Not infrequently, the soft tissue injury to the fingers of workers caused by vibrating tools results after some time.

It is also sometimes called as "white fingers". Its medical term is Raynaud's phenomenon. The first indication of injury is that the fingers go numb. Your affected fingers feel numb and your hand movements are clumsy. The loss of sensibility starts in the fingertips and in serious cases, spreads upto the arms. It can be aggravated by cold because cold causes the blood vessels to constrict, which further reduces the blood supply to the affected tissues.

After regular exposure to vibrations, a worker usually shows the first symptoms after one to three years of work. A special characteristic is the considerably reduced ability of the fingers to resist cold. A far advanced injury manifests itself when fingers exposed to cold whiten and the hands often get numb.

The heavier the tool, the more hazardous the vibration. Since noise and vibration often go together, you may be exposed to a double stress.



## Preventive Measures

The source of the vibrations and the noise is to be found in the machines used.

Wherever possible, such hazardous machines must be removed from the workplace.

- \* Before employing a person for work which involves unavoidable exposure to hand vibrations, the question must be put to him if he has suffered from "white fingers" in the past or whether his fingers easily become white or blue from cold. Smokers and diabetics are particularly exposed to such a risk. That is why diabetics should never work with vibrating tools.
- \* Cold hands are more sensitive to vibration injuries than warm ones. It is necessary to warm up before starting work. A good body warmth ensures a good blood supply to the hands. Suitable gloves should be used to keep the hands sufficiently warm.
- \* The worker should get as many breaks as possible.
- \* In general, the vibration level increases if the machine is not satisfactorily serviced. Therefore, good maintenance of all working parts of the machine is of great importance.



## MILK IS USELESS

In certain industries, milk is distributed free of charge to employees as a protective measure against physical hazards in the working environment. This is a concealed fraud. Milk protects no one from specific physical hazards in the working environment. It goes without saying that milk is good as general nutrition for children and adults, but to distribute milk as protection against occupational hazards tantamounts to giving sugar-coated pills to employees. Such erroneous information implies that people are exposed to serious occupational hazards while believing that they are protected. With false sense of gratitude to the so called "philanthropic employer" the workers are often tricked. In their innocent faith they are lured to put a blind eye on all reasonable, scientific and well documented specific occupational health hazards and safety measures which must be adopted.

## SHIFT WORK

Irregular working hours inevitably create problems which have their medical and social sides. Very few people can adapt completely to shift work and irregular working hours. The conditions of such work put a great deal of pressure on those body mechanisms which govern stress and they create problems and ill health in the form of stomach and intestinal disorders as well as cardiac and vascular changes. Moreover, lack of sleep can lead to various forms of nervous complaints and reduced immunity (the body defences against infections) in a few days.

A consequence of all this is that shift work should be avoided as far as it is possible. But some jobs are such that the work must continue also during the night. In these cases, the working hours for shift working should be shorter than for others.

## HAZARDS OF VISUAL DISPLAY TERMINALS

Visual Display Terminals (V D T) are generally known as Screen Based Equipment (S B E). VDTs usually form a part of computer system, an electronic key board is attached to a T.V. like screen which displays letters and characters as you type them into the machine.

As the use of these equipments is growing in Indian offices, shops, banks, design centres and many other work places, we should be careful about hazards associated with their use.

Screen-based equipment pose several risks to health, amongst which are:

1. Cataracts of the eyes - arising from leakage of nonionizing radiation
2. Eye-strain and short-sightedness - arising from characteristics of the visual
3. Backache and muscle fatigue - arising from poorly designed work station
4. Repetitive movement-injuries of fingers, hand, arm and shoulders - arising from excessive key strokes
5. Depression and neurosis - arising from poor system of work design
6. Face rashes arising from electrical discharge
7. And the most dangerous hazard is miscarriages and birth defects, arising from X-ray emissions

Several studies in Canada have found the rate of miscarriages between 50 to 100 percent:



### MICROSCOPES CAUSE EYE DAMAGE

Eighty percent of those who do fulltime work with microscopes, have eye trouble. Most of them feel the trouble even after working time. It is sometimes difficult for them to match TV and to see clearly when driving a car; and when they try to read, the lines may merge with one another, their eyes feel hurt and they have headaches. They may suffer from other work related physical troubles like pain in their necks, shoulders and backs, etc. Their vision goes down and they use optical glasses.

## Working Posture

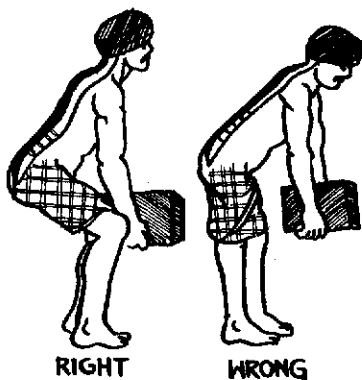
**Problems:** Incorrect working position can cause serious injuries and illhealth. Many workers are made to stand throughout the period of their work. Standing at one place for long time can cause fatigue and swelling of legs. Many workers sit in one position for the whole day, which is not good for their health. Sitting in a posture with forward bend for long periods can cause back-ache. Some loading, unloading and storing jobs require lifting heavy loads and stretching. Incorrect lifting can cause back injury.

**Prevention:** Standing all day should be avoided. Even when standing is necessary, frequent rest should be taken. Continuous standing at one place should be avoided.

Sitting posture should ensure straight back, with proper support. Unnecessary bending should be avoided. For example, women working in garment making, handloom weaving, beedi-making, and cooking enterprises, sit in a particular position for hours at a stretch which causes abdominal complaints and back sprains.

Loading and unloading should be avoided as far as possible. Even when it is essential, it should be done without putting pressure on the back. Stretching of hands and legs beyond their normal reach should also be avoided.

The important thing is to ensure that the work is organised to suit the abilities and needs of the workers.



## STRESS

Stress is a health problem caused or aggravated by conditions at work. When our body is subjected to repeated, prolonged or continuous physical or emotional stress, it reacts in such a way that we can become ill.

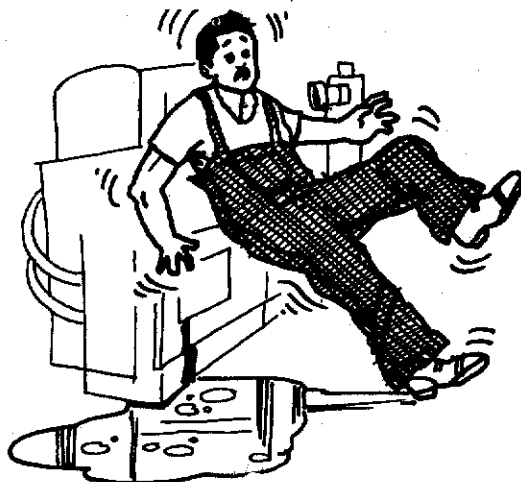
The most common stress related diseases are cold, severe headache, lack of sleep, high blood pressure, asthma, peptic ulcers and heart diseases. The first symptoms of stress are generally irritation and depression.

If the work is monotonous, lonely and repetitive, if speed of work and work load is constantly high, if there is job insecurity, then stress is also high. A recent international study conducted by ILO confirms that day to day job stress produces sickness.

## SLIPPERY FLOORS

Uneven and slippery floors are the most common sight in our work places. Water, oil, paint, grease, etc. make the floors slippery and hazardous.

Accidents caused by slippery floors are easiest to prevent. If maintenance of cleanliness and dry floors can be ensured, a majority of the accidents can be avoided.



# HOW WOMEN AND CHILDREN ARE AFFECTED

Some industries primarily employ women and children. And they are most severely affected by occupational health hazards in those industries. Examples of some such industries are beedi-tobacco, electronics, brick-kiln, match/fireworks, etc.

## Beedi-Tobacco Workers

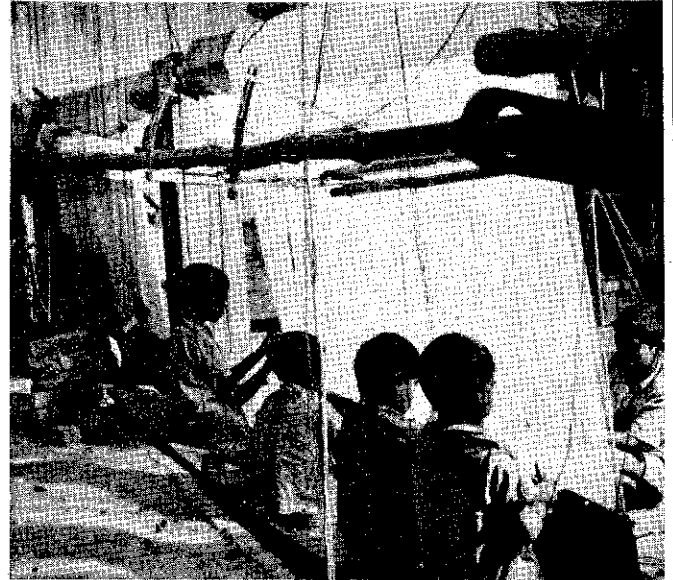
National Institute of Occupational health recently conducted a study of Beedi workers in Gujarat, situated in and around Nadiad. Here small factories employ about 10-15 workers, and large factories about 80 workers. In each factory, three types of operations are carried out: Pulverisation of the dried leaves, sizing, and filling up in large bags. Most of the operations are undertaken by women workers inside a room or shed.

100 workers participated in the study, out of which 74 were female. The exposed workers had symptoms like vomiting, giddiness, headache, tiredness, loss of appetite, etc. These symptoms occurred due to tobacco dust exposure. 69 workers out of these 100 reported these symptoms. And since women workers are involved in the processing of tobacco, it affected them most.

The average value of air concentration of nicotine in the examined factories during the working hours was  $1.18 \text{ mg/m}^3$  more than twice the permissible limit.

## Electronic Workers

Electronics industry is one of the fastest growing industries in India. It employs mostly women workers as they



are regarded as innately better at intricate, monotonous, eye-straining work which is typical of electronics production. Thus the hazards mostly affect the women workers, in this industry.

Electronics is one of the most dangerous industries in terms of degree of workers' exposure to a number of acids, solvents and gases. In the tin plating section, the temperature is extremely high; workers there often breathe in dangerous fumes with obnoxious odour from chemicals. In the moulding section, workers often experience dizziness and vomiting. In bonding section, workers use microscopes continuously and thus develop eye-sight problems within a few years. In ceramics section, the temperature is always very low. Management provides a thin uniform and cap to workers. So the worker often develop cold and even bronchitis.

### Brick Kiln Workers

Brick Kiln industry in India is the backbone of construction enterprise. According to one estimate about 30 lakh workers are employed in Brick Kiln industry in the country.

A Brick Kiln worker can be found standing on the furnace even during the sun of May-June and mixing water and mud during extreme cold of January. This is coupled with high exposure to dust throughout the working period. Consequently, workers suffer from cough and cold, heat stroke and respiratory diseases. At the age of 30, they begin to look old.

Women work in this industry in large numbers. They are most severely affected by these hazards. Many pregnant women workers have had abortion while working.

Detailed information about the health hazards to Brick Kiln workers does not exist. Only recently, a systematic investigation of this issue has started.

### Match Workers

Sivakasi, a small municipal town in Ramanathanpuram district of Tamilnadu, is

known for its match production. More than one lakh workers are employed in the match and fireworks here. Half the workers are children below the age of 15 years.

The working conditions in these factories are extremely unsafe and hazardous. They work in cramped environments with hazardous chemicals and inadequate ventilation. Dust from chemical powders and strong vapours in both the store room and bath room are obvious at every site.

They handle several dangerous chemicals: Zinc Oxide (which causes metal fume fever after being absorbed through the lungs and respiratory system), Antimony (which can cause eye irritation, sore throat, headache, nausea, vomiting, diarrhoea) and phosphorous (which can cause phossy jaw and damage to bones).

These are all highly explosive materials which cause frequent explosions and fires, killing and disabling hundreds of workers.

No systematic study to investigate the various health hazards in this industry has been conducted so far.



## **OCCUPATIONAL DISEASES**

This chapter has two major parts. The first one contains occupational diseases caused by dust. These include cotton, silica, asbestos, mica and wood.

The second part focuses on occupational diseases caused by chemicals. This happens in three ways--by inhaling the fumes, by contact with chemicals, and by swallowing the chemicals. It contains special focus on solvents, dermatitis, cancer-causing materials, welding, etc.



# COTTON DUST

## The Problem

If you have a job where cotton is handled or processed in an enclosed workplace, your health may be in danger from exposure to cotton dust.

Inhaling cotton dust over a period of time can cause a variety of health problems and, in many cases, can lead to a severe respiratory disease called "Brown Lung" or "Byssinosis".

## Cotton Dust-What it is and how it can affect you?

Cotton dust gets into the air during the handling and processing of cotton. It is present whenever raw cotton is used. Raw cotton comes not only in bales but also as floor sweepings and other wastes emanating from cotton processing operations. In addition to cotton fibre or lint, Cotton dust may also contain fungi and fungal spores, pesticides and minute fragments of various plant components. The invisible particles of cotton dust are what you need to worry about, the particles that are small enough to enter your lungs when you breathe. So although the air in some workplaces looks clean, cotton dust may still be present in amounts large enough to affect your lungs.

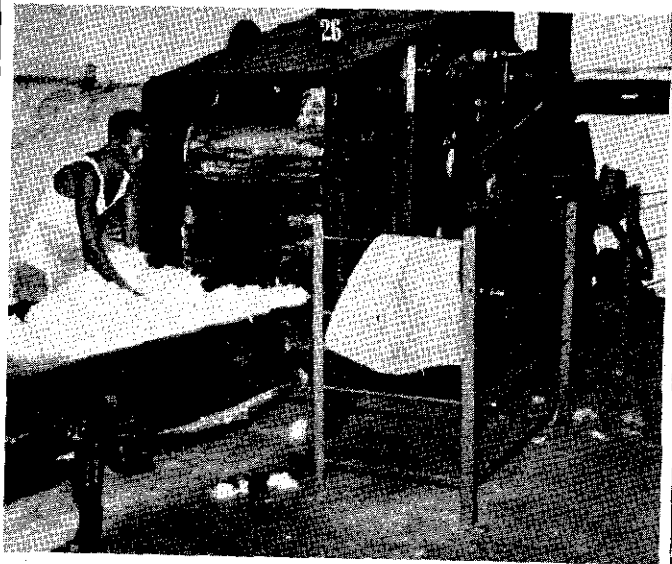
The disease begins as a simple irritation of the bronchial airways. Workers exposed to large amounts of cotton dust over a period of time may start having breathing trouble.

In early stages, Brown Lung victims suffer from cough, tightness of chest and shortness of breath, upon return to work on Mondays. These symptoms may disappear later in the week, but this does not mean

that the condition is not harmful.

However, in this early stage, the effects may be reversible if the affected worker is removed from the dusty room and posted elsewhere. In order to save other workers from falling ill with brown lung, the dust control measures in the work place where he fell ill be must made more **stringent** and dust monitoring be done more frequently, carefully and regularly. In absence of any such preventive measures as described, these reactions to cotton dust exposure can get worse and one can finally develop a serious respiratory disease called 'Byssinosis', or 'Brown Lung disease'. The symptoms stated above extend to other work days and finally they become more severe and continuous, resulting in total and permanent disability. If dusty conditions in the work room are not urgently remedied, not one but many workers in the shop floor become simultaneously affected.

You can't recover from an advanced stage of Brown Lung disease (byssinosis). In most cases it is permanent, and it can cripple and ultimately kill you.



In an effort to describe brown lung's peculiar characteristics, a British physician Dr. Schilling graded its stages:

- Grade - 0 - No symptoms of Byssinosis.
- Grade -  $\frac{1}{2}$  - Occasional chest tightness on the first day of the work.
- Grade - 1 - Chest tightness and/or breathlessness on every first working day.
- Grade - 2 - Chest tightness and/or breathlessness on the first and other working days.
- Grade - 3 - permanent incapacity results because of reduced breathing capacity.

Many cotton mill workers whose breathing problems have been diagnosed by unsuspecting physicians as Emphysema, Asthma or Bronchitis, probably in fact are the cases of Byssinosis in its various stages of development.



## What Causes Byssinosis ?

Byssinosis is associated with cotton dust. The cause may be found in cotton fibres. Workers in the dustier parts of the mill are most likely to contract the disease.

Diagnosis of byssinosis is based on symptoms, occupational history, and measurements of diminished lung function during exposure. Because the disease primarily affects the function of the lung rather than causing a specific change in its structure, it is not diagnosable by chest X-ray.

## The Doctor's Mistake

Doctors may or may not be knowing about byssinosis. Instead of telling workers that they have byssinosis, doctors often refer to their condition as bronchitis, asthma or emphysema. They neglect to tell workers that they are victims of byssinosis. Many doctors say that they were never trained to diagnose Byssinosis.

In Great Britain, a Byssinosis Act was adopted as long ago as 1948 and workers have been paid worker's compensation upon early retirement for the past almost four decades.

The owners and managers of the textile industry have a big stake in suppressing the facts about brown lung.

The workers do not connect the pain in their chests, the coughing, the shortness of breath with the air they breathe on the job. They can't smell what is causing the disease. They can't feel it. They can't see it - even if they can see clouds of cotton lint in the air. The dust that damages the lungs is too small to be seen by the naked eye.

Studies show that about one-fourth of active textile workers have lung problems related to breathing the cotton dust.

These conditions demand action. Textile workers in India have been enduring

unhealthy working conditions for too long. They must not be required to give up their breath to make a living. They are entitled to an environment free of hazards of brown lung disease. And those who have been already victimised by this disease surely have the right for prompt and equitable compensation.

### Brown Lung is Preventable

Brown Lung disease can be prevented. The mills can be cleaned up. The technology has been developed. The equipment is available. All that is needed is strict enforcement of standards limiting the amount of dust in the atmosphere of work places to which workers can be exposed without harm. And effective enforcement of rules requiring the industry to sample the air regularly for analysis and record it and to report the same to the employees and their representatives.

