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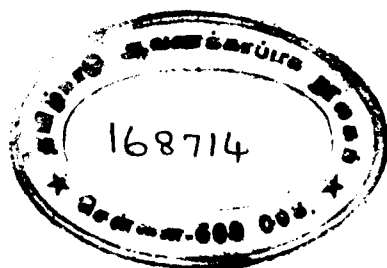
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World Health Day

7th April 1969

"HEALTH, LABOUR AND PRODUCTIVITY"

World Health Day, 7th April 1969, marks the anniversary of the coming into force of the Constitution of the World Health Organization (WHO). Each year a special theme, of importance to a large number of countries, is chosen. The theme for this year is Health, Labour and Productivity.



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“Health, Labour and Productivity”

DR. M. G. CANDAU,

Director-General of the World Health Organisation.

Men and women are essentially the creators of all progress and development. For without human intervention, materials, money and machines would be sterile instruments indeed.

Amongst the objectives of development are health and productivity. They are reciprocal and complementary. without health, productivity can hardly flourish. On the other hand, productivity may increase the means and opportunities for better health.

But work, upon which productivity also depends, has its hazards. Apart from accidents, men nowadays are not likely to be damaged fatally by their occupations, as was often the case in the not too remote past.

Yet the basic conditions for human health can be neglected. Dust, heat, noise, toxic substances, fatigue—all of them undermine the worker's fitness. The technocraft thinking only in terms of production may develop types of machinery which while brilliant in performance are detrimental to health. Paradoxically, also, ill-considered efforts to increase production can have the unintended effect of reducing output because of illness and absenteeism.

However, a properly planned health programme will deal with these and other hazards, and promote health in doing so.

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Occupational health work entails the prevention of illness and accidents and the improvement of working conditions. Machinery can be adapted to man, rather than man to the machine. Fatigue can be diminished, and monotony avoided. In another context, the worker can be specially selected for his job, and latent skills can be developed.

Doctors, nurses, social-workers, health engineers and architects can all contribute in maintaining the physical and mental well-being of the worker.

But in developing countries alike—wherever industrialization is a potent factor in economic progress—much remains to be done.

The diseases of occupation have long been of concern to the governments of many countries, but only after the First World War was it recognized that the problems of industry, like disease, know no frontiers and call for the setting up of international standards. The International Labour Organization was accordingly established in 1919 and, thus, will celebrate its fiftieth anniversary this year.

It has been WHO's privilege to be associated closely and fruitfully with ILO in many fields, where health and work share common or parallel interests.

A year ago WHO celebrated its twentieth birthday. It is therefore a great pleasure on the occasion of World Health Day this year to offer congratulations to an older member of the United Nations family on its fifty years of continuing achievement.

The Ergonomic Wheelbarrow

ROBERT TAYLOR.

In spite of its shiny name, ergonomics is not a modern invention. Its basic principles were first applied by the prehistoric genius who thought of the wheel. Since then, man has been constantly rediscovering this body of knowledge, and its importance in relation to work in winning wide recognition.

Stimulated by military demands during two world wars, ergonomics has developed to a point where it involves the interaction of a number of medical and engineering disciplines. The range of its operations has continued to widen, and can be as useful in a field of potatoes as in the automated control room of the latest type of steel factory.

Few tools exist that are less complicated than the wheelbarrow, but how often is it properly handled? Back ailments are one of the most common single causes of absenteeism and illness among farmworkers, and an ergonomist would point out that this is often caused by lifting loaded wheelbarrows the wrongway. The worker copes with this, as in lifting many other types of load, by bending down, taking the strain on his back and spine. Instead, he should keep his back straight and lift the load with the muscles of his thighs and legs, which are built for the purpose.

Man-job adaptation.

For hundreds of years it has been considered good management to oblige the man to adapt to the difficulties of his job. There was so much noise in the cotton mills that workers became deaf. The glassblowers of ancient Venice

gazed too often at their ovens, and their eyes dimmed with cataract before middle age. If output fell in 19th century factories, 12-hour shifts were simply lengthened to 14 hours. Regular breaks for meals were not countenanced.

It is obvious that, humane considerations apart, the old attitudes to labour involved steady loss both of trained workers and potential production. If the glassblowers had protected their eyes, their skill would have been available for many more years to their employers. Output may rise for a while when a shift is lengthened, but then the law of diminishing returns begins to operate, and production declines as workers become exhausted.

Today the ergonomist seeks to reverse the process, to adapt the job to human capacities, anatomical, physiological and psychological. What can happen when his knowledge is not utilized is illustrated by an incident from the industrial development programmes now being pushed ahead in many countries. An order was placed by a firm in Formosa with an European manufacturer for a "package" factory to make transistor sets, the factory to be delivered and assembled on the spot, ready for operation. Delivery was made on time, but there was one hitch. The layout of workbenches, their height from the ground, and the positioning of levers and operating buttons had all been designed with the relatively tall European woman in mind. For the smaller Asian women, the benches were in most cases too high, and some of the levers were out of reach altogether.

Here was a case for the study of the anthropometric and biotypic differences between races an important area of ergonomics, and the delay for rejigging was costly both in financial terms and in lost output of transistor sets.