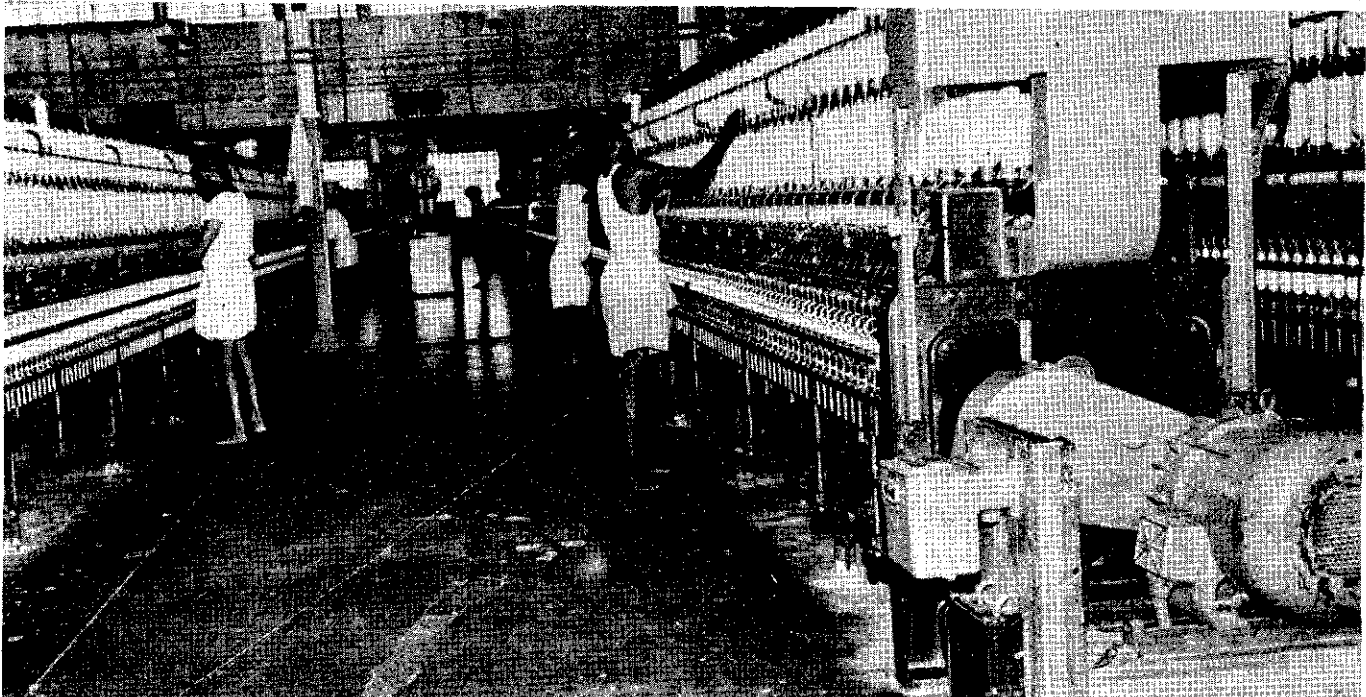
### What should be Done ?

1. Potential employees in cotton mills should have pre-employment physical examinations, including pulmonary functions tests; definite reactors to cotton dust who can be identified before employment, should be placed

in jobs where there is little exposure to cotton dust.

2. There should be regular medical surveillance of the workers at risk; any one who develops signs of respiratory distress should be transferred to areas where dust is not a problem.
3. Machinery capable of screening out fine as well as large dust particles should be installed in high - risk areas so that the respirable quantity of cotton dust does not exceed its recommended TLV (less than 1 mg./cubicmetre of air).
4. Provision of high efficiency dust respirators to workers exposed to high dust jobs.

But, like anyother obstructive lung disease, once the lung is damaged, it will never completely repair itself. If a person stops working in the dust very early, before permanent lung damage occurs, he/she can recover. But once the lung functions impairment is advanced (beyond stage 2), there is no cure. Only symptomatic treatment . aiming to make breathing easier is possible for him/her.

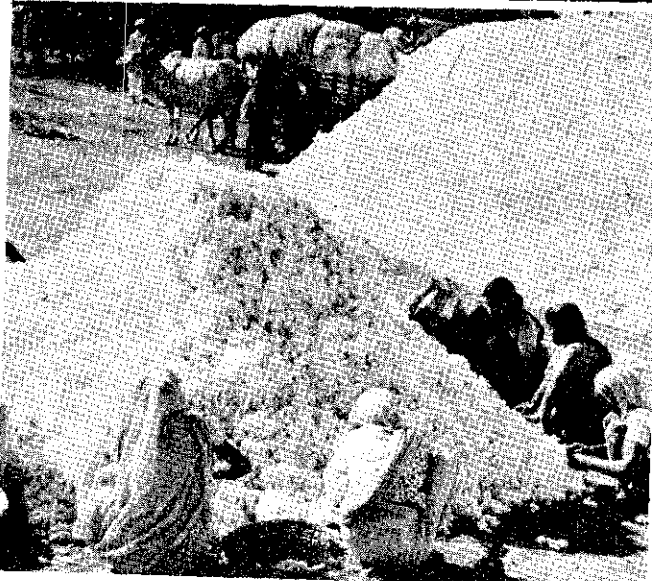


## HISTORY OF BYSSINOSIS

- 1746: Coughing among flax and hemp workers first documented By Dr. Ramazzini, the "father" of occupational medicine.
- 1908: French and British scientific reports show presence of, lung disease among textile workers. The characteristic symptom - Monday morning chest tightness.
- 1933: U.S. Scientists say there is no byssinosis among U.S. textile workers.
- 1942: Britain introduces compensation for byssinosis victims.
- 1960: 9 British doctors found byssinosis among cotton textile workers of USA.
- 1966: America fixed cotton dust level at 5mg/m
- 1972: First American cotton textile worker received compensation for byssinosis.
- 1976: It is estimated that 1.5 lakh American textile workers (19 percent of the total) share byssinosis. More than 3.5 disabled due to this disease.
- 1980: After a long struggle between managements and unions of textile industry, American government reduced the permissible cotton dust level to 2mg/m . At this level of cotton dust it is estimated that 13 percent of the workers will get byssinosis.
- 1984: About 30 percent of the 10 lakh Indian textile workers are estimated to be suffering from byssinosis.
- Byssinosis becomes a compensable disease under worker's compensation Act in India.

### Politics of Occupational Health:

After two hundred years of discovery of byssinosis, it is still disabling and killing a large number of textile workers.



# SILICA DUST

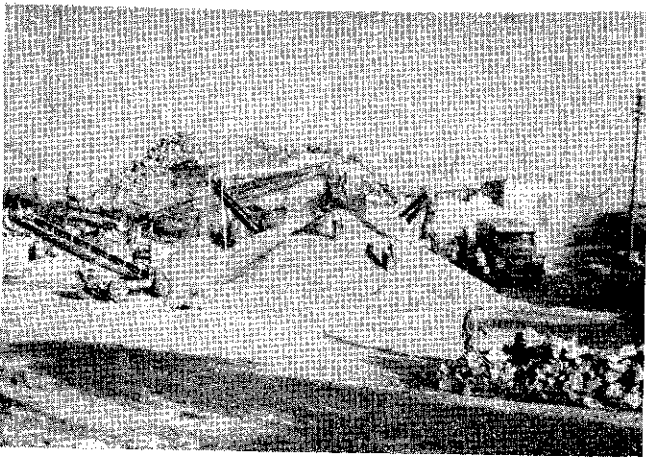
Silicosis is the medical name of miner's disease caused by long term inhalation of invisible dust containing Silica particles. It is popularly known as Black lung among coal miners. The disease develops insidiously and is not felt until it is too late. The symptom is an increased shortness of breath during physical exertion.

## Dust and How it Affects you ?

Silicosis is still one of our most serious occupational diseases. It is incurable. This means grave invalidity and, in more serious cases, slow suffocation leading to death.

Silicosis has been known for many centuries and largely preventable yet it has not been eradicated.

Silicosis can be caused by something seemingly as inoffensive as dust. When this dust is inhaled the smaller dust particles penetrate into the finest parts of the lungs. This reduces the ability of the lungs to supply the body with the necessary oxygen.



In the very first phase the person with the illness does not notice any symptoms but gradually feels more and more tired, easily becomes breathless, etc. and the heart finds it more and more difficult to function because of the reduced oxygen supply. In more serious cases, this means slow suffocation. The horrible thing is that the disease continues to develop even after the person suffering from Silicosis has already stopped working in dusty conditions. On an average, it takes about 10 to 15 years for the first symptoms to appear, obviously depending on the amount of dust inhaled. The disease is often noticed among workers engaged in dusty occupations at the age of 50 to 60 years, but may appear in younger age group also.

When a person has already inhaled dust containing fine silica particles for several years and lung deterioration has started, there is a greater risk for catching another devastating illness - tuberculosis of the lungs - which by itself alone takes a heavy toll of life in our country. In case of an industrial worker, the cause of death is often described as tuberculosis but in fact the work environment may have been the original culprit where the person inhaled dust containing silica, that subsequently prepared the fertile background for bacteria to merrily grow in the lungs and rapidly destroy them eventually killing the worker in a course of few years.

## Where the Hazardous dust is found ?

The disease is caused by dust particles containing silica particles which are smaller than 5 micromillimeter and invisible to the eye. At higher temperature, the silica is transformed

to tridymite or cristobalite which are even more dangerous.

Dusts which may cause silicosis can be found in Steel works, mainly in the steel dressing shops, at demolition work involving furnaces and converters, bricklaying of ladles, in Smelting plants and foundries, in furnace and ladle work care removing; as well as in sand-blasting, mining, stone crushing, pottery work, quarrying, powder painting, stone and metal grinding and puttying etc. One must also be aware of the fact that there are other pollutants at some of the above mentioned workplaces which combined with each other, may further impair the worker's health.

### Preventive Measures

Those who have worked in an environment as described above and been exposed to dust which may cause silicosis must have their lungs X - rayed soonest possible. Those who have even traces of lung injuries must be transferred, immediately, because any further continuation of working on their part in an environment with abundant Silica particles all around means an aggravation of their disease with risks for further complications in the form of tuberculosis, and with limited health care possibilities - an actual death sentence.

The doctor must tell, everyone having symptoms, about his/her condition and give accurate information on the consequences for the future. It goes without saying that the person concerned must be given immediate facility of transfer from the section so that the damage already established in his lungs is not any further allowed to aggravate, which is certainly avoidable.

Those who are suffering from silicosis must get their occupational injury registered and receive occupational injury indemnity.

The trade union should demand for measures by the employer to eliminate the hazard. Numerous measures can be taken.



### What the Unions should Check

- \* Material containing large quantities of silica should be replaced as soon as possible.
- \* Dust generating work processes should be carried out in special, isolated premises.
- \* Dust binding substances should be used, e.g. water jet in mines and rock drilling, use of mist projectors and electrostatic precipitators when and where found suitable.
- \* Dust sources should be encased and spot - ventilated and filtered so that the dust is not spread any further.
- \* The work premises should be cleaned carefully and regularly.
- \* This can be done by vacuum - cleaning. In such a case the vacuum cleaners must have a special filter which takes up the dangerous dust. Do not dry - sweep. Machines and tables should also be cleaned every day.

- \* Ventilation ducts, separation and fans should be cleaned regularly.
- \* Dust sources and ways of dispersion should be mapped out.
- \* Dust measurements should be made regularly and recorded.
- \* Respiratory protective devices should be considered and provided as 'emergency measure', to be used only during temporary, short-term work

assignments such as repairs and cleaning. The protective devices must be capable of stopping the hazardous dust. Dust filters protect only against dust. If gases, smoke, etc. are present, a combination filter is necessary. Also make sure, that the filters be changed regularly.

Personal protective equipment is not the long term solution; the source of dust must be tackled.



## BLACK LUNG

Coal mines are inherently unhealthy places to work. Not only in underground mines, but also in open cast quarries where giant earth movers are at work, the workers inhale large amount of coal dust, fumes, and gases which cause many diseases, mainly respiratory in nature. They include influenza, asthma, emphysema besides stomach and lung cancer and hyper-tension. The most fatal of all respiratory diseases is pneumoconiosis, commonly known as black - lung. It is incurable. It is caused by the inhalation and retention of coal dust in the lower lungs.

Dust is produced during various industrial activities like blasting, grinding, drilling and crushing, etc. The very minute size (0.2-10.2 microns) itself makes it highly reactive, both

chemically and biologically. And it becomes more toxic than its parent lump from which it has been disintegrated. Because of its small size, these particles do not settle down and remain suspended in the air for quite a long time.

It has been found that the various operations at the mechanised coal mines can not only generate more dust but they reduce the size of the dust particles to a minimum. And these tiniest particles are more dangerous. Scientists have estimated that particles which are retained in the alveoli (the gas exchanging sacs of the lung) weigh 5 micrograms or below. These particles are termed as respirable dusts -- the cause of black lung.



# ASBESTOS

## What is it ?

Asbestos is the name given to a peculiar complicated mineral substance containing magnesium, silicate, iron, calcium, sodium, and other minerals as its contents. It is silky and fibrous in nature and can be woven like textile into cloth like material. Depending upon its mineral composition, asbestos is available in nature in several varieties. The most common type is called Chrysotile (or white asbestos), which accounts for about 90% of world production of total asbestos. The next most common form is Crocidolite (or blue asbestos). Then there are other varieties viz: amosite, actinolite, tremolite and anthophyllite.

## How it affects you ?

It has been known for a long time that chronic inhalation of asbestos particles at work place causes an occupational lung disease called as asbestosis, which means a gradual obstruction and damage to the lungs. It can be fatal due to suffocation or overtaxing of the heart.

The asbestos dust can pass through the natural filter system of the nostrils and the mucus lining of the airtubes and make its way into the lower lobes where they become impacted in the respiratory bronchioles and beyond. It later on leads to fibrous thickening of the walls of the alveoli and turns the elastic tissue of the airsacs into rigid fibrous tissues. It may primarily affect the pleura leading to its thickening and formation of cartilaginous or calcified islands over it, which are known as "plaques".

Common symptoms of asbestosis are insidiously progressive breathlessness and sometimes dry cough at night or in the morning. A

considerable decrease in capacity for work is a consequence. In some cases where chronic bronchitis also simultaneously develops, the cough may be accompanied by mucoid or mucopurulent sputum.

X-ray examination of workers exposed to asbestos has shown many to be suffering from thickening of the pleural sac, with pleural plaques and haziness of the lung tissue particularly in the lower zones. Subsequently, lung cancer and mesothelioma of the pleura may be found to develop in these cases.

Incidence of lung cancer in patients suffering with asbestosis has been found to be about 10 times higher than in the general population.

The most chilling discovery was a connection between asbestos exposure and Mesothelioma - a formerly extremely rare and always fatal cancer of the pleural membrane or rarely of the peritoneum which encase the lungs and abdominal organs respectively.

It has been found that of all the varieties, crocidolite or "blue asbestos" is the most dangerous one, because of its cancer producing propensities.

Efforts have been made to make easier and earlier diagnosis of asbestos diseases possible and to learn the mechanisms by which asbestos fibres cause cancers of varied types.

## Where it is found ?

Asbestos has more than 3000 applications. This is so because of its resistance, flexibility, heat insulating properties and low price.

Asbestos is used chiefly in the following products:

- \* Asbestos cement
- \* Construction tiles of asbestos cement
- \* Asbestos cement pipes
- \* Insulation compounds
- \* Packing and gasketing
- \* Friction material
- \* Textiles
- \* Floor Tiles
- \* Plastic material
- \* Filling and reinforcement materials
- \* Caulking, levelling and surfacing compounds
- \* Asbestos Cardboards
- \* Asbestos paper
- \* Insulation boards
- \* Filter felt
- \* Brake lining, etc.

### High Incidence of Asbestosis in India

Recent studies from different parts of the country indicate a high incidence of asbestosis:

1. In a survey of an asbestos cement unit in Faridabad, Central Labour Institute (Bombay) found that out of 850 workers, 58 (about 7 percent) suffered from asbestosis and 58% experienced changes in the functioning of the lungs.
2. A similar study of 800 workers of Asbestos Cement Ltd. Bombay conducted by the National Institute of Occupational Health (Ahmedabad)

revealed that out of 800 workers, 224 suffered from more advanced stages of asbestosis. While the management flatly denied these figures, the study also noted that another 128 workers had contracted the disease as well, although it had not reached an advanced stage.

It is estimated that, at least, one-third of the workers in asbestos factories are suffering from asbestosis.

### Symptoms of Asbestosis

- \* Difficulty in breathing
- \* Crackling sound during breathing
- \* Breathlessness on exertion
- \* A dry cough
- \* "Finger Clubbing" - (thickening around the base of the nails).
- \* Weight loss

### Asbestos harms the children most

Affective measures must also be taken to protect those who live near asbestos work sites. Asbestos must not be spread to the outer environment.

### What the Law says ?

With intensifying debate and growing consciousness about the health hazards of asbestos, in an amendment in 1976 to the Factories Act of 1948, asbestosis has been incorporated as a notifiable disease in India.

The Schedule 14 of the Factories Act, applies to Asbestos. It requires proper exhaust, dampening and separation while working on asbestos. It also requires proper health checkups and maintenance of records.

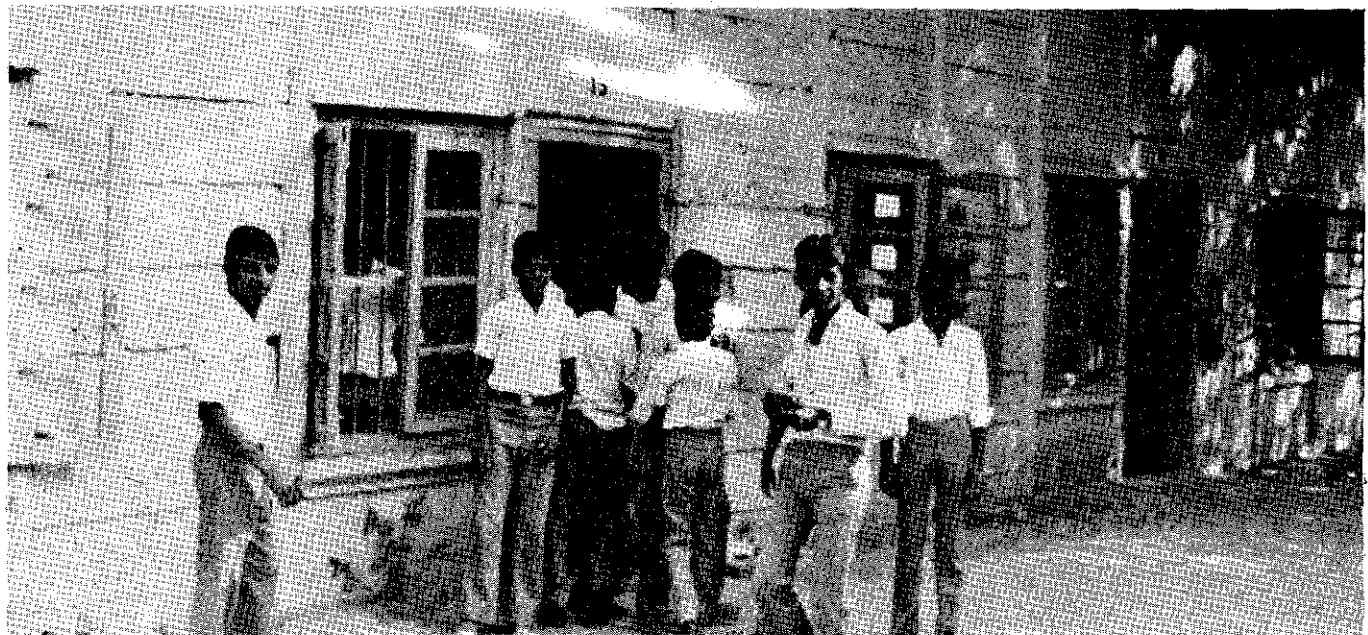
#### What Needs to be done ?