Protective clothing.

Rejigging is not always possible, however. In fact, one of the challenges facing the work scientist is that very often he must deal with factory plans which would be too costly to scrap. In heavy industries such as iron and steel making, for example, the worker's potential output may be seriously limited by the fact that he has to cope with extremely high temperatures, both as part of his general surroundings and for brief periods during certain processes. The thermometer is likely to hover around 40°C in parts of the mill, and can shoot above 1600°C at an open-hearth furnace.

Management does not need to be told that this effect output very seriously, but the capital investment required to modernize and automate heavy plant is frequently a barrier to improvement. Since the environment is static, man becomes the variable. The aim of the ergonomist will be to ways of enabling workers to operate the plant at least risk to themselves, and at the same time to achieve a high level of production. He will therefore interest himself in the design of protective clothing. A man wearing a suit of thick cloth may at first sight be ill-equipped for work in a steel mill, but in fact the fabric can act as an absorbent, trapping heat before it reaches the wearer. If the fabric is combined with a reflectent surface, and some form of insulating layer, it will prove extremely effective in shielding the worker against high temperatures. The investment in such clothing can be recovered in a short time, since it enables the worker to lengthen his shift and shorten his rest-periods.

The subject of protective clothing also throws light on the essentially interdisciplinary nature of ergonomics. Research of this kind brings together experts in the physiology of work and environment, as well as biologists and physicists, and specialists in such divisions as the study of muscles,

biometeorology and safety engineering. The problems range from industry to agriculture, from the difficulties of working with white-hot metal to the risks facing a farm labourer operating machinery with cold, numbed fingers.

The inefficient topee.

Some of the knowledge gained has served to sweep away long-cherished but erroneous ideas. The white man in the tropics used to place considerable faith in his topee as a defence against the sun. In fact it was an uncomfortable piece of headgear that gave no more protection than a light cap. On the other hand, heat loss from the head in low temperatures is much greater than commonly realized—it has been found that an out-door worker can keep his feet warmer in winter by putting on a hat. The fishing industry has a high accident rate, but the ergonomist is helping to reduce it by designing boots that provide a grip on a heaving, slippery deck.

Which comes first then—the chicken or the egg? The trial-and-error approach to work—or the design based on ergonomic principles? It is a human weakness that the trial-and-error approach often wins. But a classic example of how central ergonomics can contribute to progress is provided by the Andean Indians, a race of seven million people who were trapped in a steadily descending spiral of poverty and ill health until the United Nations mounted a special programme for their aid.

One of the factors that prevented them from bettering their lot was the poor design of their farming tools, which wasted muscular strength and did little more than scratch the soil. The crops they raised were thin and of little economic value. Income was consequently low, and diet

suffered. Weakened by malnutrition, and a prey to disease their ability to work was seriously affected. They now have modern implements, and are moving towards a better life.

Disorganized landscape of dials.

Applications of ergonomics can be made at all levels. Developing the knowledge gained in designing the cockpits of jet aircraft, scientists have turned their attention to the control system that have now spread to large areas of industry, including steel and chemicals, oil, textiles, paper, rubber, machine tools and printing. Here there is a confrontation between man and cybernetics of a type with which we are all becoming familiar. Dials, flashing or winking lights, switches, buttons, meters, gauges and levers compete for the attention of the operator. His mind is bombarded with information of varying degrees of urgency, and errors may be costly.

Mechanization and automation is not found only in the richer economies. The steel factories at Bhilai, Durgapur and Rourkela in India, the Kariba Dam in Zambia, the Owen Falls power station in Uganda testify to the complexity of industrial advance throughout the world.

On the basis of much investigation into patterns of body movement and sensory perception, the ergonomist can make a valuable contribution to the design of multi dial panels and switchboards. He will recommend that dials be grouped in patterns, for example, so that the operator's attention can move from one fixed point to another rather than wandering across a disorganized landscape.

If the pointers on a group of dials can be arranged to return to 12 o'clock when registering normally, the one eccentric needle that moves to right or left will be quickly

spotted. Horizontal scales will be used in preference to vertical ones, because it has been found that the human eye reads them more accurately.

The figures 6, 8 and 9 are readily confused, as are the capitals B and D, so they will not be used to register crucial data. From studies of fatigue in workers, the ergonomist will be able to calculate the margin of safety that must be built into meter readings, to allow for periods of slower response.

The hard-nosed accountant.

Elsewhere researchers are examining the links between fatigue and accidents, and the correlation between environmental temperature in the factory and absenteeism. It is research to satisfy the most hard-nosed cost accountant. In terms of loss of working days, accidents cost British industry alone an average of about \$ 900,000,000 a year, or well over four times twice the total resources available to the United Nations Development Programme in 1968.

A simple alteration in work rhythm can pay dividends. By introducing a carefully calculated series of three-minute pauses through shift in "guinea pig" Swiss factories, export were able to change the pattern of peaks and declines in output radically. The curves flattened sooner, and production rose by more than 11 per cent.

Such gains are worth thinking about, particularly when scaled up to the production needs of the developing countries. Even at the end of the Fourth Five-year Plan, in 1970-71, per capita income in India, for example, will not be more than \$110 (Rs. 825), or less than one-seventh of the per capita income in Japan today.

Agriculture, still the major activity in the poorer areas of the world, faces a tremendous challenge. The Food and Agriculture Organization estimates that to cope with population growth the production of food will have to be doubled by 1980 and tripled by the year 2,000.

Needs and resources are in very delicate balance, and such factors as increased work efficiency can help tilt the scales in the right direction.

—Courtesy: WHO.

The Changing Pattern of Occupational Health

JOHN TAYLOR.

We live in a world which, under the pressures of technical and social development, is undergoing rapid change. The spread of mechanization and automation is effecting industry across a broad spectrum, the multiplying discoveries of science are influencing the look and feel of our environment, new materials are transforming traditional mental concepts.

As children, we associated storage with sacks made of jute and sisal, and playrooms with soldiers made of lead. Now we live in a society whose culture symbols for future archaeologists may well be the polythene bag and the plastic toy. Once when engineers thought of strength, they thought of weight. Now we can produce a 300 foot concrete bridge span made of aluminium that weighs only 200 tons, and is as solid as a similar construction in steel that weighs twice as much.

It is a world facing a great shift towards urbanization and industrialization, particularly in the developing countries. While at one end of the time spectrum, suburbia is busily filling in the spaces between the great conurbations of the richer nations, at the other end the whole process of city-building is beginning again; today more than 40 of the 65 urban centres with a population of a million or more are located in the poorer areas of the globe.

Inevitably, the altered patterns of life are influencing our work systems, and the health and safety of the worker. During the industrial revolution, the employer saw to it that the worker lived near the factory, in the mean streets so characteristic of many cities. Today the worker is usually

much better, housed, but he must often travel for an hour or more morning and evening, crowded into buses and trains and subways, to reach his place of work. His contacts with his family, and his rhythms of working and sleeping, may be disrupted by shift work, the imperious demand of the machine to be surrounded by its attendants day and night.

As a result of technical change, and improved safety and health regulations, some of the ancient diseases connected with certain occupations are disappearing. Ramazzini, the famous 17th century writer on medical subjects, once described the agonizing predicament of a mirror-maker on the island of Murano in the Venetian lagoon, who could study in their own reflections the symptoms of poisoning from the mercury they absorbed daily into their bodies.

With the substitution of silver nitrate for the amalgam of mercury and tin formerly used in mirror silvering, this chapter of quiet occupational horror has been closed. Few painters today suffer from lead 'colic', although lead has so many uses throughout other industries that the risks have not disappeared. The incidence of lead poisoning is now generally low however, because of better control. Harmless chemicals have been found to replace white phosphorus in match manufacture, thus eliminating the necrosis of the jaw, known as 'phossy jaw' that once afflicted the workers in this industry.

The problem of safeguarding workers health remains. Illness and accidents still cause the loss of millions of man-days a year, with consequences which are extremely serious whether analysed in human or in economic terms. Because of improved occupational health services, the doctor today may see the X-ray of lungs of a miner suffering from silicosis at a much earlier stage than in the past. Because the miner

now uses a pneumatic drill instead of a pick, the pattern on the viewing screen will have changed. The pick threw up heavier particles of dust, causing large nodules in the lungs. With the drill, the dust is finer, but no less deadly. Now the X-ray shows a "ground glass" pattern, but the damage to the lungs remains irreversible.

The question of dust is worth looking at in some detail, not only because of its importance as an occupational risk, but because of the wider implications for any development plan linked with productivity. The economic expansion in certain countries over the past few decades has quite often meant an accelerated industrial growth with which safety factors have not kept pace. If a trained man has to be withdrawn from the labour force, or transferred to other duties, output suffers. If he is disabled, a corresponding strain is thrown on the community's medical and social services. A steady drain begins, slowing the progress of a country which may already be striving to close a gap 100 years wide.

Dust, in fact, is a man-made plague that threatens thousands of workers every year, in the coal mines of Asia, America and Europe, the gold mines of Africa and the Soviet Union, the potteries of Japan and Britain metal mines of Bulgaria, France and Hungary. It is a danger to tunnellers and stone cutters, and to men who work in quarries, foundries, textile mills and many other types of industry.

Once again, technical advance at many levels has yielded better protection. Progress is recorded on the old tombstones in cemeteries in Sheffield, in Britain, a traditional centre for the manufacture of cutlery. When sandstone, grindstones were in general use, cutlery grinders had a life expectancy of less than 40 years. Today the grinding wheels are made of synthetic abrasives like carborundum, and the workmen lead normal lives, freed of the fear of pneumoconiosis.

The machine itself is coming to the rescue by altering many fundamental processes. Hoisting and handling appliances, fork lift trucks, moving belts, conveyors and chutes are replacing many workers on the shop floor, and at the same time removing men from contact with those points where dust may be created.

Mechanized handling systems are frequently combined with forms of enclosure, so that the product is like a traveller on an underground railway, diving into tunnels and emerging only briefly at certain "platforms" for further treatment. This makes it easier to install efficient exhaust ventilation to remove the dust from the air.