Improved engineering designs for the work-places in old asbestos industries with vacuum exhaust ventilation should be brought into practice. The workers through audiovisual aids, pamphlets, posters and meetings, etc. should be properly educated to be very particular in taking personal precautions and maintaining hygiene. They should not take the asbestos handling lightly. No foods and drink be taken in work place and/or stored in utensils contaminated or lined with asbestos. If need be, personal protective devices e.g. masks, gloves, goggles, head cover, etc., must be used where there is likelihood of temporarily heavy dust generation, in the work zone or even outside the work-place in closed or open space. Only those new machines should be allowed to be installed in which dusty process is completely enclosed and fully automated.

Asbestos must be urgently replaced by a less hazardous substance.

It has been banned in several Western countries; workers' should struggle for a similar action in India.

Till then, strict vigilance is called for. Strong union action alone can ensure protection of workers.



## HISTORY OF ASBESTOSIS

1899: Fibrosis of the lungs of an asbestos worker described by a Scottish doctor from a postmortem examination.

1930: In Britain, asbestosis named and recognized as a major industrial hazard.

1947: British Chief Inspector of Factories reports that lung cancer is associated with asbestos exposure.

1959: Mesothelioma, a rare cancer of the lung, is found among South African asbestos miners.

1968: Asbestos discovered in one-fourth of workers at an Indian asbestos cement factory.

1970: United States government sets asbestos standard at 5 fibres per cubic metre of air (5/M<sup>3</sup>).

1976: United States reduced standard to 2 fibres/M<sup>3</sup> due to pressure from workers. Use of Asbestos Cement in U.S. discontinued.

Johns - Manville, leading multi-national asbestos company closes 4 plants in U.S. It collaborates with Shree Digvijay Cement Co. Ltd. in its asbestos - cement factory at Ahmedabad.

1977: 11 factories in India produce total of 501,000 tonnes of asbestos-cement products.

1978: U.S. government bans use of asbestos in pipes.

1980: It is estimated that 1 lakh of the 10 lakh present and former asbestos workers in the U.S. will die of cancer.

1981: Times of India reports that 35% of Bombay asbestos workers have asbestosis.

From 1976-1981, imports of asbestos fibres into India rose by almost 50%.

Sweden bans asbestos cement altogether. Workers at Hindustan Ferodo, a large factory producing asbestos brake and clutch linings, strike for 7 months for better working conditions.

India notified asbestos as killer disease under the Factories Act.

1982: Britain bans many asbestos products. After public outcry following a television documentary on asbestos workers, British Government plans to reduce asbestos standard to 0.5 fibres/millilitre of air.

1984: As many as 11,000 workers are employed in India's 19 asbestos factories. Estimates of lung disease among them range up to 50%.

Asbestos mines continue to operate in Bihar, Andhra Pradesh and Rajasthan, producing 20,000 tonnes per year.

Politics of Occupational Health: After eighty years of discovering asbestosis, asbestos is still used and produced in India.

# EXPORT OF HEALTH HAZARDS

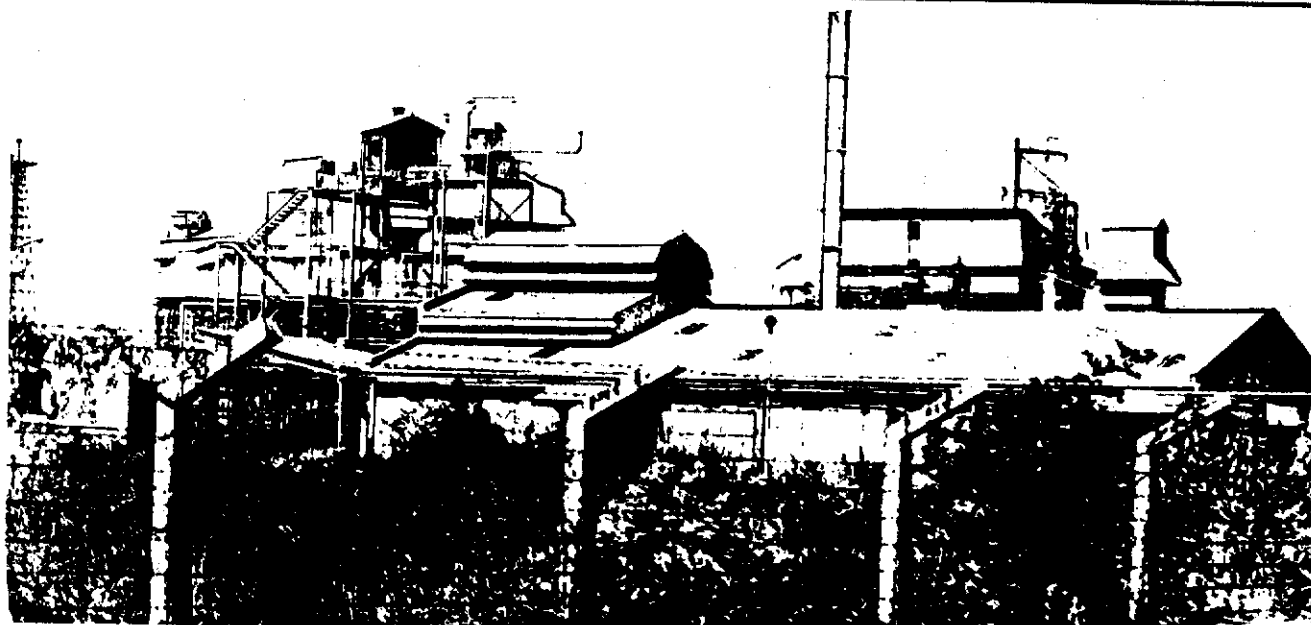
The struggles of workers in ensuring Occupational Health and Safety have had many positive impacts in several Western countries. In countries like Great Britain and USA, government regulations on maintaining standards of health and safety have also become rather stringent. As a consequence, many companies are trying to shift production of hazardous substances to other Third World countries. In this process, they are exporting health hazards to the developing countries

A concrete example of this can be seen in the case of Asbestos. The growing awareness against Asbestos production in America has lead to American multinational companies shifting production of Asbestos to a country like India. Shri Digvijay Cement Plant and Hindustan Ferado are two such examples, and Asbestos industry in India has been growing despite increasing awareness of its hazards in the West. The same situation exists in respect of chemical dyes. Indian Dye

Industries and Amar Dye-Chem are two examples of export of hazardous dye production process to India from the West. Import of second hand machinery from the West also brings in the possibility of increased accidents. Out-dated technology and obsolete machinery are being dumped in the country.

Another interesting example of export of health hazards can be seen in a textile factory in Malaysia owned by the Birla Group. When the workers in this factory complained of cotton dust, noise, chemical and safety hazards, they were told that worse conditions existed in India.

These trends point towards the urgent need for building linkages across unions and worker organisations in different parts of the world. It is only through continuous exchange of information and international solidarity that such trends of exporting health hazards can be resisted by the workers.



# MICA DUST

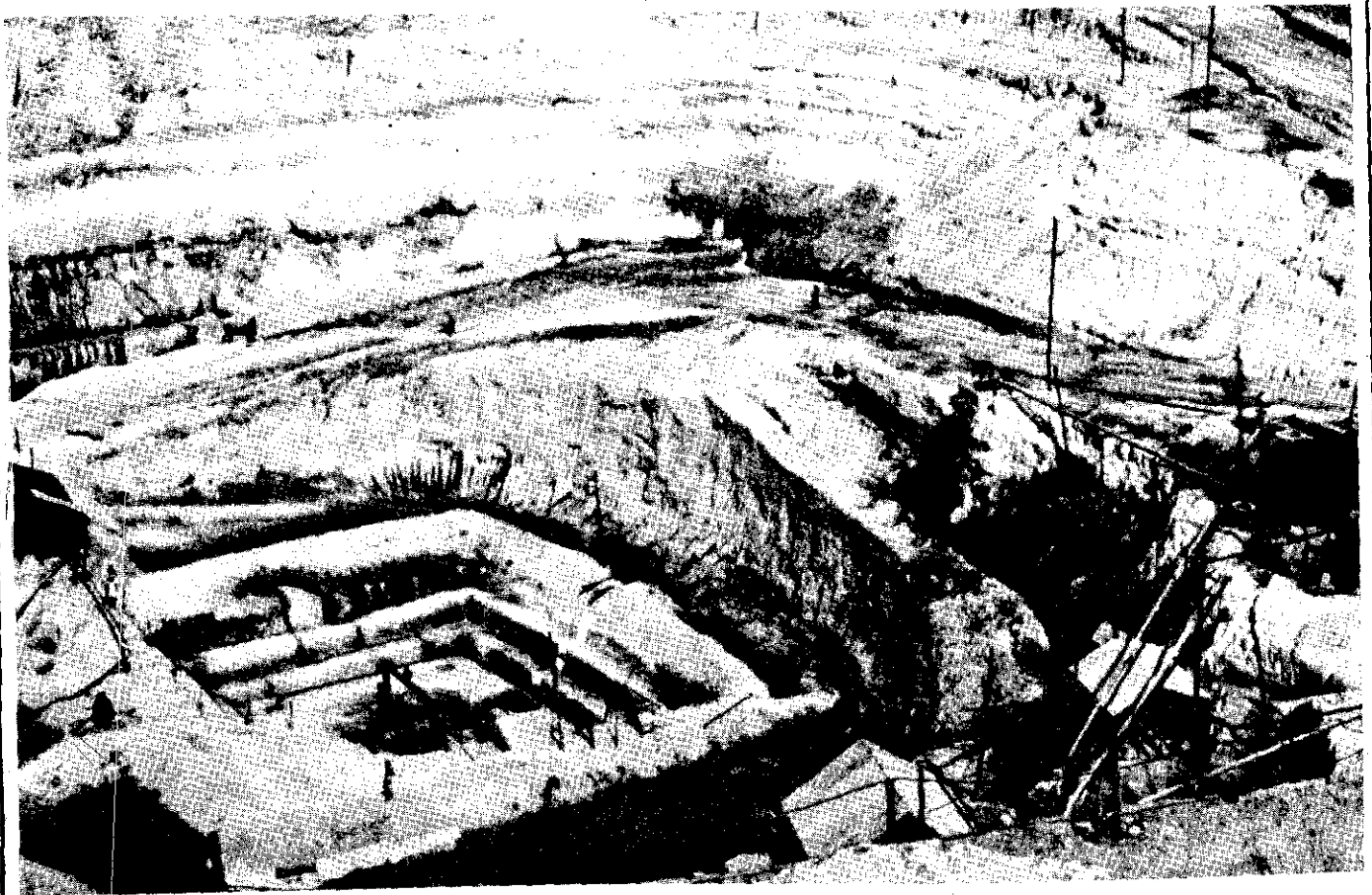
Mica is a mineral that is mainly used in manufacturing glass and ceramics, electrodes and insulation for electrical wires and machine parts.

Workers in mica mines and manufacturing side are exposed to its dust. This dust can damage workers' lungs through breathing. Mica dust causes scars in lungs, pain in the chest and shortness of breath. It also causes irritation to eyes and skin.

Mica dust can be controlled through ventilation and wet methods of handling. The proper ventilation system can keep

mica dust away from the workers.. While sweeping or moving the mica, it can be done in the Wet state which largely eliminates dangers of mica dust inhalation by the workers handling it.

Regular checking of air samples from the workplace is needed to monitor the level of mica dust. A proper health programme to periodically conduct chest X-ray and lung function test for mica workers is also important. Workers with a history of chronic lung disease should not be exposed to mica as it can aggravate their illness.



# WOOD DUST

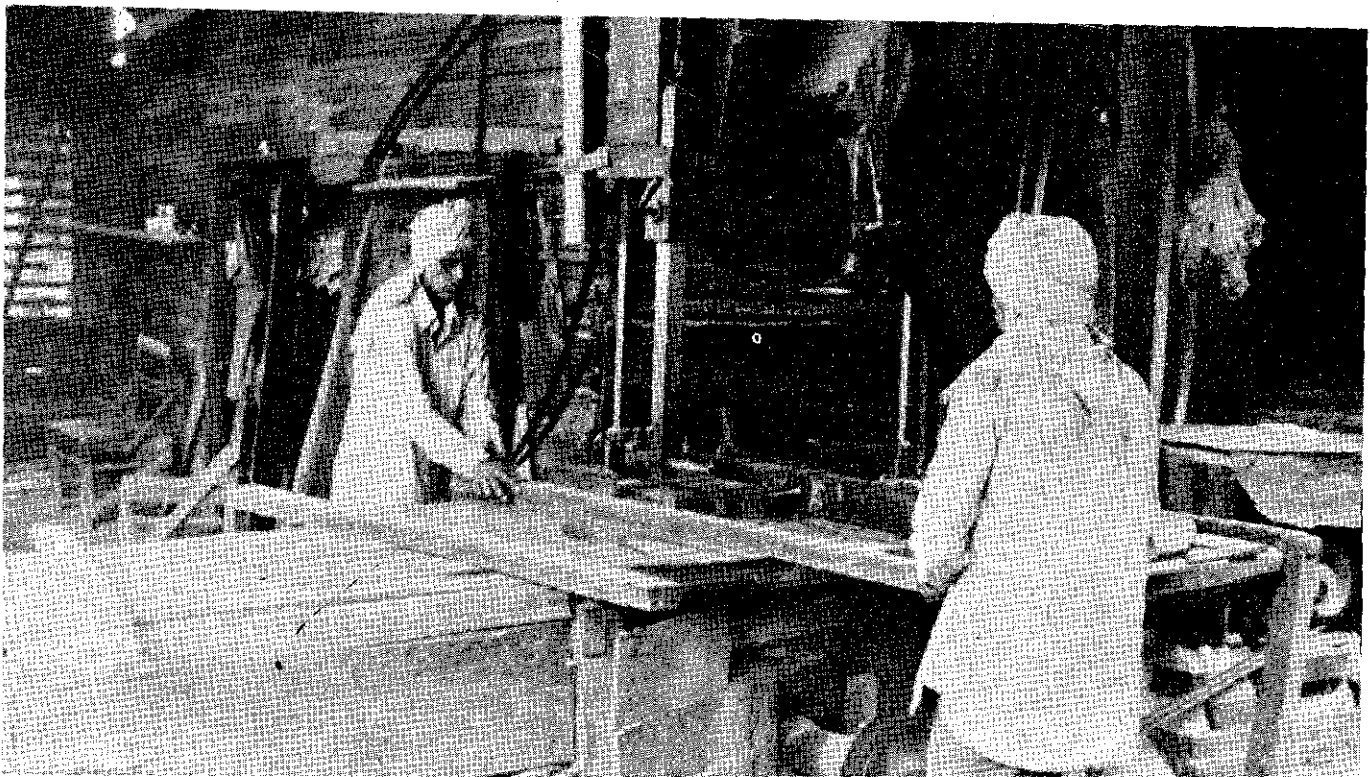
Wood dust is a major problem in the furniture and wood work industry.

Workers who are constantly exposed to it can suffer from various harmful effects. When inhaled, the dust enters the air passages and lungs causing chronic irritation and disorders of the respiratory passage. Decreased breathing capacity is a common symptom.

A number of scientific studies show that wood dust causes Nasal Cancer (cancer inside the nose).

It is also responsible for skin irritation (rashes on the hands and other parts of the body) and various allergic reactions.

To eliminate health hazards related to wood dust, steps should be taken to prevent the dispersal of dust from machinery and equipment. Proper ventilation, continuous cleaning and use of personal protective devices can reduce the hazard of wood dust.



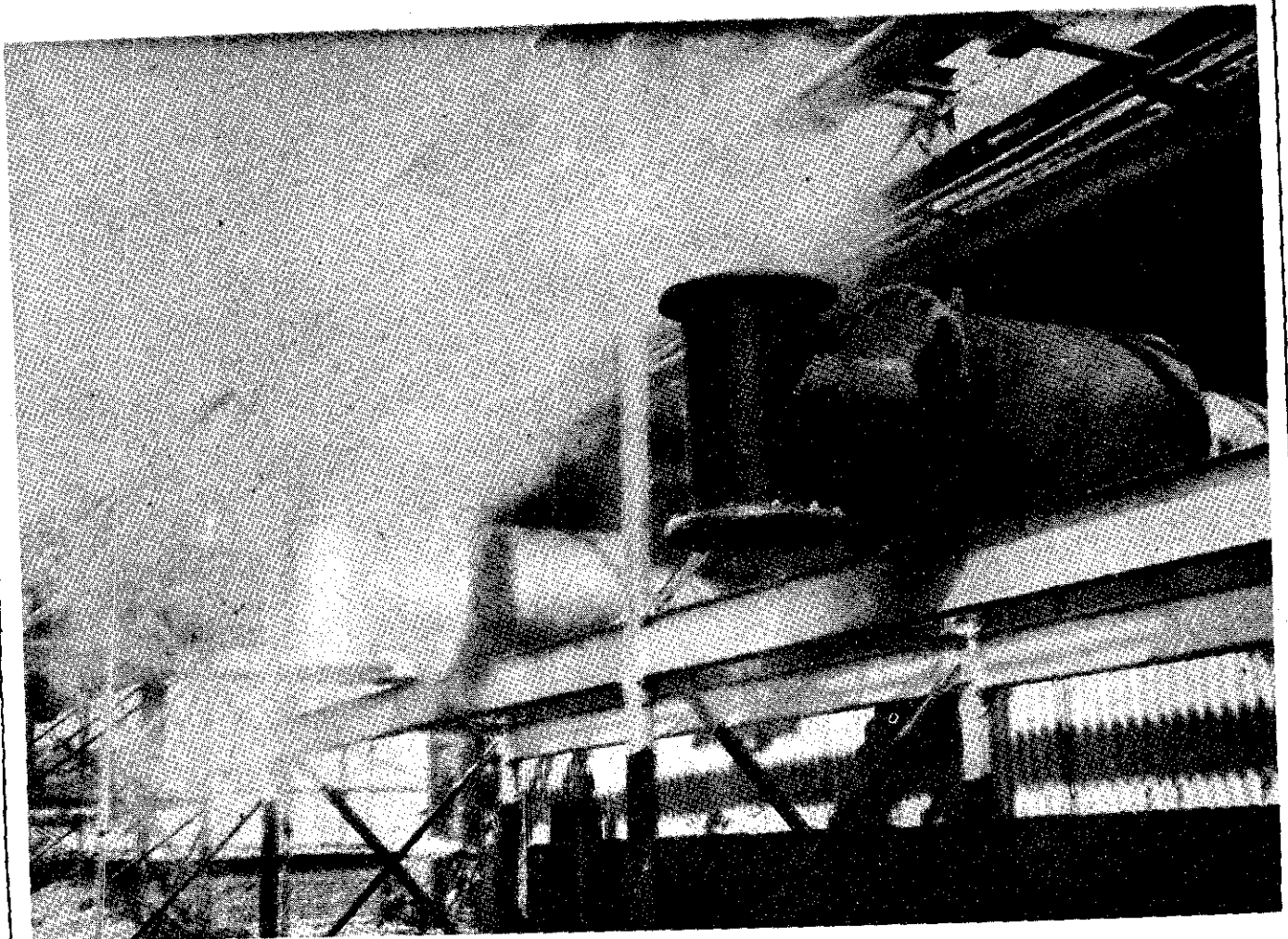
# HAZARDOUS WORK ENVIRONMENT KILLS SMOKERS

Many workers suffering from respiratory diseases including lung cancer, have been told by the doctors that smoking is the cause of their illness.