In South Africa, miners could once work only for a period of about six years. The introduction of dust-suppression practices has increased their working life to 18-27 years, representing a tripling or quadrupling of the mining force. The state in Britain today helps to support an army of about 50,000 miners who are either partially or completely disabled by pneumoconiosis, but new cases fell from 3,654 in 1960 to 1,403 in 1965.

The influence of mechanization and automation has also helped to cut down injuries from accidents. In Finland, to take as an example a country where the timber industry is not particularly dangerous by world standards, about 500,000 working days are lost each year as a result of accidents in logging and timber floating. In West Germany, one worker in ten has an accident in an average year. The ratio in Italy is one worker in nine. These are figures taken at random, to indicate the scale of a problem that affects the whole of the world's timber industry.

Lifting equipment has led to a sharp reduction in the accidents which occur where physical effort is required, particularly hernia. Mechanization and enclosure in iron and

steel plants has enabled management to withdraw workers from direct contact with moving parts and hot metal. Soviet technicians have outlined a plan for a fully automated factory where pouring ladles and cranes for hauling pig-iron and steel are to be replaced by induction pumps and closed tubes through which the molten metal would be drawn by means of moving magnetic fields.

Unfortunately, there are other trends connected with modernization that are less encouraging. The study of reports from developing countries shows that the increasing use of pesticides, some of which are highly toxic, is often accompanied by casualties among those handling them. Parathion, for example, is playing a key role in improving rice crop yields, but no other chemical used in agriculture has claimed as many lives. Mechanization on the land is frequently associated with a steep rise in injuries, an indication that training and supervision are not adequate.

In any modern economy there will be a growing company of workers in services and non-manual occupations, and they, too, are having to learn to cope with change. The office worker in the past often worked at a furious pace at certain times of the month with quite periods in between. Now his work is provided by a machine and there is a steady flow that can be planned and evenly distributed throughout the year. The worker himself, however, comes under a daily, unrelenting pressure of a kind familiar to factory employees but to which office staff are less accustomed.

He may find that the whole content of his job has suddenly changed and that the skills he has acquired over the years are no longer needed. The book-keeper has to put down his pen, and learn to cope with a complex key-board. The tabulating machine operator must maintain constant vigilance to avoid having to halt his machine to make adjust-

ments. There is a mounting rhythm and tempo. The worker must keep up. It is the beginning of stress, the modern disease.

It has been calculated that as much as 40 per cent of office personnel involved with mechanization and automation exhibit signs of the stress associated with work that is both monotonous and exacting. Such effects include physical and mental symptoms, increased irritability, insomnia, depression, skin rashes and cardiovascular and digestive disorders. They become more accident-prone, more susceptible to infections, more likely to suffer from stomach ulcers and arterial hypertension.

Scientific advance touches life at many points. Nuclear energy plants are not yet a feature of every economic landscape, but an ingenious range of x-ray and gamma-ray equipment is becoming an essential part of modern industrial technology. It is used to test alloys and castings, monitor the flow of liquids, in pipes, inspect weldings, gauge wear and tear. In blast furnaces, for example radioactive sources are built into the lining at regular intervals. A simple detector applied from outside will monitor wear by measuring the decrease in activity.

But since radioactivity can pass through walls and sealed storage containers, such equipment calls for extremely careful handling. The biological effects on man can be devastating, so this one occupational risk has received a great deal of research and attention. Safety levels are usually high, however, and cures of radiation damage are comparatively few at present.

Technology is racing ahead in many other areas, however. The chemical industry is in a period of unprecedented expansion, as world demand rises for the multiplying

derivatives of coal-tar and petrol. Where once the visible and tactile world was made of iron and steel and wood, now it is likely to be made of plastics.

Church spires and road tankers, greenhouses, freight containers, trawlers, motor-car bodies, even railway engines are today being made of reinforced plastic materials. Europe produced over seven million tons of plastics in 1966, and the United States nearly as much again.

The test-tube revolution has not been without human cost. Chemicals not only act on each other, they also act on man. Since skin is his largest organ, it is the first target, and in fact industrial skin diseases in many countries represent a percentage of between 60 and 80 of all illnesses affecting workers. Actual contact with chemicals is not always responsible, but the risk in the industry is a major one. Dermatitis is not usually a fatal affliction, but apart from the mental suffering involved it interferes seriously with production. Skilled men may in some cases be obliged to remain idle for many months before being able to return to work, and sometimes become so sensitized that they have to stay away from such work altogether.

In this as in many other industries, however, the worker is much better protected than in the past. Both at the national and international level, the problem of occupational diseases is the object of research, study and discussion, and where possible, regulation or recommendation. This is but an acknowledgment of the fact that health and wealth are closely related, and that disease and poverty are stamped on the other side of the medal.

—Courtesy: WHO

The Factory is a Battlefield

BY JOHN TAYLOR.

To a certain extent, a factory can be compared to a battlefield. Depending on the industrial process in use, the hazards facing the workers can escalate steadily. Sharpnel is no more lethal to the human body than the flying piece of steel that breaks off from a worn chisel. Materials that are likely to explode are common enough in manufacturing.

A damped-furnace can give off carbon monoxide, a colourless, odourless gas that deprives the victim of the power of movement before halting the life of the body. In the manufacture of artificial fibres, workers run the risk of contact with carbon disulphide. Inhaled in small quantities over a period of years it can lead to depression, personality changes, and insanity. Compounds of cyanide have wide applications in electroplating, and the extraction of gold and silver. The poison, familiar to readers of detective stories, kills within one to two minutes.

Radioactive substances have so many uses both as tracers and gauges that they are becoming a familiar part of modern technology. The danger to the worker is no less than for the man threatened by a tactical nuclear weapon.

The figures speak for themselves. The International Labour Organisation has reported that in the last war British forces suffered casualties, including dead, at the rate of nearly 11,000 a month. In factories in Britain casualties were at the same time running at over 22,000 a month. Casualties in the United States armed forces were about 25,000 a month. In American factories during the same period the casualty rate was over 160,000 a month.

Economic anaemia.

It is true that these figures are conditioned by the priorities of war but they also throw light on the dangers to health that arise in the work environment. The risks to the worker include not only injury but illness. In some countries in Europe, the illness rate per week from all causes is much higher than the accident rate. In the United Kingdom, for example, it ranges from 9 to 14 times higher, depending on the industry.

In a recent year in Britain, it was estimated that for every minute lost through labour disputes, nine minutes were lost through industrial injuries, and over two hours through sickness. One German worker in 10 has an accident each year, so industry as a whole bears a loss, at a very conservative estimate, of at least half a million working weeks. In the United States, over 500 million working days are lost annually because of illness. Apart from the important question of human loss, this is a form of economic anaemia.

The statistics, it should be borne in mind, are drawn from parts of the world where industry is highly developed, both in terms of size and concentration, and where systems of health protection operate with acknowledged efficiency. They are a measure of how much remains to be done, however, particularly in countries where industrialization is just getting into its stride.

Ignorance of the potential risks of the factory environment can have tragic consequences. A WHO expert on a tour of factories in Asia was once buttonholed by a worried executive, who told him that nearly three-quarters of the workers in a department making electric dry cells had been stricken by a mysterious illness. "Some cannot lift their arms," the manager said in some puzzlement. "Some are no longer able to move their legs." After a visit to the department,

the WHO official was able to make an immediate diagnosis—paralysis caused by manganese used in the manufacture of the batteries.

Unnecessary noise.

Bringing about an improvement in the factory environment is sometimes a question of spending considerable sums of money, but it can also be a matter of a few pennies. Better health and safety are components that can be slotted into the working pattern at many levels, from questions of design and location involving the plant architect and engineer to the provision of soap, water and clean towels.

Noise, for example, is a part of modern life, but a great deal of it is unnecessary. Not only does it threaten permanent deafness for certain workers, but it also has a close relationship with productivity. In a study of a weaving shop, the noise of the looms was found to produce a sound pressure of nearly 100 decibels. Earplugs were issued, which reduced the pressure by about 15 decibels. At the same time output, even by those workers who objected most to wearing the earplugs, rose sharply. In some cases, performance improved by as much as 12 per cent.

The health adviser will seek to eliminate the sources of noise, however, while the factory is still at the blueprint stage. Since sound tends to be deflected upwards, he will suggest that the factory building be placed on a hill rather than in a valley, out of consideration both for the employees and the community. Earth embankments help to muffle the noise from buildings where heavy machines are running. Administrative offices can be located at some distance from the production areas.

Noise moves easily along long, straight passageways and corridors, so they should be avoided. Absorbent materials like wood may be used in the construction of certain parts of

the building, instead of reflectant metals and plastics. The steady encroachment of the machine is also affecting the office worker so care should be taken to put enclosures round clacking calculating machines, humming photo-copiers, and busy typewriters. The speed of communication offered by open-plan systems can be more than offset by the noise level produced.

Temperature, humidity and accidents.

More and more production executives are recognizing that improvements in working conditions pay for themselves. Quite recently, acting on a recommendation from the company's medical staff, the lighting in an American cotton mill was doubled. Output rose by 4.5 per cent and the number of rejects fell, so that costs overall were reduced by 24.5 per cent. After a study of the results, the lighting was improved in two further stages, resulting in a production increase of 10.5 per cent, and a fall in production costs of nearly 40 per cent.

The problem of proper lighting is not solved simply by building a factory with huge windows. If there is too much light, it can produce glare, which is as troublesome to the eyes as too little light. Hot sunlight streaming through such windows can also affect the working environment, and therefore overall efficiency, by raising the temperature. There is some difference, however, between the temperatures at which men doing sedentary work feel uncomfortable in different climates.

In India, an office worker may begin to feel sleepy above 25° C, while in Britain, on a winter day, his counterpart might start nodding at 18° C. For an American, the point of discomfort might be 22° C. As the temperature and humidity continue to rise, however, there is a general falling-off in both physical and mental work, and accidents increase sharply.

The introduction of a cooling plant for their take air at a gold mine in Brazil reduced the temperature from 32° C to 27° C at 6,000 ft below the surface. The number of fatal accidents at once began to show a decline. In the 16 months preceding the installation of the plant there were 20 fatal accidents, and in the 16 months following the total was only six.