Smoking is no doubt harmful. But smoking alone is not responsible for the respiratory diseases among workers.

The fact is that hazardous work environment is much more responsible for

respiratory diseases in workers. Hence, a serious investigation of work environment is crucially important, if a large number of workers appear to be suffering from respiratory diseases in a work place. Smoking may only aggravate these diseases, but hazardous work environment causes these diseases among non-smokers as well.



# CHEMICAL HAZARDS

## What is it?

Workers need to be aware of possible damage to health arising from the use of chemicals at work. The dangers to health due to chemical and other toxic substances are potentially much greater than those from accidents. Harmful effects are not always obvious. It has been estimated that there are approximately twenty lakh chemical compounds. Only a small number of these have been tested thoroughly enough for their dangerous properties to be known. Nothing is actually known about a large number of chemicals. You will certainly find that some potentially harmful substances are used at your workplace.

Chemical hazards may exist in one or more of the following ways:

- \* during the manufacture of a substance
- \* by its nature a manufactured product or substance itself might be poisonous.
- \* it may produce harmful ingredients in storage
- \* in the handling and use of substance
- \* in the disposal of waste products.

## What are the different forms of toxic materials?

The form of a substance greatly determines as to how it can get into the body, and what damage it can cause. Moreover, this form can also change during the production process, so we may have to ask: How is the substance used? Could this usage affect or alter its ability to cause damage?

The main forms of toxic materials are:

- \* Solids
- \* Dusts
- \* Liquids
- \* Vapours
- \* Gases



## How are we affected?

Usually there are three ways in which toxic substances find their entry into the body. Often a substance can simultaneously get in by more than one route.

### Inhalation:

This is by far the most common route through which toxic substances get absorbed at work place. Dusts, gases and vapours can all find their entry through inhalation, wherefrom they can be absorbed into the blood stream and taken to many different parts of the body.

### Skin Contact:

Some substances (e.g. acids and alkalies) may attack the skin directly. These are often called 'Corrosive' substances. Some others irritate the skin (e.g. certain cutting oil) and can cause dermatitis (skin disease), and possibly skin cancer after prolonged exposure; other substances (e.g. phenol or nitrobenzene) easily penetrate the skin and enter the blood stream.

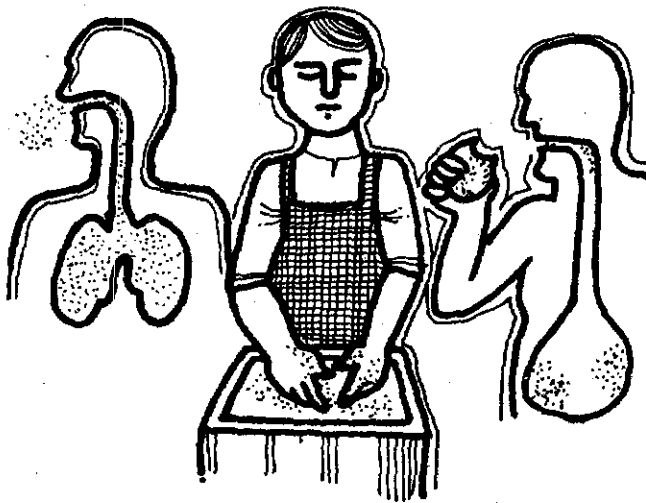
### Ingestion:

It means the swallowing of a toxic (poisonous) substance. This

route is less common, but can occur through eating or drinking in the presence of contaminants.

A chemical can enter the body and cause injury in several ways:

Breathing      Skin Contact      Swallowing



Our bodies have a considerable capacity to tackle the dangerous substances. It is primarily the liver and kidneys which do this work, but if conditions at workplaces are such that the body is exposed to a chemical over a prolonged period of time, it will be unable to render it harmless. Some of such substances may be then stored up in the body and can cause various injuries. Lead and Cadmium are among this type of substances which can cause severe poisoning to our body. It takes a long time for the body to deal with lead by throwing it out; and, in the case of cadmium this does not, in fact, occur at all.

### What these chemicals can do to our body?

The answer to this question depends upon as to when an effect occurs -- immediately (acute) or some time after

single or repeated (chronic) exposures to the chemical:

\* acute poisoning -- is often discovered quickly and has short - term effects which may be followed by recovery or permanent damage. The common symptoms are dizziness, headaches, vomiting, irritation to eyes, nose, dry cough, feeling of suffocation, injury and irritation of skin, rashes, etc.

\* chronic poisoning

If the body takes in a dangerous substance over a long period of time, this can lead to chronic poisoning. The onset of symptoms is gradual and, therefore, may go unnoticed. In some cases this could be 20 or 30 years after exposure.

A simple example can illustrate the difference between acute and chronic effects:

The acute reaction to alcohol is drunkenness. Heavy doses may produce vomiting and unconsciousness.

The chronic reactions to alcohol may include addiction (alcoholism) and liver damage.

The distinction between acute and chronic effects is vital to an understanding of hazards from chemicals at work. These two types of effects may be qualitatively and quantitatively quite different, and protecting against acute effects alone may not be sufficient enough to effectively control the chronic effects of the said substance.

Both acute and chronic poisonings can result in permanent injury. But in most of the cases the injury can be of a passing nature, if the exposure is not massive and steps are taken to ensure that the person exposed to the substance does not come into contact with it again. However, the nature of substance, amount

and route of exposure, health status of the worker (in females-pregnancy) and the rapidity at which first aid was available are some major determinants for the extent of injuries and degree of damage to health experienced by a worker following contact with the toxic agent.

Apart from the timing of the body's reaction to a substance, the following types of damage should be considered:

\* Poisoning

Some substances have a direct and destructive effect on human tissues and bodily functions. Strong acids and alkalis damage the tissues on direct contact. Other poisons can be absorbed into the body; and they attack internal organs, for example liver, kidneys, brain, lungs, heart, stomach and urinary bladder, etc.

\* Sensitisation and allergies

Some substances do not cause harm when first used, but the body gets sensitized to them. It can develop a reaction to them if used later. Allergic reactions can range from rashes, to extensive superficial skin damage, cough and breathlessness to asthmatic type of attacks, fits and seizures.

\* Fire and explosions

Many chemicals and substances are flammable, particularly when present in gas, vapour or dust forms.

A list of common toxic substances and their effects is provided.



\* Unborn Children

A number of substances do not harm adults but can affect unborn children, especially in the early stages of pregnancy.

\* Cancer

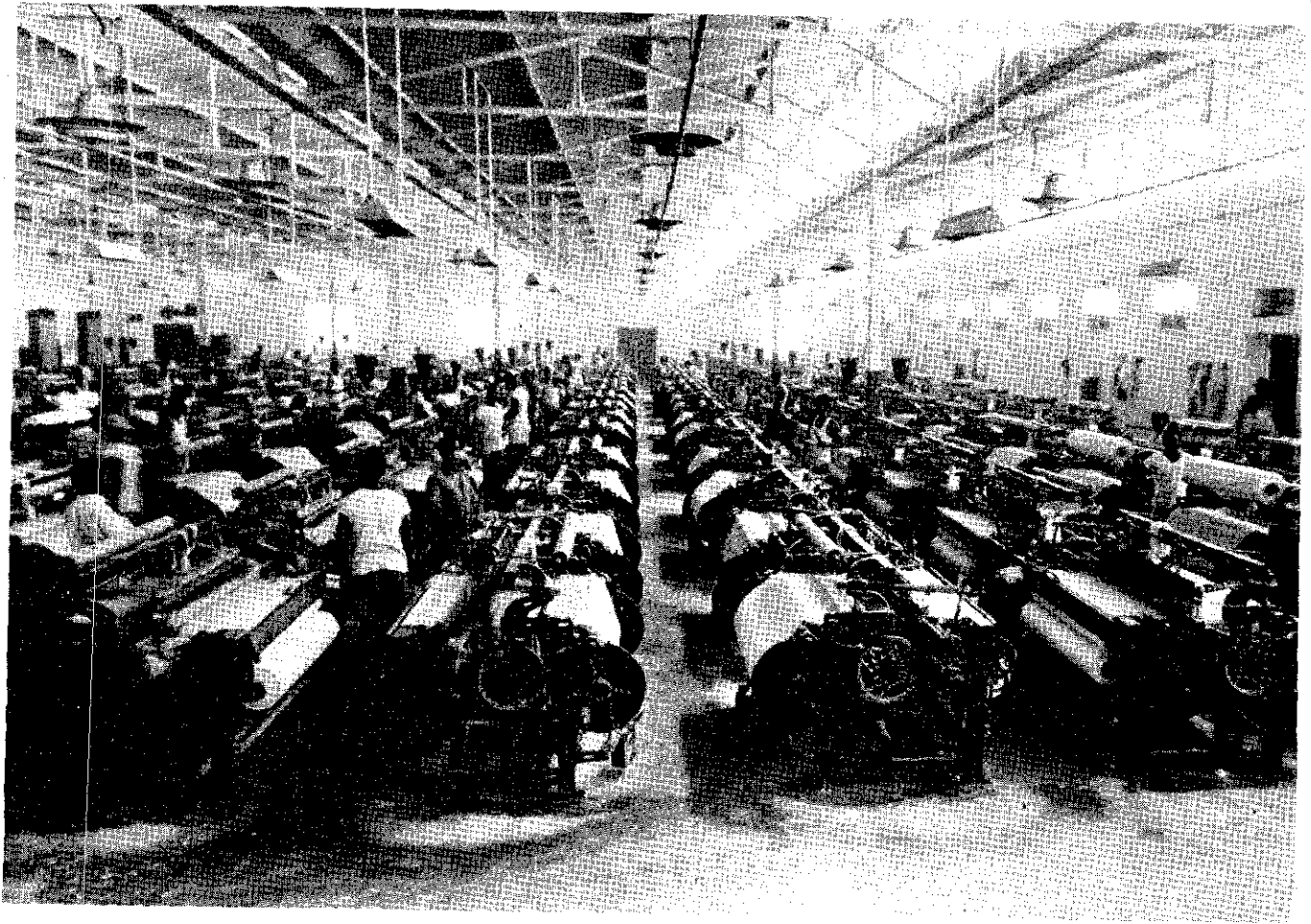
A number of industrial substances can cause Cancer. They are known as "Carcinogens". A list of common occupational carcinogens is provided.

### OCCUPATIONAL HAZARDS AND CHILDBIRTH

Extended exposure to various chemicals and radiations can be hazardous during pregnancy and child birth. Extended exposures to radiation (viz. X-rays), and mercury is known to cause impotence and low fertility. Exposures to Inorganic Lead can cause abortion among pregnant women. Several chemicals like Trichlorethylene and Anesthetic gases can cause birth defects in new born children of mothers who are exposed to them.

Many other chemicals have been shown to be causing reproductive defects. While full knowledge of this is still not available, it is now certain that extended exposures to the following can endanger reproduction:

Carbon Monoxide, Carbon disulfide, Chloroprene, Chlorodiphenyls, benzene, toluene, xylene, DBCP pesticide, vinyl chloride gas.



# COMMON OCCUPATIONAL CARCINOGENS

| AGENT                                                                                   | ORGAN AFFECTED                             | OCCUPATION                                                                                                                                |
|-----------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Wood                                                                                    | Nasal cavity and sinuses                   | Woodworkers                                                                                                                               |
| Leather                                                                                 | Nasal cavity and sinuses; urinary bladder  | Leather and shoe workers                                                                                                                  |
| Iron oxide                                                                              | Lung; larynx                               | Iron ore miners, metal grinders and polishers; silver finishers; iron foundry workers                                                     |
| Nickel                                                                                  | Nasal sinuses; lung                        | Nickel smelters, mixers, and roasters; electrolysis workers                                                                               |
| Arsenic                                                                                 | Skin; lung; liver                          | Miners; smelters; insecticide makers and sprayers; tanners; chemical workers; oil refiners; vintners                                      |
| Chromium                                                                                | Nasal cavity and sinuses; lung; larynx     | Chromium producers, processors, and users; acetylene and aniline workers; bleachers; glass pottery, and linoleum workers; battery makers; |
| Asbestos                                                                                | Lung (pleural and peritoneal mesothelioma) | Miners; millers; textile, insulation, and shipyard workers                                                                                |
| Petroleum, petroleum coke, wax, creosote, anthracene, paraffin, shale, and mineral oils | Nasal cavity; larynx; lung; skin; scrotum  | Contact with lubricating, cooling, paraffin or wax fuel oils or coke; rubber fillers; retort workers; textile weavers; diesel jet testers |
| Mustard gas                                                                             | Larynx; lung; trachea; bronchi             | Mustard gas workers                                                                                                                       |
| Vinyl chloride                                                                          | Liver; brain                               | Plastic workers                                                                                                                           |
| Bis-chloro-methyl ether, chloromethyl/methylether                                       | Lung                                       | Chemical workers                                                                                                                          |
| Isopropyl oil                                                                           | Nasal cavity                               | Isopropyl oil producers                                                                                                                   |

Coal soot, coal tar, other products of coal combustion

Lung; larynx; skin; scrotum; urinary bladder

Benzene

Bone marrow

Auramine, benzidine, alpha Naphthylamine, beta-Naphthylamine, magenta, 4-Aminodiphenyl, 4-Nitrodiphenyl

Urinary bladder

Gashouse workers, stokers, and products; asphalt, coal tar, and pitch workers; coke oven workers; miners; still cleaners

Explosives, benzene, or rubber cement workers; distillers; dye users; painters; shoemakers

Dyestuffs manufacturers and users; rubber workers (pressmen, filtermen, laborers); textile dyers; paint manufacturers.

Source: National Cancer Institute, USA



# COMMON TOXIC SUBSTANCES

| Toxic Substance | Common Source of Exposure                                                                                                                                     | Adverse Health Effects                                                                                                                                             |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acetone         | Paint thinner; glue.                                                                                                                                          | See "solvents".                                                                                                                                                    |
| Acrolein        | Vehicle exhaust; other burning.                                                                                                                               | Excessive irritation of skin and mucous membranes of eyes and respiratory tract.                                                                                   |
| Ammonia         | Cleaning; blueprinting; heat treat (nitriding furnace); coke oven by-product.                                                                                 | Irritation of respiratory passages, cough and shortness of breath, pulmonary edema, bronchitis, severe irritation of eyes, conjunctivitis, caustic action on skin. |
| Asbestos        | Manufacture of brake shoes; insulating materials (both installing and maintenance); plastic fillers.                                                          | Severe lung injury; cancers of the lungs, stomach, colon, and lining of the lungs.                                                                                 |
| Benzene         | Solvent; contaminant in toluene and other hydrocarbon solvents; coke oven emissions.                                                                          | Anemia, blood damage, leukemia, see also "solvents".                                                                                                               |
| Beryllium       | Grinding of spot weld guns; machining beryllium metal; machining of die cast ram tips;                                                                        | Metal fume fever, severe lung injury, cancer.                                                                                                                      |
| Brass           | Non-Ferrous foundries, welding with brass.                                                                                                                    | Metal fume fever (influenza-like reaction), may also contain lead.                                                                                                 |
| Cadmium         | Brazing; silver solder ; plating; welding on plated or some alloy steel.                                                                                      | Loss of appetite , weakness, nausea, vomiting, rapid pulse, inflammation of lungs, cough, soreness of chest. Metal fume fever chemical pneumonitis, emphysema.     |
| Carbon monoxide | Gasoline exhaust; untuned propane exhaust; foundry cupolas; faulty furnaces and burn-off from molds in foundries; any burning of carbon containing materials. | Headache, nausea, dizziness, slow pulse, redness of skin, weakness, dimness of vision, coma and death. Long term effects on heart, vision, and memory.             |