Substitution, mechanization, enclosure.

Ventilation affects not only the temperature, but also the cleanliness of the atmosphere. The lungs of a factory worker turn over about 60 lb. of air a day, which may contain particles of deadly silicate dust so fine they cannot be seen by the naked eye, or the fine powder of the nerve-paralysing phosphorus compounds used in some artificial insecticides. In a confined space, the heat from an industrial process like welding can cause the air itself to become a danger to man. A chemical reaction may be set in motion, causing the nitrogen and oxygen to combine to form harmful nitrous oxides. The industrial hygienist can combat the problem of air contamination by working with the engineer on local exhaust ventilation system.

Other weapons he can bring into play to reduce the casualties on the factory battlefield include substitution, mechanization and enclosure. Solvents, for example, are in widespread use today in industry, but some of them are highly toxic. The medical adviser will recommend the substitution of less dangerous materials for such substances as carbon tetrachloride or benzene. Carbon tetrachloride attacks the liver and kidneys, and phosgene may be given off when it comes into contact with hot metal, yet it is sometimes used in fire extinguishers. Benzene is so dangerous that it has been known to cause death even in the laboratory.

The principle of substitution can be applied not only to substances, but to processes and methods. Spray painting involves inhalation hazards, and the difficulty may be resolved **may** by arranging for paint to be applied dipping instead. The introduction of glove booths has helped to reduce the radiation danger attached to the luminizing of clock and watch dials. Mechanical fingers have replaced human hands in the application of lead oxide to storage batteries.

Psychological pressure.

One of the most fundamental ways of reducing the level of danger for the worker is to insist on good housekeeping, which often does not involve any expenditure whatsoever. It simply means that both the staff and the factory should be clean and tidy, not only for the sake of appearances but also because of the elimination of latent risks. A clutter of ropes and tools on a factory floor, for instance, increases the possibility of an accidental fall. And whether a man grazes his elbow or fractures his skull in a fall is purely a matter of chance.

There should be no cracks in floors or worktops where dangerous substances can lodge. Spilled mercury, for example, gives off a dangerous vapour, and should be wiped up immediately. One of the best means of protection against dermatitis is a high standard of hygiene, so workers need to be trained to keep their hands and fingernails clean. If prevailing attitudes are correctly oriented, then a slight deviation will be noticed at once, and psychological pressure will be generated to correct it. Many gallons of chocolate-brown paint are still used in factories because it helps to camouflage dirt, but this is not good safety management.

Nor is industrial health only a question of scale of operation. A high proportion of industry, particularly in the developing countries, consists of workplaces with less than

100 workers, often in widely scattered areas. It may be more difficult to deal with 100 plants employing 30 men than with a single factory employing 3,000, yet the workers all face some degree of risk. In addition, the loss of manpower through illness is magnified in a small factory, because of the strain it throws on those who remain. At the national level, the drain affects the whole economy. A developing nation is like a man running uphill—it needs all the health and help it can get.

—*Courtesy*: WHO.

Too Sick to Work

ROBERT PLANT.

The drag of ill health on the economy is tremendous. The sick worker, obviously, cannot achieve as much as the worker who is fit. Multiply the effect by hundreds, by thousands, by tens of thousands, by millions—illness can severely cripple economic effect.

The very brevity of life in poor communities represents an economic loss. The early years of existence—to adopt a simple and purely economic argument—are a drain on the family as on national resources. Some years ago, three American authors wrote a book called *The money value of man*, in which they sought to express this drain in cash terms for their own country, the richest and one of the healthiest in the world. They assumed that the average person in the United States was non-productive for the first 18 years of life and estimated that the cost of supporting a child in a family of comparatively modest income up to that age at that time—1947—was about \$ 10,000. Three years later another American writer, Hanlon, put the figure at \$ 20,000 including the cost of education and recreational facilities to the State.

Not until a worker has been producing for several years does society begin to break even. Then the gain accumulates rapidly. Hanlan estimated that an average American with a normal life-span would by the time he died have made a net contribution to the economy of \$ 34,000 over and above all he had consumed himself. The authors would no doubt agree that calculations about the economic value of human life cannot be very exact, and in any case cash figures soon become out-dated, but they illustrate the point.

Even if a worker lives long enough to break even, he may still not live long enough to make the normal contribution to the national economy of the man who lives out a full life. His premature death then represents a loss. In a report written at about the same time, O. R. Ewing calculated that premature death was costing the U.S.A. \$ 11,000 millions a year. Yet the average life span of a male born in the U.S. had risen from 48 at the beginning of the century to 65 at the time Ewing was writing; for women, the figure had risen from 51 to 71. In Sweden, the first country to keep mortality records, life expectancy 200 years ago was 34 years, about the same as in some developing countries today. It took half a century to add 7 years to the average human life-span in Sweden and another century to raise the figure to 57. Now it has passed the biblical optimum of threescore years and ten. Countries like Sweden can afford to invest in their young people because they know they will normally get a full working life in return.