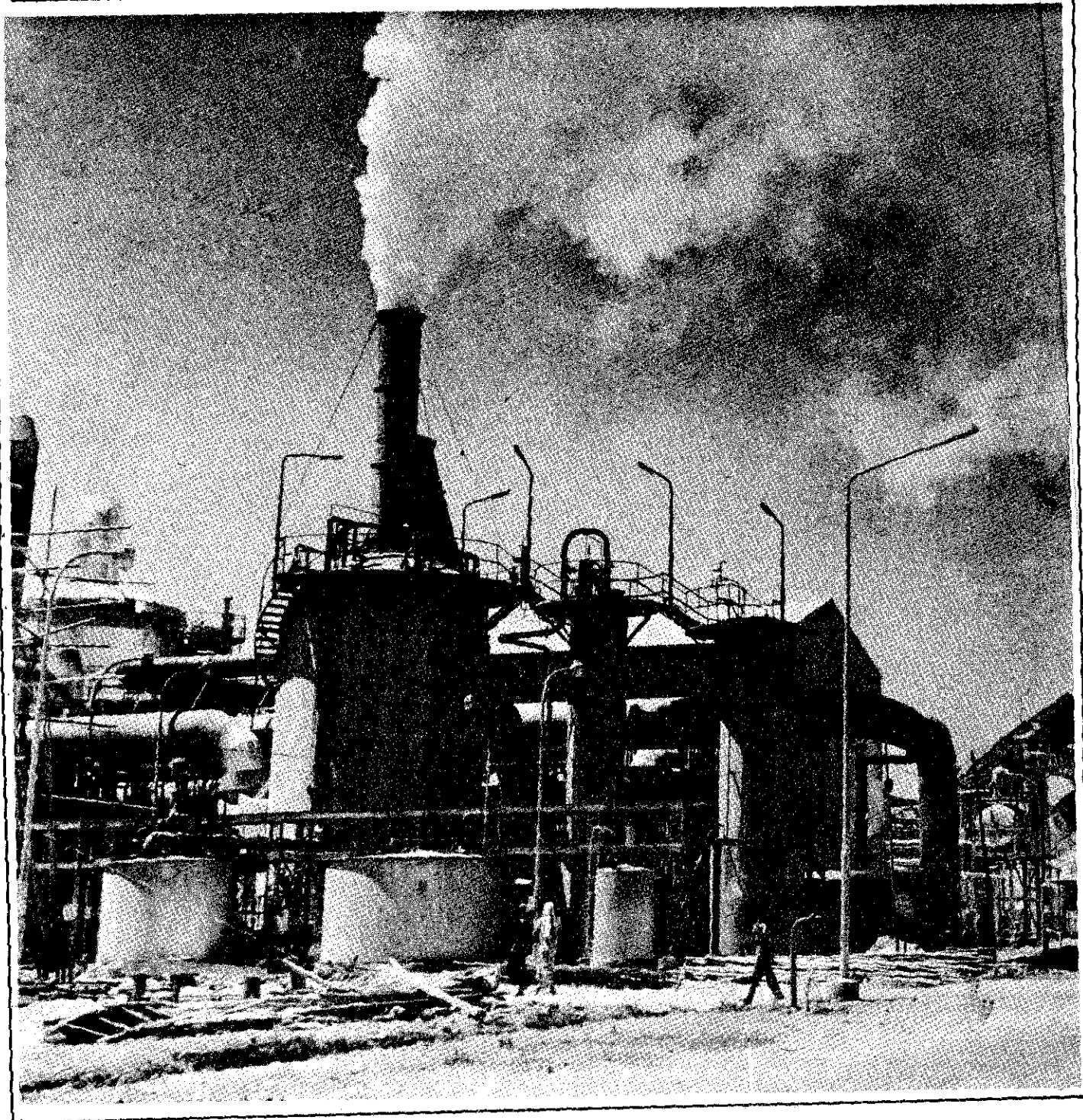
|                                 |                                                                                                                          |                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Chromates                       | Pigments in brightly colored paints; spraying and sanding these paints.                                                  | Lung cancer, skin ulcerations.                                                                                                                     |
| Chromic Acid; Chrome Metal Fume | Plating; etching; metal cleaning; welding stainless steel.                                                               | Irritation and ulceration of mucous membranes; skin damage; perforation of nasal septum.                                                           |
| Cutting Fluids (Oil Mist)       | Machining operations.                                                                                                    | Skin irritation; chemical pneumonias; possible lung and skin cancer; chemical additives to fluids raise additional unresearched problems.          |
| Ethylene dichloride             | Gluing plexiglass.                                                                                                       | Liver and kidney damage, see also "solvents".                                                                                                      |
| Epoxy                           | Gluing operations; metal surfacing (powdered form).                                                                      | Skin disease and sensitization; Lung disease and sensitization (powdered form). Some epoxy chemicals cause nausea, lung damage, and kidney damage. |
| Fiberglass                      | Car body mock ups, insulation; boat manufacture, especially dangerous when ground or cut up with power tools.            | Skin irritation, lung irritation; possible lung cancer (depends on size of fiber).                                                                 |
| Fluorides                       | Stick Welding (coating on rod contains fluorides); fluxing molten aluminium or zinc.                                     | Respiratory irritation, chills, fever, shortness of breath, cough. Long term exposure may affect the bone structure or cause kidney damage.        |
| Gasoline                        | Engine fuel; wipe-off.                                                                                                   | See "solvents"; lead gasoline has a lead hazard.                                                                                                   |
| Hydrochloric Acid               | Pickling tanks, plating, metal treating, fluxing aluminum.                                                               | Violent coughing, shortness of breath, bronchitis, destruction of teeth, contraction of throat, coma, caustic action on skin.                      |
| Hydrogen Sulfide                | By-product of oil refining and waste water treatment, chemical and dye manufacture.                                      | Irritant to eyes and respiratory tract, foul "rotten egg" odor, lung disease, nerve damage.                                                        |
| Isocyanates (TDI, MDI, HDI)     | Used in making polyurethane foam, polyurethane paints, insulating material, certain core-making operations in foundries. | Asthma-like attacks, tightness in chest, difficulty in breathing, reduces lung capacity over period of time.                                       |

|                                      |                                                                                                                             |                                                                                                                                                                                                                                                                                                           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lead                                 | Storage battery manufacture; soldering operations; spraying and sanding lead based paints; non-ferrous foundries; ceramics. | Fatigue, irritability, sleeplessness, pains in joints, stomach pains, damage to blood forming systems, anemia, kidney damage, nervous system damage, sterility and birth defects.                                                                                                                         |
| Mercury                              | Electrical apparatus manufacture; fungicide in paints.                                                                      | Inflammation of gums, loss of teeth, thyroid problems, nervousness, irritability, kidney damage, brain and nervous system damage, personality changes.                                                                                                                                                    |
| Methyl Alcohol (Methanol)            | Solvent.                                                                                                                    | Blindness, abdominal pain, liver damage, and see "solvents".                                                                                                                                                                                                                                              |
| Methyl Ethyl Ketone (MEK)            | Solvent, cleaning agent, thinner in paints and glues.                                                                       | See "solvents".                                                                                                                                                                                                                                                                                           |
| Methylene Chloride (Dichloromethane) | Paint stripping; cleaning; degreasing.                                                                                      | Affects the blood, see also "solvents".                                                                                                                                                                                                                                                                   |
| Naptha                               |                                                                                                                             | See "solvents", can also contain benzene.                                                                                                                                                                                                                                                                 |
| Nitric Acid                          | Plating; pickling, metal stripping; descaling.                                                                              | Irritation of air passages, spasmodic cough, bronchitis, feeling of suffocation, pain in chest, digestive disturbances, depression of the central nervous system and severe burns on the skin.<br><br>Continued exposure to diluted fumes is said to cause chronic inflammation of the respiratory tract. |
| Oil Mist                             | Machining operations.                                                                                                       | See "Cutting Fluids".                                                                                                                                                                                                                                                                                     |
| Oil Smoke                            | Heat treat, forging, burning or welding on oily stock, burn-off from oily engines.                                          | Contains irritating and cancer-causing chemicals.                                                                                                                                                                                                                                                         |
| Ozone                                | Welding, electric arcing.                                                                                                   | Irritation of eyes and respiratory tract, headache, cough, pulmonary edema.                                                                                                                                                                                                                               |

|                                           |                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perchloroethylene<br>(Tetrachlorethylene) | Degreaser, cleaning agent.                                                                                                                                                                                                                                                                          | Liver damage, possible kidney damage, see also "solvents".                                                                                                                                                                                                                                                                                                                                                                            |
| Polychlorinated Biphenyls (PCB's)         | Transformers; capacitors; heat transfer systems; fire retardants.                                                                                                                                                                                                                                   | Chloracne, pigmentation of skin and nails, swelling of eyelids, visual disturbances, liver damage, cancer                                                                                                                                                                                                                                                                                                                             |
| Silica                                    | Foundries, ceramics, porcelain-coating operations, glass making.                                                                                                                                                                                                                                    | Obstructive lung disease, emphysema, silicosis.                                                                                                                                                                                                                                                                                                                                                                                       |
| Solvents                                  | Paint and glue thinners degreasers, cleaning agents. Four classes can be distinguished:<br>1) Aliphatic hydrocarbons (glues and cold cleaning)<br>2) aromatic hydrocarbons (glues and paints),<br>3) chlorinated hydrocarbons (degreasing and cold cleaning),<br>4) polar organics (paint solvents) | All solvents can dry and irritate the skin with continuous contact causing skin disease. All solvents affect the nervous system causing headaches, nausea, dizziness, sleepiness, drunkenness, unconsciousness and death. Solvents can irritate the eyes and mucous membranes. Most solvents are easily absorbed through the skin. Some solvents cause permanent nervous system damage, kidney and liver damage, and possibly cancer. |
| Styrene<br>(Vinyl Benzene)                | Used in making plastics; polyester lay-up and fiberglass lamination.                                                                                                                                                                                                                                | Strongly irritating to eyes and upper respiratory tract, headaches, nausea, and skin irritation.                                                                                                                                                                                                                                                                                                                                      |
| Sulfur Dioxide                            | Burning of some die lubricants, combustion of sulfur-bearing coals and petroleum fuels.                                                                                                                                                                                                             | Irritation of mucous membranes, irritation of lungs, bronchitis, shortness of breath.                                                                                                                                                                                                                                                                                                                                                 |
| Sulfuric Acid                             | Plating; metal cleaning; battery recharging; battery plant forming operations; automotive emissions.                                                                                                                                                                                                | Skin irritation and damage, irritation to mucous membranes, irritation to lungs, shortness of breath, decay of teeth.                                                                                                                                                                                                                                                                                                                 |
| Talc                                      | Paint, rubber & ceramic industry.                                                                                                                                                                                                                                                                   | Lung disease, may also contain asbestos as an impurity.                                                                                                                                                                                                                                                                                                                                                                               |
| Toluene                                   | Thinner in glues and paints; cleaning agent.                                                                                                                                                                                                                                                        | May contain benzene as a contaminant, see also "solvents"                                                                                                                                                                                                                                                                                                                                                                             |
| Trichloroethane<br>(Methyl Chloroform)    | Cleaning solvent & vapor degreasers                                                                                                                                                                                                                                                                 | See "solvents".                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Trichloroethylene                         | Cleaning solvent & vapor degreasers                                                                                                                                                                                                                                                                 | See "solvents", possibly also cancer.                                                                                                                                                                                                                                                                                                                                                                                                 |
| Turpentine                                | Paint thinner                                                                                                                                                                                                                                                                                       | Kidney damage, see also "solvents".                                                                                                                                                                                                                                                                                                                                                                                                   |

|              |                                                                                      |                                                                                                         |
|--------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Welding Fume | Welding                                                                              | Lung damage, other hazards depending upon type welding, type steel, type rod, and any coating on steel. |
| Zinc         | Welding on galvanized steel, brass foundries, powdered metal operations die casting. | Metal fume fever (flu-like attack) nausea.                                                              |

Source: United Auto Workers, U.S.A



# METHYL ISOCYANATE

MIC is a colourless liquid.

It is used in the production of polyurethane foams and plastics. Its more common use is as an intermediate chemical in the last stage of pesticide (carbaryl 1) or drugs manufacture.

Exposure takes place through inhalation and skin absorption. Its TLV (1977) was set at 0.02 ppm.

Even extremely low level of exposure may trigger an asthmatic response. The first effect of exposure is watering of the eyes and damage to the cornea. Inhalation blocks the nasal and bronchial passages and the larynx. It can also bring about asthma, bronchitis, pneumonia, pulmonary infection and other respiratory ailments. Heavy exposure causes death by suffocating spasms (muscular contractions) of the tubes carrying air to the lungs, or by drowning as body fluids released by the irritating gas accumulate in the lungs.

Victims who have survived the exposure of this gas are likely to be more susceptible to lung infections, kidney failure and liver complications. It can cause ulceration of cornea (permanent blindness), brain damage and lung

cancer. It causes pulmonary edema and viral respiratory infections.

MIC has no antidote and no treatment. About the only way doctors can deal with anyone who survives significant exposure is to supply oxygen and administer sedatives and painkillers.

Several firstaid steps are possible:

1. Eye-wash with large amounts of water, occassionally lifting the lower and upper lids.
2. Wash contaminated skin with water.
3. Artificial respiration if breathing has stopped.
4. Give the person affected, large quantities of water. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit.

Steroids may be administered on a short-term basis (2 to 4 days) to decrease the inflammatory response of the lung. Some experts suggest the use of Sodium Thiosulphate as an useful antidote.



### How Methyl Isocyanate Affects Humans

The gas vapor has an unpleasant odour and burns upon contact with any moist parts of the body exposed to air. If inhaled or swallowed in sufficient quantities, death may result.

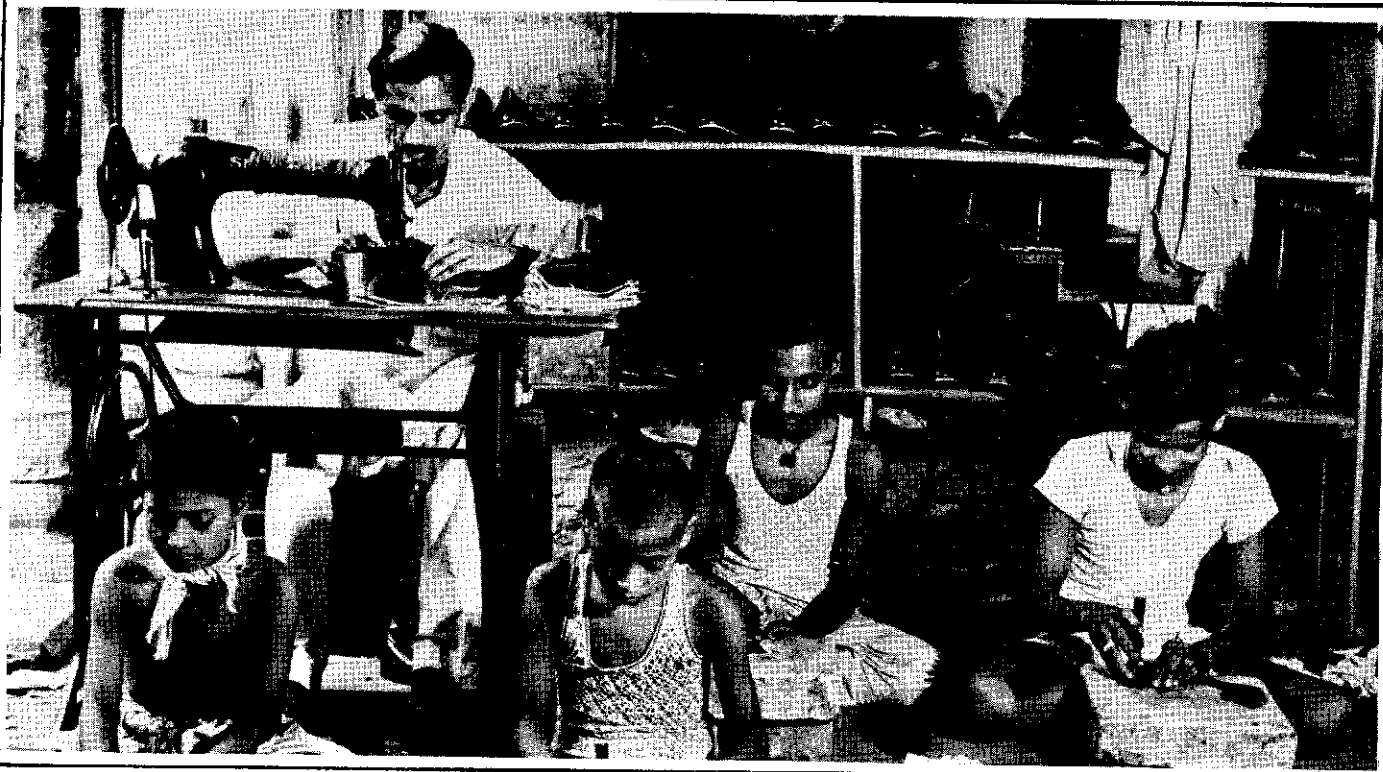
Constricts the nasal passages making breathing difficult, sometimes extremely painful, even through the mouth.

Irritates the eyes causing tears and possibly permanent damage and blindness.

Irritates the skin and corrodes the tissue causing redness, swelling and severe or permanent injury.

Swells throat tissues, also constricting breathing and causing violent coughing attacks.

Swells and fills the lungs with blood causing suffocation.



# THE HAZARDS OF SOLVENTS

## What is the hazard ?

Workers in practically all occupations are exposed to solvents, the hazards of which they frequently do not know. Solvents are liquids in which inks, varnishes and adhesives, etc., are made; they have the ability to dissolve other substances, particularly greases and fats. Solvents are used in paint manufacture to suspend pigments, dissolve oils and as thinners to dilute the paint and reduce its viscosity.

All solvents are poisonous. There is really no such thing as an "absolutely safe solvent." Some solvents are worse than others, but every solvent should be treated with great suspicion.

Solvents evaporate rapidly. Evaporation means that the substance becomes part of the air that we breathe in. It then travels through the lungs into the blood to the internal organs, e.g. the brain and liver. Solvents in general, pose a hazard to the central nervous system, they can damage the brain and cause incurable nervous disorders, cause liver and kidney injuries, malformation of the foetus and possibly leukemia. Some solvents also aggravate heart and vascular ailments.

## How it affects us ?

Generally speaking, solvents can damage the body in four ways by causing:

1. Skin disease
2. Irritation of Eyes, Nose and Throat
3. Narcotic effects on the nervous system
4. Damage to the internal organs.

## Skin Disease

All solvents can cause skin disease (dermatitis) by dissolving the naturally present protective oil barrier film over the skin. If the skin has enough direct contact with a solvent, it can turn dry and white and can develop cracks and fissures.

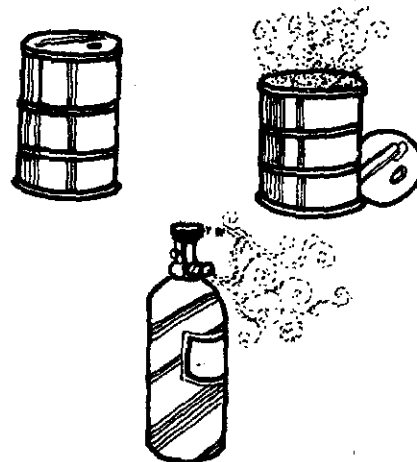
Usually the solvents can penetrate the skin and enter the bloodstream. Some solvents are noticeably irritating on contact, but others may not cause any sensation or pain even while they are penetrating the skin.

## Irritation of Eyes, Nose and Throat

All solvents can irritate the sensitive membranes of the eyes, nose and throat. The airborne concentration at which this occurs varies from solvent to solvent.

## Narcotic Effect on the Nervous System

All solvents can affect the nervous system through what is known in technical terms as "Narcosis" or "depression of the Central Nervous System" (CNS). It is actually the brain itself which is affected by the solvent and this in turn leads to a variety of symptoms.



## Damage to Internal Organs

Many solvents have been known for years to cause damage to the internal organs, primarily the liver and kidney e.g. carbon tetra chloride. Recent medical research is showing that more organs are affected than previously thought.

### The Symptoms

The effects of solvents appear in various ways. The first symptoms may be dizziness, a feeling of intoxication, headache, difficulty in breathing and a slurred speech. Signs of general fatigue, failing memory, absent-mindedness, nausea and impaired reactivity may also occur.

### Solvents can also cause :

#### Cancer

Some solvents have been found to cause cancer. Benzene causes leukemia. Some chlorinated solvents like, carbon tetrachloride, chloroform, trichloroethylene and Perchloroethylene, are now suspected to cause cancer.

#### Peripheral Nerve Damage

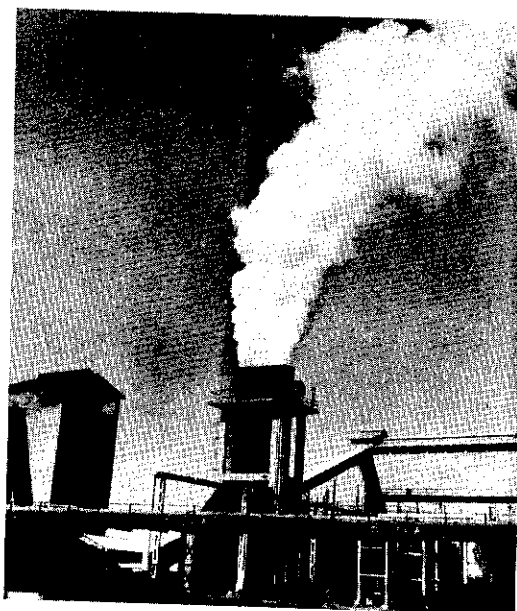
Now studies have indicated that solvents may also damage the "peripheral Nervous system" which is the system of nerves leading from the spinal cords to the face, and neck, arms and legs trunk and perineum, etc. The symptoms caused by nerve damage are numbness, tingling sensations, weakness and paralysis in the arms and legs.

The study of car spray painters exposed to a mixture of toluene, xylene butylacetate and naphtha was found to cause numbness in the hands and feet, slowed nerve impulse and slowed dexterity (plus an impairment of intelligence and memory functions).

## Heart attack

Several solvents have so far been found to contribute to a form of heart attack known as "arrhythmia". It appears that these solvents make the heart muscle more sensitive to adrenaline in the body. In this sensitive state, the adrenalin causes the heart to beat rapidly and irregularly, which in some cases even leads to death.

Methyl chloroform, trichloroethylene, toluene carbon disulphide and gasoline have all been found to cause this problem.



## Guidelines for safe handling of chemicals and solvents

Never handle or use a chemical or solvent without knowing what hazards are associated with it. It is best to assume that all the chemicals pose some health hazard in one way or another.

It is important that people working with some chemicals do receive specific information on the potential risks to their health, training in the manner that how they should protect themselves and colleagues and how they should wear and look after the personal protective equipments. Each person working with dangerous substances should be provided

with written instructions containing illustrations. Poisonous and dangerous substances should be marked as such.

### Is Exchanging substances and materials possible?

You should always find out if it is possible to replace a dangerous substance with one that is safer.

Make sure that there is adequate fresh air ventilation. It is important to ensure that the concentration of vapours and gases in the workplace air is kept

below the prescribed limit (T L V). Some form of regular and frequent monitoring is highly desirable and important from workers point of view.

A combination of adequate local exhaust ventilation, safe work practices, good housekeeping and preventive maintenance protective clothing, separate eating and safe drinking water facilities away from the work area, bath and change of clothes facilities with separate lockers for street and work clothing will adequately ensure that workers are protected from adverse health effects.

## THRESHOLD LIMIT VALUES(TLVs)

Threshold limit values, or TLV's as they are commonly called, seek to control atmospheric contamination from industrial pollutants. These limits state the maximum permissible concentration of a substance in the air at a workplace. They are intended to represent conditions that most workers could be exposed to repeatedly without any harmful effects.

But there are many problems with TLVs. Firstly, these TLVs are separately made for each chemical. In many work places, like fertiliser factory, a worker is exposed to several chemicals simultaneously. Secondly, the TLV is arrived at on the normal conditions of environment and human body. In most work places, neither of these normal conditions operate. Heat, noise, dust etc. are common at a work place; and, most workers are already malnourished and unhealthy. Hence, even TLVs do not represent safe levels of pollution.

Though the safe limits can be identified by scientific research and investigations, the actual TLV suffers from several limitations.

Some 500 substances have been given TLVs. This is not a large number considering the tens of thousands of chemicals that are in daily use by industry.

The T.L.V.s have no legal force. They act as guidelines, and therefore, are supposed to represent good industrial practice.

There are two main measures for indicating the extent of contamination. These are, 'parts per million' (ppm) and 'Milligrammes per cubic Meter' ( $\text{Mg}/\text{m}^3$ ). In general terms "ppm" measures the volume of pollutants, while " $\text{mg}/\text{m}^3$ " measures the weight.

# LIST OF FIFTEEN

| <u>Product</u>                                 | <u>Properties</u>                                                                                                                                        |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACETONE<br>2 prophanone<br>dimethylketone      | Colourless liquid with<br>sweet or sharp smell.<br>Highly volatile.<br>Miscible with water.                                                              |
| INDUSTRIAL<br>PETROL<br>solvent naphtha        | Colourless liquid.<br>Volatile to highly<br>volatile depending on<br>composition. Sparingly<br>soluble in water. Easily<br>absorbed through the<br>skin. |
| n-BUTANOL<br>1-butanol,<br>n-butyl,<br>alcohol | Colourless liquid with<br>sharp smell. Gives off<br>vapour, especially when<br>heated, Soluble in<br>water. Easily absorbed<br>through the skin.         |
| ETHANOL<br>ethyl alcohol                       | Colourless liquid with<br>characteristic smell.<br>Volatile. Miscible<br>with water.                                                                     |

# COMMONEST SOLVENTS

## Examples of occurrence

Usually as a solvent and dissolvent.  
In the manufacture of other chemicals  
and drugs.

As a solvent, dissolvent and degreasing  
agent.

As a solvent. In the production of  
other chemicals.

Usually as a solvent, dissolvent and  
antifreeze agent. In the manufacture  
of other chemicals such as acetalde-  
hyde and acetic acid. As a fuel.

## Risks

Inhalation or ingestion of large amounts  
can induce headache, dizziness, fatigue  
and, in serious cases, fainting. Removes  
the oil from the skin. Repeated contact  
with the skin can produce eczema.  
Splashes in the eyes produce severe  
irritation.

The fumes have an irritating effect on  
the eyes and the respiratory passages.  
Inhalation or ingestion can induce head-  
ache, nausea, dizziness and, in severe  
cases, fainting. If the liquid gets  
into lungs (is inhaled) in conjunction  
with ingestion or vomiting, pneumonia  
can result. Inhalation over a long  
period can produce nerve damage,  
especially if the petrol is of the hexane  
type. Removes the oil from the skin.  
Repeated contact with the skin can  
produce eczema. Splashes in the eyes  
produce irritation.

The fumes have an irritating effect on  
the eyes and the respiratory passages.  
Inhalation on contact with the skin  
can induce headache, dizziness,  
fatigue and in serious cases, fainting.  
Removes the oil from and irritates the  
skin. Repeated contact with the skin  
can produce eczema. Splashes in the  
eyes produce severe irritation.

Inhalation or ingestion of large amounts  
can induce dizziness, headache, nausea  
and, in severe cases, fainting. Removes  
the oil from the skin. Repeated contact  
with the skin can produce eczema.  
Splashes in the eyes produce irritation.

ETHYL ACETATE  
acetic acid  
ethyl ester,  
acetic ester

Colourless liquid with  
fruity smell, Highly  
volatile:  
Miscible with water.

ETHYLENE  
GLYCOL  
1,2-ethylene  
diol, glycol

Colourless and odourless,  
viscous liquid. Gives  
off vapour when heated.  
Miscible with water.

MINERAL  
TURPENTINE  
thinner with  
17-22 per  
cent aromatics,  
white spirit,  
dilutine

Colourless liquid.  
Gives off vapour,  
especially when heated.  
Sparingly soluble in  
water.

METHANOL  
methyl  
alcohol, wood  
alcohol spirit

Colourless liquid with  
a faint smell of alcohol,  
Volatile, Miscible with  
water. Easily absorbed  
through the skin.

Usually as a solvent and dissolvent. In the manufacture of drugs and other chemicals. In paint and dyestuffs, synthetic fibres and plastics industries.

The fumes have an irritating effect on the eyes and the respiratory passages. Inhalation, ingestion or contact with the skin can induce headache, dizziness, nausea, loss of appetite and, in severe cases, difficulty in breathing and fainting. If the liquid gets into the lungs (is inhaled) in conjunction with ingestion or vomiting, pneumonia can result. Absorption over long periods is thought to affect the liver and kidneys. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce irritation.

As a solvent for dyes and plastics (e.g. cellophane) and as an antifreeze agent and hydraulic fluid. In the manufacture of plastics (e.g. polyester fibres), printing inks, explosives, cosmetics and other chemicals.

Inhalation or ingestion can induce dizziness, vomiting, stomach pains, weakness, can affect the central nervous system and in serious cases lead to fainting. Is thought to cause kidney damage. Removes the oil from the skin. Splashes in the eyes produce irritation.

As a solvent, degreasing and cleaning agent. In the manufacture of other chemicals e.g. formaldehyde.

Inhalation or ingestion can induce headache, nausea, dizziness, fatigue and, in severe cases fainting. Ingestion can also produce irritation of the digestive organs, vomiting and diarrhoea. If the liquid gets into the lungs (is inhaled) in conjunction with ingestion or vomiting, pneumonia can result. Inhalation over long periods can produce nerve damage. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce irritation.

As a solvent, dissolvent and anti-freeze agent. As an additive in motor fuel and industrial alcohol.

Inhalation, ingestion or contact with the skin can induce dizziness, headache, nausea, disturbed vision and also, in severe cases, damaged eyesight and fainting. Absorption of small amounts over long periods can damage the eyesight. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation.

METHYLENE  
CHLORIDE  
Dichloromethane

Colourless liquid with a faint sweetish smell. Highly volatile. Miscible with water. Easily absorbed through the skin.

METHYL ETHYL  
KETONE  
2-butanone,  
MEK

Colourless liquid with acetone-like smell. Volatile. Miscible with water.

METHYL  
CHLOROFORM  
1,1,1, trichloroethane

Colourless liquid with a sweetish sickly smell. Highly volatile. Sparingly soluble in water.

STYRENE  
Phenylethylene  
vinyl benzene

Colourless to yellowish liquid with sweetish or sharp smell. Gives off vapour, especially when heated. Partly soluble in water. Easily absorbed through the skin.

As a solvent and degreasing agent.

Inhalation, ingestion or contact with the skin can induce dizziness, fatigue, headache, nausea and, in severe cases, can affect the heart and lead to fainting. Absorption over long periods of time can give rise to headache, fatigue and numbness of the limbs. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation. When heated, toxic and corrosive gases are formed.

As a solvent. In the dyes and paint, plastics, drugs and cosmetics industries.

The fumes have an irritating effect on the eyes and the respiratory passages. Inhalation or ingestion can induce headache, dizziness, nausea and, in severe cases, fainting. Irritates and removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation.

As a solvent, dissolvent and degreasing agent. In the drug and petroleum industries.

Inhalation or ingestion of large amounts can induce headache, fatigue, dizziness and, in severe cases, can lead to fainting, affect the heart and produce a drop in blood pressure. Ingestion can also lead to nausea and vomiting. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation. When heated, toxic and corrosive gases are formed.

In the manufacture of plastics. As a solvent. In the reinforced plastics industry.

The fumes have an irritating effect on the eyes and the respiratory passages. Inhalation, ingestion or contact with the skin can induce headache, fatigue, nausea, dizziness, coughing fits, difficulty in breathing and, in severe cases, fainting. Ingestion can also give rise to a metallic taste in the mouth, vomiting, stomach pains and diarrhoea. Absorption over long periods can impair reactions and memory. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation. When heated, styrene can polymerize and generate considerable heat. Under the action of light and the oxygen in the air explosive

TOLUENE  
methylbenzene,  
toluol

Colourless liquid,  
sweet or sharp smell.  
Volatile. Sparingly  
soluble in water.  
Easily absorbed through  
the skin.

TRICHLORO-  
ETHYLENE  
ethylene  
trichloride,  
tri

Colourless liquid with  
sweetish smell. Volatile.  
Partly soluble in water.

XYLENE  
dimethyl  
benzene,  
xylof

Colourless liquid. Gives  
off vapour, especially  
when heated. Sparingly  
soluble in water. Easily  
absorbed through the  
skin.

As a solvent. In petrol and other petroleum distillates. In the manufacture of drugs, explosives, TDJ, and other chemicals.

As a solvent, dissolvent and degreasing agent. In the manufacture of other chemicals.

As a solvent. In the manufacture of drugs, dyestuffs, fibres and other chemicals. In many petroleum distillates such as motor fuel.

peroxides are formed. Peroxides accelerate the polymerization of the styrene.

The fumes have an irritating effect on the eyes and the respiratory passages. Inhalation, ingestion or contact with the skin can induce headache, fatigue, dizziness, nausea, loss of appetite, muscular weakness and, in severe cases numbness, tingling of the limbs and fainting. If the liquid gets into the lungs (is inhaled) in conjunction with ingestion or vomiting, pneumonia can result. Absorption of large amounts over long periods of time is thought to affect the liver and kidneys. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation.

Inhalation or ingestion can induce headache, dizziness, nausea and, in severe cases, can lead to fainting, affect the heart and result in damage to liver and kidneys. Inhalation over a long period of time is thought to result in damage to the nervous system. Removes the oil from the skin. Repeated contact with the skin can produce eczema. Splashes in the eyes produce severe irritation. When heated, toxic and corrosive gases are formed. Can react violently with strong alkalis leading to the formation of toxic and inflammable gases.

The fumes have an irritating effect on the eyes and the respiratory passages. Inhalation or ingestion of large amounts can induce headache, nausea, dizziness and in severe cases, fainting. Absorption over a long period of time can cause damage to liver and kidneys. Removes the oil from the skin. Splashes in the eyes produce severe irritation.

# DERMATITIS (SKIN DISEASES)

Occupational dermatitis is one of the most common industrial diseases. Dermatitis means inflammation of the skin. It ranges in severity from simple irritation to real damage, and accompanied by such symptoms as painful reddening, swelling, itching or a rash.

Occupational diseases of the skin are most commonly caused by chemical substances.

## What causes Dermatitis ?

Chemicals which can harm the skin are divided into two broad groups:

- i) Primary irritants ii) Sensitizers

Primary irritants are chemicals which on direct contact can cause an immediate injury to the skin. About 80% of all

Occupational skin diseases are caused by primary irritants. Primary irritants damage the skin by dissolving the natural protective barriers of fats and oils or by reacting with the keratin or waxy outer layer.

Sensitizers are chemicals which cause an allergic skin reaction. These may not cause demonstrable skin changes on first contact but penetrate the skin barriers and induce non apparent specific chemical changes in the skin. Any subsequent exposure to even a very minute quantity of the sensitized chemical brings about a violent reaction. Instead of directly destroying the skin tissue, sensitizers cause the body's immune system to respond. You can tell the difference between reaction to a sensitizer and a primary irritation in several ways shown below:

## **PRIMARY IRRITANTS**

Would affect normal skin in all exposed persons if applied in a sufficiently concentrated form for a sufficient length of time.

Only the exposed area affected.

Effect is variable according to concentration of irritant and duration of exposure.

Reaction may be immediate or delayed.

Patch test gives negative result when the irritant is applied in low dilution; if applied undiluted, may give a positive reaction.

Occurs directly on the exposed site and consists of an erythema, vesication and oedema varying in degree according to the potency of the irritant substance.

## **SENSITIZERS**

Affects only a limited number of those exposed.

Whole of the skin may be affected.

Reaction varies more in relation to frequency of application, degree of exposure and potency of the sensitizer.

Reaction does not occur until sensitization of the skin is established. After that it is immediate.

Patch tests with suspected allergens in low dilution are likely to give positive results.

Onset is rapid, sometimes explosive and consists of erythema, vesication and oedema together with marked itching on the exposed site with often secondary sensitization spreading to other areas of the body.

Mechanical, physical, or biological agents also cause skin disorders. Cuts or abrasions due to mechanical factors may open the way to skin infection. Mechanical forces such as vibration or friction can also harm the skin.

Hot metal burns, heat rashes, chapped skin, frostbite and radiation burns are the direct causes of physical agents acting on the skin.

Biological agents may be bacteria, fungi, or parasites. Also, there are hundreds of plants and woods that cause dermatitis by virtue of their naturally occurring chemical components.

### CAUSES OF DERMATITIS

| <u>Chemical</u><br><u>causes</u> | <u>Physical</u><br><u>causes</u>         | <u>Biological</u><br><u>causes</u> |
|----------------------------------|------------------------------------------|------------------------------------|
| Cleaning Compounds               |                                          | Bacteria                           |
| Solvents                         | Heat                                     | Viruses                            |
| Adhesives                        | Cold                                     | Fungi                              |
| Disinfectants                    | X-rays                                   | Parasites                          |
| Acids                            | U.V. rays<br>Infrared rays<br>Microwaves | Plant saps<br>and alkaloids        |
| Dyes                             | Bone<br>fragments                        | Wood<br>resins                     |
| Cosmetics                        |                                          |                                    |

dermatitis is most common to hands, fingers, and forearms because of frequent direct contact with the agents.

The face and neck can be affected if touched by hands contaminated with the offending materials or if the offending materials happen to be as vapours or dust. Feet and legs are often affected first, if workers operate in wet processes. Portions of the skin covered by clothes may also be affected, if the hazardous fumes or vapours penetrate the clothing or saturate clothing not frequently washed.

### Skin Cancer

The skin is one of the body's most frequent sites for cancer development.

This is mostly due to exposure to ultra-violet radiation in sunlight. Chemicals, alone or in combination with sunlight or other chemicals, are also known to cause skin tumor growth.

### What can be done to Prevent it ?

The only way to prevent skin disease is to make changes in the work processes.

1. Enclose any operation giving off mists, fumes, dusts or heat.
2. Ventilate the work area. Place exhaust ventilation at the point where toxic material is given off.
3. Replace the cutting fluids frequently, to prevent contamination.
4. Substitute mild materials for strong ones, and/or dilute them if there is no substitute.
5. Put up splash guards to reduce skin contact.

### Personal Protection

1. Where protective clothing must be used, it should cover all exposed areas and be comfortable to work in. These should be regularly cleaned. Oily clothes must be drycleaned - Soap and water won't get oil out.

2. Change rooms and bath facilities should be kept in good shape and located near the job.
3. If protective ointments or barrier creams are used, they should give actual protection from the specific irritants, be easily applicable and easily removed.

**Note :**

Barrier creams are thought to be an ineffective way of protecting the skin. Sometimes the ointments and creams prescribed to heal an infection can actually make it worse.