In developing countries, 15 would perhaps be nearer the age at which workers might be considered productive, yet in many regions more than half the deaths occur before the age of 15, representing an almost total loss to the economy. It has been estimated that the average life expectancy of two-thirds of the world's people at birth is little more than 30 years, although accurate returns are not everywhere obtainable. In many parts of the world there is no legal obligation to report births and deaths. "Most infant deaths occur at home, unrecorded and undiagnosed", observe the authors of a book on the health services of Tanganyika published in 1964. A recent report on health objectives in Brazil revealed that in a typical country area 51 per cent of deaths were under one year of age and another 21 per cent under the age of 20. Only 17 per cent of the people reached the age of 50.

It is true that children still work in many places but their output is meagre. Their contribution is more than cancelled in later life by the effects of retarded growth, lack of education and other deficiencies caused by too onerous a childhood, not to mention premature death itself. It is equally true that aged persons also make little if any contribution to production, but this is rather a factor in societies with high life expectancies. Long life is normally a gift of a thriving economy, productive enough to support its veterans.

Economically, old people have generally made more than a sufficient contribution: society is mostly not the loser. This is true particularly in developing countries, where comparatively few workers complete their full working life: for every aged worker who enjoys five years of retirement, there are ten younger workers who die five or more years before they reach retiring age. It is they who represent the loss to the economy.

The burden of disease.

People who die young have probably during their short lives suffered diseases that have reduced their working time still further. Disease is from one point of view a more insidious menace to the economy than premature death, for the sick worker not only ceases to produce but continue to consume, to say nothing of health service costs. Even in the most advanced societies, work lost through familiar ailments such as the common cold and other minor complaints is generally much greater than losses from other causes of absence, such as industrial disputes.

In terms of output, it is not easy to compare disease and dispute because a strike of quite short duration in a key industry can deal a heavy blow to national production, while, with some of the workers off sick, a well-organized undertaking may be able to keep going, even if not at peak

efficiency. Despite attempts to catch up with lost time afterwards, the economic drain of sickness is heavy and must be immeasurable in the developing countries. Most of these countries are in the tropics and sub-tropics, where tuberculosis, trachoma, parasitic diseases and dysentery gallop like horses of the Apocalypse across the land. It has been estimated that schistosomiasis, a disease caused by absorbing a parasite from rivers and lakes, reduces productivity in Egypt by 33 per cent. In Tanganyika, during a typical month, 40 per cent of the workers on a sisal estate applied for treatment of this disease at the company hospital. Such a percentage suggests that practically the whole labour force was infected. Among peoples living near the great lakes in Africa, more than three quarters have been known to be suffering from schistosomiasis, which is not always recognized as an illness by the victim but causes vague symptoms at first and weariness.

Man against Mosquito.

Malaria, the scourge of the tropics, is steadily yielding to the massive eradication campaigns of recent years, but it is still a blight on the economy of many developing countries. Where the disease is rife, 30 to 43 per cent of the workers may be incapacitated by it at any one time during the year. The malaria mosquito, lighter than a fly, enjoys the grim distinction not only of killing men, women and children, and of disabling workers for long periods by fever, but also of attacking the economy by rendering land unfit for human occupation. When malaria was finally eradicated in Sardinia, an additional million people were able to settle on the island. Until then, malaria had barred agricultural extension. The present tourist boom would of course be unthinkable if Sardinia were still malarious.

As late as 1955, 40 per cent of the South American continent was infested with malaria. Much of this enormous area, rich in potential wealth, was underpopulated. By 1962, malaria eradication programmes were in progress in one-third of the area; the campaign has since been extended and now covers all the countries. In 1968, out of 179 million persons living in originally malarious areas of the Americas, 72 million were in areas from which the disease had been eliminated and another 106 million were in areas where an eradication campaign was under way.

Of the 687 million people living in the originally malarious areas of South East Asia, more than 616 million had been covered by eradication programmes by the beginning of 1968 and 268 million of them were living in areas already free from the disease. Among results, the following examples have been cited. When the campaign started in Nepal, only 5,000 people were living in the fertile but malarial Rapti Valley area; seven years later the same land was supporting a population 13 times as large. In other words, there had been an increase in production of roughly 1,200 per cent. In India, the Terai area of the State of Uttar Pradesh, once a desolate, malaria-infested waste, is now prosperous agricultural land. In three small sub-districts of Karnal in Haryana, more than 13,000 additional acres were brought under cultivation after the mosquito had been conquered. In Pakistan, one season's work on malaria control in an Eastern Bengal area was reported to have increased the rice crop by 15 per cent. D. K. Visvanathan in his book *The Conquest of Malaria in India* estimates that the eventual economic gain to his country from malaria eradication will be the equivalent of \$ 672 millions a year, representing an annual dividend of 75 per cent of the sums invested in the campaign.

All such calculations are of course indicative rather than precise. Every social transformation involves a complex chain of events. Malaria eradication means liberating human beings from the illness and from the threat of the illness. On the side of development, it spells improvement of the land, increased working capacity, better capacity for learning, greater initiative, etc.,—all of which are factors that can contribute to progress. Similar results can of course be claimed for successful operations against other mass diseases. Population increase—which may be judged economically favourable or unfavourable depending on circumstances—needs also to be taken into account. However, judging some of the results to be economically unfavourable is no justification for allowing a preventable mass disease from perpetuating itself. The problem is rather to plan ahead the socio-economic development of the country taking into account all the consequences of satisfying the basic rights of the population.