Most occupational skin diseases are relatively mild and curable. However, industries with high incidence rates of occupational skin disease should not be ignored. Various substances that cause skin disease may also induce other diseases which are often more difficult to recognise and not readily correlative to a worker's job. Many diseases due to prolonged exposure are chronic and irreversible, and may lead to permanent disability or death.

Dermatitis is included in the list of occupational disease in the Factory's Act.

## GETTING NAMES OF WORKPLACE CHEMICALS

Obtaining information about chemicals that workers handle or face while on the job remains one of the major problems for their health and safety. Too often the very names of chemicals are deliberately withheld from workers. The smokescreen of "trade secrets" is often used to hide facts about potential dangers of chemicals already being used in the plant.

Management should have and always be ready to provide a list of chemicals used in the plant with a Hazardous Materials Data Sheet on each chemical which incorporates the ingredients by chemicals name, complete health effects including possible symptoms, safe handling procedures, engineering controls, personal protective equipments and emergency treatment procedures. Remember, you want the generic names and not just trade names, whenever possible. This information should be available to any worker upon request.



# PHOSGENE

It is a colourless liquid or gas with a sweet odour at low concentrations and, sharp, pungent odour at high concentration.

It is used as follows:

1. Intermediate in organic synthesis.
2. In metallurgy to separate ores by chlorination of the oxides and Volatilization.
3. Used in chemical warfare, esp. during World War I.
4. Now used in industry in preparation of pharmaceutical and chemical products.

Its TLV (1977) was set as 0.1 ppm.

The exposure takes place through inhalation.

It is a poisonous gas causing nausea and suffocation when inhaled. It severely irritates respiratory system. After a day or two, symptoms include, fatigues, restlessness, cough and other signs of pulmonary edema characterised by cough, abundant quantities of foamy sputum, progressive difficulty in breathing, dryness or a burning sensation in the throat, vomiting and pain in the chest. Pulmonary edema may progress to pneumonia, and cardiac failure may occur

Splashes of liquefied phosgene in the eye may produce severe irritation. Skin contact with the liquified material may cause severe burns.

It has no clear treatment. The use of a diuretic may be required. Steroids may be administered on a short-term basis (2 to 4 days) to decrease the inflammation of the lung.



# CHROMIUM HAZARD

## (For Leather Workers)

Most leather works use chromium salts for tanning, and thousands of the workers handling these suffer from dermatitis, chrome ulcers and perforated nasal septum.

In most of its commercial uses, chromium is in its chromate form. In this form it is acidic, and quite stable. Some common industrial chromates are sodium dichromate, potassium dichromate and chromic acid.

Chromates are irritant and corrosive. They can be absorbed through the skin and the respiratory system. Chromium compounds not only irritate and ulcerate the skin, nose, throat and lungs, but can also cause lung cancer.

### Chrome Ulcers

These are the most common problems caused by working with chromates. The

chromium corrodes the skin and soft tissues, entering through a cut or graze.

If it is not treated quickly, the ulcer may go deep into the soft tissues, even down to the bone of fingers or hands.

The ulcer is usually round, with hard, raised edges. Healing is slow.

Multiple ulcers are often the site of other infections, which may even make amputation of a joint or finger necessary.

Prevention depends on adequate exhaust ventilation and suppression of dusts and mists. Where possible, wet methods of cleaning should be used. Concentrations of chromium in the workplace air must be measured at regular intervals.

Medical supervision of chromate workers must be made regularly. Wherever necessary, workers should be encouraged to use personal protective equipments.



# WELDING

## What is the hazards

Welding is one of the most common jobs in wide variety of trades all over the world. What started as a reasonably straight forward operation, however, has become increasingly complex with the development of various new techniques. These new developments have added many potential health risks, sometimes life-threatening, for the welders. The risks involved affect not only the worker at the job but also those who are working nearby. The commonest risks are eye damage, skin injuries, burns and gas poisoning.

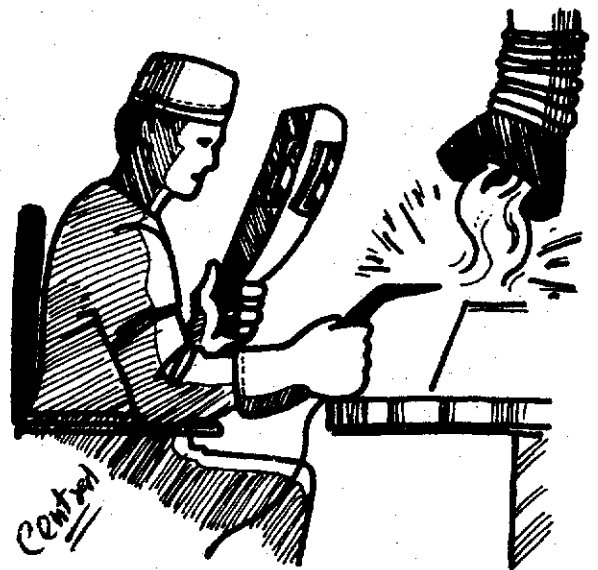
There are many symptoms that a welder can notice e.g. nausea, fatigue, breathing difficulties, chest pain, etc. These warnings must be taken seriously and immediate improvements be made. It is well known that long term exposure to welding fumes leads to serious lung diseases, e.g. asthma, sydnosis, chronic bronchitis, etc. These in turn, often cause permanent disability, forcing the affected workers to leave their jobs.

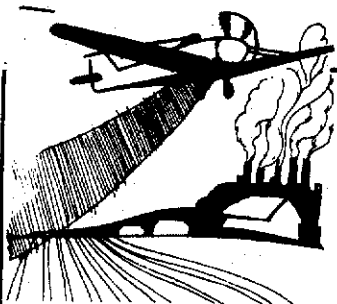
## What can be done

On all welding jobs, the welder should wear suitable protective goggles or face mask to protect his eyes against the welding arc. The welder should also wear protective gloves. The work area should be partitioned off so that people nearby are not blinded.

Apart from the intensive glare, which is typical for all types of welding, electric arc welding also radiates invisible ultraviolet and infrared rays. These are dangerous and can damage the eyes and the skin. In such cases, the eyes should be protected with a special type of filter glass.

- The skin of the face and hands should also be carefully protected. The best way to do it is to use a helmet and gloves. In electric arc welding there are added risks of working with electricity.
- Some types of welding require effective air extraction from the work area. This is important where the welding is carried out on metals with painted surfaces or covered with an alloy of lead, cadmium, mercury, Fluorine or Zinc. Welding on such alloys leads to a build up of dangerous smoke and gas.
- Acetylene and oxygen are normally used in gas welding. The oxygen and acetylene tubes should be kept separate from one another and the gas cylinders should be stored in a safe place. In the event of a fire, it should be easy to remove the cylinders to a place of safety.





## ENVIRONMENTAL POLLUTION



The problem of occupational health is not just confined within factories. Environmental pollution is also a big issue. Many factories throw their effluents in the rivers, streams and land nearby. This pollutes rivers, kills fish and makes drinking and bathing water dangerous to the health of all. Land and cattle of the area are also seriously affected.

You may have seen dirty, black smoke coming out of the chimneys of these factories and power houses. They pollute the air we breathe. This in turn causes respiratory diseases. Its effect is maximum on workers

and their families, as they live near these factories and power houses, but the general population also suffers on account of pollution of the ambient air of the environment by this smoke which ultimately spreads far and wide and vitiates the quality of air.

Thus environmental pollution and occupational hazards are closely linked in many instances. And workers struggles inside citizen's struggles against environmental pollution. This has been successfully attempted in Chembur area of Bombay, particularly in the case of RCF factory.

## HAZARDS OF PHARMACEUTICAL INDUSTRY

One factory in Bombay produces isordyl - a drug for heart ailments. Men in the manufacturing department and women in the packing department get exposed to the constituents of this drug, mainly iso-sorbide-dinitrate. The effects of this exposure are fatigue, headache, sometimes even vomiting and hormonal disorders. Women complain about changes in their monthly cycles, due to hormonal changes in the body.

Production and Research in the pharmaceutical industry may be classified initially as the production of antibiotics, steroids, vaccines and hormonal drugs, etc.

In a prestigious factory in Bombay producing hormones, some of the

workers handling this drug were exposed to detrimental effects. Due to hormonal imbalance, some of them had to be hospitalised. This was done secretly some years back and the matter was hushed up.

In the research and development departments, workers are exposed to new chemicals (with unknown hazards) dangerous viruses, germs, etc. One of the pathologists cited a case when a worker got exposed to the culture of bacteria raised in the laboratory on an artificial media which cause typhoid. That particular culture was at a higher stage of development in the test-tube and this worker had an instant attack of Typhoid and became unconscious.

# LEGAL ASPECTS

The most direct reference to occupational health and safety comes in the Factories Act. However, certain provisions exist in the Mines Act, 1952, The Plantations Labour Act 1951, The Contract Labour Act, 1970, The Inter-State Migrant Workmen Act, 1979, The Beedi and Cigar Workers Act 1966, The Employment of Children Act, 1938, The Workmen's Compensation Act 1923.

## Factories Act

The Factories Act was designed to protect the health and safety of workers in the factories.

Workers are to be protected against dust and fumes injurious to their health and factory inspectors can take air samples in the factory for testing. Safety and health surveys can be carried out after giving written notice to the employers.

Section 11 to 20 of Chapter (III) of the Act deal with these issues. Provisions here also include cleanliness, adequate ventilation, heat, humidity and lighting facility, enough working space and proper toilet and drinking water facility.

Act deals with safety. The Act requires the owner to inform the Chief Inspector of Factory, any worker's absence of more than 48 hours of work due to injuries as well as fatal injuries.

The Act lists a number of notifiable diseases. The owner has to inform the Chief Inspector if any worker contracts any one of these diseases.

The Act empowers the government to declare any manufacturing process dangerous and stop it. The government can also prohibit the employment of women and children, require medical testing and Sections 21 to 40 in Chapter (IV) of the worker protection. The list of notifiable diseases is shown alongwith.

# ESI HOAX

Most industrial workers are members of Employees State Insurance Corporation. The ESI has its own hospitals, clinics and doctors for the treatment of workers.

## What is Your Experience of ESI?

By and large workers complain of indifference and negligence by ESI doctors and other staff.

In respect of occupational diseases, ESI doctors mostly draw a blank. Workers are never diagnosed to have any work related diseases. This is due to many reasons. Firstly, ESI doctors are not trained to diagnose and treat occupational diseases. Secondly, ESI clinics and hospitals lack the basic equipment and facilities needed for proper diagnosis and treatment of such diseases. Thirdly, the doctors collude with the employers in not diagnosing occupational diseases so that the employer faces no responsibility for prevention and compensation.

So, when a textile worker or miner goes to ESI, the doctors tell him that he is suffering from asthma and TB, and not black lung or brown lung.

Thus, workers remain unaware and unprotected.



# LIST OF NOTIFIABLE DISEASES

1. Lead poisoning including poisoning by any preparation or compound of lead or their sequelae.
2. Lead tetra-ethyl poisoning.
3. Phosphorus poisoning or its sequelae.
4. Mercury poisoning or its sequelae.
5. Manganese poisoning or its sequelae.
6. Arsenic poisoning or its sequelae.
7. Poisoning by nitrous fumes.
8. Carbon bisulphide poisoning.
9. Benzene poisoning, including poisoning by any of its homologues, their nitro or amino derivatives or its sequelae.
10. Chrome ulceration or its sequelae.
11. Anthrax
12. Silicosis
13. Poisoning by halogens or halogen derivatives of the hydro-carbons of the aliphatic series.
14. Pathological manifestation due to:
  - a) radium or other radioactive substances.
  - b) X-rays
15. Primary epitheliomatus cancer of the skin
16. Toxic anaemia.
17. Toxic jaundice due to poisonous substances.
18. Oil acne or dermatitis due to mineral oils and compounds containing mineral oil base.
19. Byssinosis.
20. Asbestosis.
21. Occupational or contact dermatitis caused by direct contact with chemicals and paints. These are of two types, that is, primary irritants and allergic sensitizers.
22. Noise induced hearing loss (exposure to high noise levels).



# WORKMEN'S COMPENSATION ACT, 1923

The Act was designed to require the employers to pay compensation to workers for occupational diseases and injuries. The Act provides for a list of compensable diseases in Schedule 3, which is also shown here. The Act provides for rate of compensation in cases of different injuries and diseases.

## Problems

These legislations suffer from a series of inadequacies and problems. The following are the main ones:

1. As with other legislations, these Acts also suffer from ineffective implementation. For example, the visits by Factory Inspectors are only rarely made.
2. The Factory Inspectorates under the Act do not have adequate number of properly trained staff. In places like Bihar, there is one inspector for more than 1000 factories. The staff of the Factory Inspectorate are also not properly trained in respect of occupational health and safety. Their collusion with the management is also well-known.
3. Many of these Acts contain several loopholes. For example, the government can relax certain provisions of the Factories Act from application to certain factories and these exemptions have been liberally utilised by the government.
4. The workers and their unions have no rights in these Acts.  
  
For example, workers have no right to information, they can not see factory inspection reports, get a copy of their own medical test report, and do not have a right to have information about materials they work with. Nothing in the Act requires factory inspectors to consult and/or involve the workers or their representatives.
5. The deterrence or punishment provided in the Acts is thoroughly inadequate. For example, non-compliance of employers with health and safety provisions can attract punishment of a few hundred rupees only. It is simply ridiculous.
6. The Acts exclude many dangerous diseases which are now well known to be occupational diseases. For example, there is no reference to cancer causing materials, e.g. asbestos, certain chemical and dye industries.
7. Workers in a large number of occupations are not covered under these Acts and thus remain unprotected. For example, construction workers do not have any rights or facility under these Acts.
8. In essence, there is no comprehensive legislation on occupational health and safety which can tackle this problem in its entirety.

# SCHEDULE III: LIST OF OCCUPATIONAL DISEASES

S.No.                      Occupational disease

(1)                                      (2)

## PART A

1. Infectious and parasitic diseases contracted in an occupation where there is a particular risk of contamination.

2. Diseases caused by work in compressed air.

3. Diseases caused by lead or its toxic compounds.

4. Poisoning by nitrous phosphorus compounds:

5. Diseases caused by chromium or its toxic compounds.

6. Diseases caused by arsenic or its toxic compounds.

7. Diseases caused by radioactive substances and ionising radiations.

8. Primary epitheliomatous cancer of the skin, bitumen, mineral oil, anthracene, or the compounds, products or residues of these substances.

9. Diseases caused by the toxic halogen derivatives of hydrocarbons (of the aliphatic and aromatic series).

10. Diseases caused by carbon disulphide.

11. Occupational cataract due to infra-red radiations.

12. Diseases caused by manganese or its toxic compounds.

13. Skin diseases caused by physical, chemical or biological agents not included in other items.

14. Hearing impairment caused by noise.

15. Poisoning by dinitrophenol or a homologue or by substituted dinitrophenol or by the salts of such substances.

16. Diseases caused by beryllium or its toxic compounds.

17. Diseases caused by cadmium or its toxic compounds.

## PART B

1. Diseases caused by phosphorus or its toxic compounds.

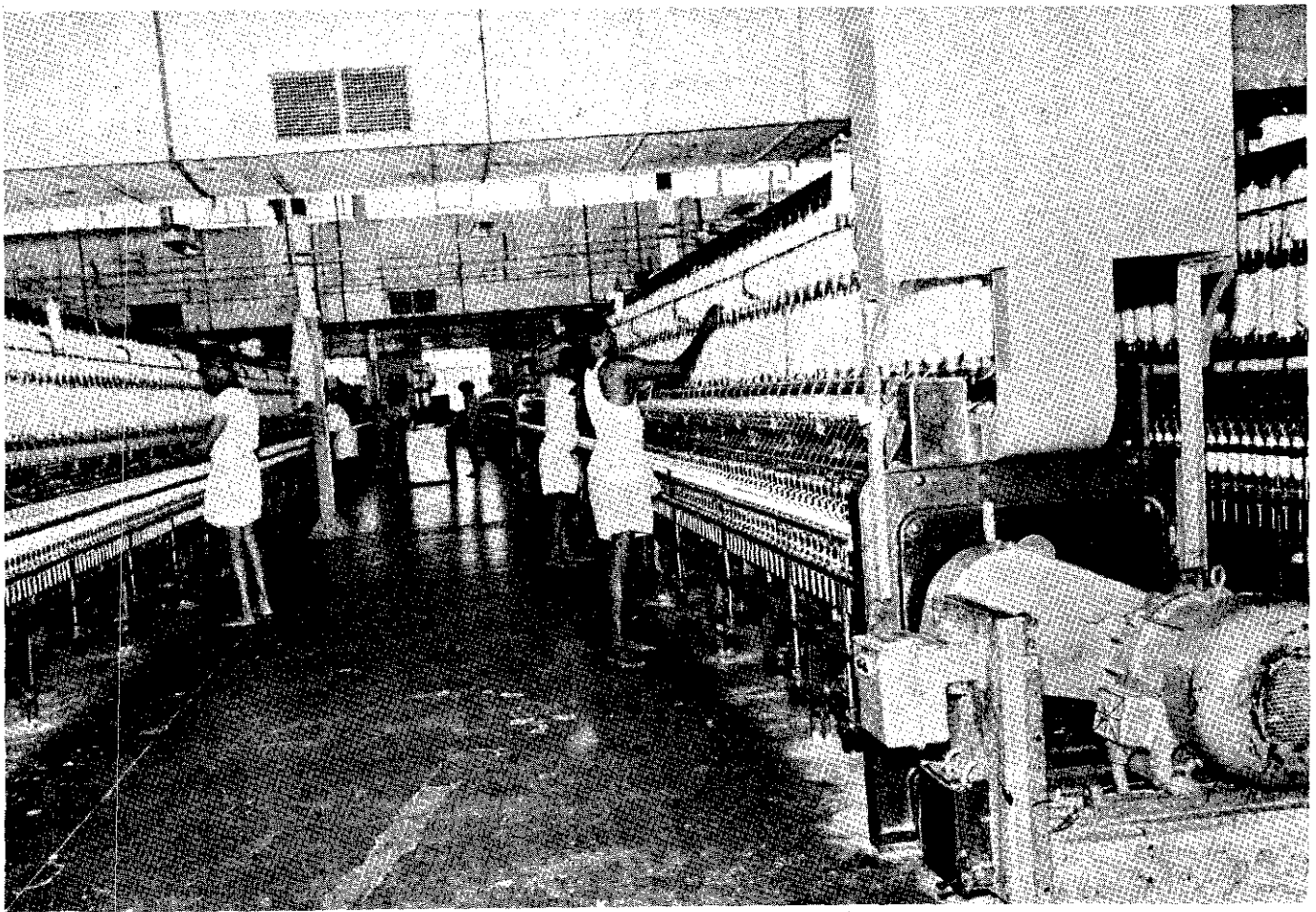
2. Diseases caused by mercury or its toxic compounds.

3. Diseases caused by benzene or its toxic homologues.

4. Diseases caused by nitro and amido toxic derivatives of benzene of its homologues.

PART C

18. Occupational asthma caused by recognised sensitising agents inherent to the work process.
  19. Diseases caused by fluorine or its toxic compounds.
  20. Diseases caused by nitroglycerine or other nitroacid esters.
  21. Diseases caused by alcohols and ketones.
  22. Diseases caused by asphyxiants; carbon monoxide, and its toxic derivatives; hydrogen sulfide.
  23. Lung cancer and mesotheliomas caused by asbestos.
  24. Primary neoplasm of the epithelial lining of the urinary bladder or the kidney or the ureter.
1. Pneumoconioses caused by sclerogenic mineral dust (silicosis, anthracosis, asbestosis) and silico-tuberculosis provided that silicosis is an essential factor in causing the resultant incapacity or death.
  2. Bagassosis
  3. Bronchopulmonary diseases caused by cotton, flax hemp and sisal dust (Byssinosis).
  4. Extrinsic allergic alveelitis caused by the inhalation of organic dusts.
  5. Bronchopulmonary diseases caused by hard metals.



# HOW TO CONTROL HEALTH HAZARDS?

## Firstly you can fight for establishing proper controls

There are three broad strategies to control hazards:

- A) Engineering Controls;
- B) Administrative Controls; and
- C) Personal protective equipment

### Engineering Controls

These are the most effective and permanent way to control health hazards. There are three types of engineering control techniques that can be used:

- (i) Substitution
  - (ii) Isolation
  - (iii) Ventilation
- (i) Substitution is the most positive of all controls. If a material, machine, or process is dangerous, the best thing is to substitute a new material, machine or process that is less hazardous.
  - (ii) Isolation of a hazard by using a barrier or establishing a safe distance from it is an effective control method. This can be done for Noise.
  - (iii) Ventilation is the movement of air to keep air contaminants (dusts, mists, gases, fumes or vapours) from reaching the breathing zone of the workers. These are of two kinds: General or Local Exhaust Ventilation.

General Ventilation is designed to move air through the entire workshop. Air is continually sucked out by fans in the ceiling or walls. Fresh air is pulled in through inlets. This make-up air mixes with, or dilutes, the air in the workplace. General Ventilation may make the workplace more comfortable. It will not make it any safer if toxic dust, fumes or gases are present. No general ventilation system can protect you from breathing contaminated air. This system can work well in offices and other work areas where the air needs to be exchanged to make it fresher.

Local exhaust Ventilation is designed to remove toxic dust, fumes, and gases at the point where they are generated. If engineered properly, it will capture the contaminant before it can escape and enter the worker's breathing zone. A local exhaust system consists of a hood close to the site to suck in the contaminated air, ducts to carry it away, a fan, and an air cleaning device to purify the air before it is vented outside.

### B) Administrative Controls

They do not eliminate hazards, but do limit a worker's exposure to a hazard. Some examples of administrative controls are:

- 1) Rescheduling the work to a time when fewer workers will be exposed.

- 2) Extending rest periods (can be used to control exposures to excessive heat or cold)
- 3) Job rotation.

c) **Personal Protective equipment and Clothing**

These are the least effective methods of fighting hazards. Besides being uncomfortable and interfering with work performance, they can create their own health and safety hazards. These things should be acceptable, only when it has been proven that engineering controls are not feasible.

The preparation of protective clothing and the more mechanical type of protective equipment is not always easy. Generally such things as overalls, boots and shoes, gloves and aprons are protective clothing, where as ear plugs and ear muffs, respirators, helmets, safety glasses, goggles and welder's masks are protective equipment.



## MEDICAL TESTING

Medical testing can be an important weapon in the fight to protect your health on the job. However, it is also a weapon that the company can use to deny your rights to healthier work provisions and environment and job security.

There are some basic things about these testings you need to know. The most important point is that medical tests won't get your health back. For many job-related health problems, there is no effective treatment. Medical examinations are only one part of an overall union programme on safety and health. Prevention -- the control of hazards -- should always receive the top priority.

### Types of tests

There are basically two types of job-related medical tests:

- i) Tests for toxic substance in our bodies alert us to dangerous exposures.
- ii) Disease Monitoring Tests look for evidence that we have already developed an occupational disease.

### How can medical tests for toxic substances be useful?

- They can detect the presence of dangerous chemicals in our bodies either before an actual disease is produced or before we feel sick. To be effective, these tests must be done at relatively frequent intervals, and compared to previous tests.
- If we have developed vague symptoms, such as dizziness, headache or fatigue, the tests may point to toxic substances which may be causing the problem.

## How can disease monitoring tests help workers?

If done periodically, tests can often pick up health problems early. They can also detect changes over time, to determine if our health is getting worse.

- They are useful documentation in worker's compensation cases.
- They are useful for union studies which can compare the records of different groups of workers to determine if there is a pattern of disease in certain work areas or industries.
- They can be used to educate co-workers about hazardous substances.



May be your illness has to do with your job. What chemicals are you working with?

Doctors should try to identify the real cause of bad health. Conditions in the plant are often to blame. Does your doctor take into consideration your working environment?

| Test                | What they are looking for                    | Possible source of Problem                                                          |
|---------------------|----------------------------------------------|-------------------------------------------------------------------------------------|
| Chest X ray         | Damage to Lungs                              | Mineral dusts, Cotton dust                                                          |
| Lung function test  | Reduced breathing ability                    | Solvent fumes, dusts, beryllium, T.D.I.                                             |
| Angiogram           | Hearing Loss                                 | Excessive Noise                                                                     |
| Urin-analyses       | industrial substances in body                | Lead, Mercury, Solvents, dyes and their metabolites                                 |
| Blood test          | Industrial substance in body or organ damage | Lead, mercury, Solvents, Carbon Monoxide, Vinylchloride                             |
| Skin tests          | body reaction to industrial Substances       | Solvents, oils, fibreglass, plant and animal products, metal dust (Nickel, arsenic) |
| Liver function test | disease or damage in liver                   | Vinyl chloride, carbon tetra chloride, chloroform, arsenic.                         |



# FINDING THE HAZARDS

There are different ways to identify the problem spot. One does not need to be an expert to find out the hazards in his workplace. You can be the most qualified person to identify dangerous situation because you have to face them every day on the shop floor.

## Find out yourself

The best way to find out is to start by doing a complete walk-through in the entire plant, department by department, writing down every problem that is known to be a hazard or that someone suspects might be one. The first step is to list the problems you already know.

In the course of your survey, talk to as many workers as possible to find out their concerns. You may find that part of the problem is that workers are not interested. 'But, it is just not enough to write them off as 'apathetic'. They may take some hazards for granted, or be unaware of hidden dangers.

At times many workers have greater worries, particularly if their jobs are threatened and management is getting tougher. Management may stress on "individual carelessness" because it is a convenient scape-goat to save them from their own responsibility to provide safe and healthy working conditions.

A few questions to think about as you walk through the plant are:

- ☐ Is the noise so loud that it makes you hear nothing? Dulls your hearing?
- ☐ Do vapours or fumes smell terrible? Make you dizzy? Sleepy? Give you a headache?



- ☐ Do the fumes from welding operations make you feel like you have the flu?
- ☐ Does the dust make you cough or sneeze, or make your throat dry, hurt your eyes?
- ☐ Is any machinery or equipment faulty? What about electrical wiring? Do the machines have proper guards?
- ☐ Is the floor slippery? Is there sufficient light?

Write down each problem, its source and location.

## Hidden Hazards

After spotting out the obvious problems, you can proceed to discover hidden hazards. For the sake of convenience, the latter can be divided into two categories: Safety and health hazards.

This list of safety hazards does not cover everything. But it leads to the kinds of questions to ask.

# PLANT HAZARDS CHECKLIST

## Safety Hazards

1. Are all machines properly guarded so that the hands do not come into contact with the moving parts?
  - Belts, pulleys & rotating shafts?
  - Chains, sprockets and gears?
  - All rip points?
  - All rotating parts recessed or covered with collars?
2. Are the work areas and walkways free of debris and in good state of repair?
3. Are all stairways (including the emergency exit) clear, in good repair, and have guardrails?
4. Are all cables in good repair and regularly checked?
5. Is there a lockout system to prevent infumes from moving and exercised machinery?
6. Are electrical wires and outlet boxes covered and in good state of repair?
7. Is lighting adequate for the job?
8. What accidents or near misses have occurred in the recent past i.e. say in the last month or so?

## Health Hazards

1. What chemicals were inside the factory, and on the loading dock,

what information is on the label, where do they go?

2. Do workers ever get any chemical on their skin? Which are those chemicals? Can you identify them?
3. Is there any visible dust in the air? What is its source?
4. What ventilation system is installed, how is it positioned in relation to the workers, how well does it seem to work?
5. Can you smell any of the chemicals being used?
6. Which areas of the plant are noisy? In which areas is the noise so loud that you have to shout to be heard from a distance of one yard?
7. Make a list of all the substances (e.g. asbestos, acids, solvents, paints), being used in each section of the factory, with as many of the chemical names as you can obtain.
8. Health Problems

Listen, if the workers complain about:

- skin rashes
- dizziness
- fainting attacks
- nausea
- coughing and breathing problems
- eye irritation
- nose irritation

- temporary hearing loss
- ringing in the ears
- persistent headaches
- any other problems they feel to be work-related.

As you make a survey of hazards in the factory, remember:

- suspect everything

keep written records of everything you find

- draw diagrams of any area/s with particular problem/s (showing for example, position of workers, source of fumes, ventilation point).
- count the number of workers exposed to each hazard.
- document in writing all requests made to management personnel.



## HEALTH AND SAFETY COMMITTEES

The British "Health and Safety at Work Act" was enacted in 1974. In 1978, an amendment to the Act created union Health and Safety Representatives with legal rights. These Safety Representatives investigate the hazards and complaints of workers, make representations to employers and approach Health and Safety Executive (HSE) of the government.

In order to carry out these duties, Safety Representatives have legal rights in respect of employers, and Health and Safety Inspectors:

- \* Employers must give them facilities to carry out inspection of their work while the shifts are on, at least on a 3 monthly basis;
- \* if there is an accident or dangerous occurrence' they must be permitted to inspect;
- \* they must be allowed to see any documents which are relevant to health and safety;
- \* they may request the employers to establish a joint safety committee to review measures taken to ensure workers safety and health;

\* they should be immediately notified when the HSE inspector visits, and should be permitted to accompany the inspector, and consult privately; they may also take their own samples of any substance for independent analysis;

\* HSE inspectors must give them information on measurements, testing, results of sampling or monitoring, and any action taken;

\* they have a right to avail paid "time off" in order to carry out their functions, and to undergo union and TUC training.

The Act also provides the employees in general, and safety representatives in particular, the rights to information about health and safety concerns.

Since 1978, the Trade Union Congress (TUC) has trained more than one lakh Health and Safety Representatives (HSR). The workers acting as HSR, are appointed by the unions. And thus a new cadre of trained and committed leadership on health and safety of workers, has emerged within the trade unions.

Can our unions similarly create and train health and safety experts from among the members?

## **GOOD PERSONAL HYGIENE**

The importance of good personal hygiene must be recognised in preventing the harmful effects of poisonous substances. For example, dirty hands can easily transfer such substances to the mouth, eyes and face. Here are some other important tips to remember and practise:

- \* If you work with dangerous dusts, take a bath and wash your hair after work.
- \* Periodically change dirty work clothes.

\* Avoid eating food beside the workbench or machines.

Make sure that your working environment comes upto standard.

Do not get old before you need to.

### What Can the Unions Do?

Experiences of struggles of workers and unions from other countries show that several strategies are needed for correcting work place hazards, for example:

- \* Health Surveys, carried out by workers and activists.
- \* Medical Check Up of Workers, with the help of professional experts in Industrial Health/Industrial Medicine.
- \* Plant Surveys, to identify hazardous working places, machinery, processes, materials and jobs

- \* Educating and Mobilising the workers on work related health hazards
- \* Struggles for corrective measures to be adopted by the management - bringing occupational health and safety issues in the charter of demands.
- \* Pressure for more effective implementation of existing legislation and formulation of a better and comprehensive legislation.

Safe Work is Your Right: Demand It!



# FURTHER RESOURCES

The following is a select list of institutions and materials which can be a resource on occupational health and safety issues:

## A. Institutions

1. National Institute of Occupational Health  
Meghani Nagar,  
Ahmedabad - 380 016.
2. Industrial Toxicology Research Centre  
Mahatma Gandhi Marg,  
P.O. Box No. 80  
Lucknow - 226 001.
3. Central Labour Institute  
Sion, Bombay - 400 022  
(Regional Offices at Kanpur,  
Madras and Calcutta)
4. National Environment  
Engineering Research Institute  
Nehru Marg, Nagpur - 440 020.
5. Indian Institute of Technology  
Department of Bio-Medical-  
Engineering  
Hauz Khas, New Delhi - 110 016.
6. Centre for Science and  
Environment  
807, Vishal Bhawan,  
95, Nehru Place  
New Delhi - 110 019.
7. Lokmanya Medical Research  
Centre  
759/51 Deccan Gymkhana,  
Pune - 411 004.
8. Centre for Education and  
Documentation.  
3 Suleman Chambers,

4 Battery Street  
Bombay - 400 039.

Occupational Health Clinic  
ESI Hospital, Pandoo Nagar,  
Kanpur.

Regional Occupational Health Centre  
(Eastern)  
Dr. Mohammad Ishaq Road,  
Calcutta - 700 016.

Regional Occupational Health Centre  
Ground Floor, Central Library Build-  
ing, Bangalore Medical College  
Campus  
Bangalore - 560 003.

## B. Materials

1. Encyclopedia of Occupational  
Health & Safety (Two Volumes)  
1983. International Labour  
Office, Geneva. A detailed  
comprehensive guide to problems  
of work-place hazards and  
their corrections.
2. The Hazards of Work: How to  
Fight Them  
Patrick Kinnersly, Platts Press  
Limited, U.K.  
(Unit 10 Spencer Court,  
7 Chalest Road London NW1 8LH)  
1973.  
  
This book covers the physical  
hazards, chemical hazards,  
occupational diseases, British  
Law, etc.
3. Work is Dangerous to your  
Health  
Jeanne M. Stellman, Vintage  
Books, (a division of Random  
House) New York (USA), 1973.

This book covers various industrial hazards: Physical hazards, Chemical hazards and Occupational diseases. It also tells how to deal with these problems.

4. Chemical Hazards of the Work-Place

Nick H. Proctor & James P. Hughes - J.B. Lippincott Company, Toronto, 1978.

This book contains detailed information about different chemical hazards.

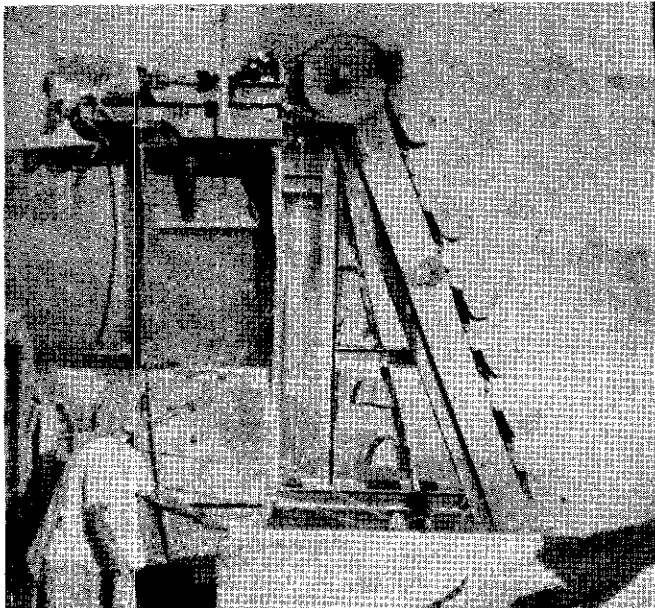
5. NIOSH/OSHA Pocket Guide to Chemical Hazards

U.S. Occupational safety and Health Administration and National Institute for Occupational Safety and Health, 1978.

Useful technical guide, lists over 750 industrial chemicals with their alternative names, U.S. permissible exposure limits, suitable personnel protection, etc.

6. Taber's Cyclopedic Medical Dictionary

U.S. F.A. Davis Company - 14th edition 1981.



This dictionary will help to figure out the easy meaning of certain scientific terms.

7. Watch out: A Hand-Book of Safety and Health for Furniture Workers

Highlander Research and Education Center, Route 3, Box 370, New Market, Tennessee 37820, USA, prepared for united furniture workers of America, 1979.

Covers specific hazards, their effects and safety precautions, in the furniture industry.

8. Warning: Your Workplace may be Hazardous to your Safety and your Health

United Food & Commercial Workers International Union U.S. 1980.

Covers common hazards for U.F.C.W. members: Barbers and beauty shop personnel, food processing, footwear, fun and leather division workers and packing houses, etc.

9. Better Working Environment

International Metalworkers' Federation, First Edition 54, bis route des Acacias, 1227, Geneva, Switzerland.

This manual provides knowledge about the dangers at work and what can be done about them.

10. Health and Safety at Work

A course for union representatives - 1980, second edition Published by - Trade Union Congress, Congress House, Great Russell Street, London WC1B 3LS.

This course is for trade union representatives who deal with Health and Safety issues, and is divided into 7 issues.

## ABOUT US

Society for Participatory Research in Asia (PRIA) is a non-profit, voluntary organisation registered under the Indian Society's Act.

Participatory Research is a methodology based on the belief that knowledge is power and, therefore, can contribute towards the empowerment of the poor. It promotes the involvement of the poor and oppressed, their organizations and representatives in the creation and utilization of knowledge in their own collective interests. It thus attempts to challenge the monopoly over knowledge and its tools in the hands of the few.

We work with local groups and activists involved in struggles of the poor and oppressed.

'PRIA' provides this support through training, research, evaluation, bringing

together groups on common issues and preparation of learning materials.

We are a team of ten persons working with partner groups all over India.

In the last three years of its existence, PRIA has specially focussed on primary health care, adult non-formal education, problems of deforestation, land alienation and occupational health hazards. Besides this, workshops and training programmes on relevant themes have been organised as per the needs of partner groups.

A wide range of persons have contributed in the preparation of this manual. Ganesh Pandey, Loy Rego, Rajesh Pandey and Rajesh Tandon have worked on the text, assisted by Hemraj and Satish. Dr. N.K. Mehrotra has been extremely helpful in providing technical guidance on it. We are grateful to him.