One final example on malaria. More than 50 years ago, when malaria was rife in the southern United States, the managers of two cotton mills who had assisted a malaria control programme in neighbourhood villages said that they "had never before received such enormous returns on any investment dividends had been over 100 per cent the first year." They explained that they had supported the campaign out of pity for the victims and had been astonished by the economic benefits.

The quality of labour.

The quality of a man's effort is itself impaired by repeated illness. Habitual victims of diseases often suffer from anaemia and general debility even when presumed fit for work. Some diseases, without causing intolerable discomfort, undermine health over a period of years, schistosomiasis for example.

Tuberculosis, also, killed nearly 10,000 persons in Mexico in 1965, more than 3,000 in Peru and nearly 4,000 in Chile and Colombia. In Peru, one person in 200 was known to suffer from tuberculosis, compared, for example, with one in 4,000 in the United States and in Canada. These are known cases. In countries with meagre medical services, many people suffer from diseases like schistosomiasis, tuberculosis and leprosy without reporting to a physician, or in some instances even knowing they are infected.

Malnutrition without doubt represents the heaviest drain of all on labour quality. No men can work well without adequate food, yet two-thirds of the world's people are undernourished. Lack of good food affects production in four ways. The body tends to protect itself by avoiding effort, the result being lethargy and lack of initiative. A poor diet lowers the worker's resistance to disease and its debilitating after-effects. Absenteeism is higher. Undernourished workers are accident-prone because they lack alertness and tire quickly. An additional, but vitally important consideration is that early malnutrition may impair intelligence.

Many examples of the relationship between food intake and work output can be given, but let one suffice. In 1961-63, an International Labour Organization team made a study of productivity among workers building a large dam in India. They found that the hardest workers were the 10 per cent who came from Malabar, whose output was 80 per cent higher than the others. In tools, methods, skill, physique, age and other respects, the men from Malabar appeared to have no advantage over their fellow workers. "The only significant difference," wrote the experts, "is that they are customarily fed communally by their employers as part of

their emoluments. They were consuming an average of 4,500 calories per head per day, as against 2,800 by workers who bought and cooked their own food."

A report on the relationship between the quality of labour and economic growth published by the ILO in 1964, which was based on statistics from 52 countries at practically every stage of development showed that an increase of one per cent in calories available per person was accompanied by a productivity increase of 2.27 per cent. Until then, most studies of economic growth had assumed that the rate of capital investment was virtually the only determinant. Conscious of breaking new ground, the authors were careful to say that they had shown no more than the existence of two facts side by side. Yet Napoleon had already observed that an army marches on its stomach.

Poverty is the enemy.

Premature death, absenteeism caused by sickness, debility, lassitude, and poor nutrition are placing an immense economic burden on developing countries. All these factors relate to poverty and the only way to reduce poverty is by economic development so the vicious circle is complete. Breaking the circle calls at once for better health, more and better food, better education and greater agriculture productivity.

Here and there, one still meets persons who believe that certain races are naturally more energetic than others. The moral equality of men is accepted, but it is argued that the economic backwardness of, for example, Asians and Africans can be explained by the fact that they are by nature physically feebler and more prone to disease than other peoples. The Olympic Games dramatically refute the idea, but it may still be argued that world-class athletes are abnormal, whatever their origin. That ill health is in fact directly related

to poverty, not to racial or national characteristics, was well brought out in a study of disability and medical care among whites and non-whites in the United States, published in 1965. This showed that the incidence of chronic illness was the same for whites and non-whites of comparable age in the same income groups. The relationship was overwhelmingly between income and disease, and not between skin colour and disease. Roughly 30 per cent of the white and of the non-white populations suffered from chronic complaints in families with incomes below \$2,000 a year about 17 per cent of both groups in families earning between \$2,000 and \$3,999 a year, and less than 10 per cent in both groups in families with \$4,000 to \$10,000 a year. Other indicators, such as days confined to bed, told the same tale.

Poverty begets sickness and weariness. Sickness and weariness perpetuate poverty.

—*Courtesy* : WHO.

Poisons at Work

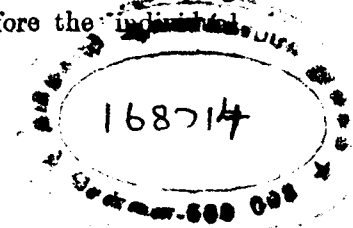
DR. ABRAHAM MARCUS.

"We cannot completely eliminate toxic hazards from every industry in which they exist. To do so, if it were possible, would be so costly in many cases as to mean financial ruin for the industries concerned. Our aim must be the achievement of realistic standards of hygiene in factories and other workplaces plus health supervision of the workers."

The question I had put to Professor R.S.F. Schilling, Head of the Department of Occupational Health at the London School of Hygiene and Tropical Medicine, was this: "Can we abolish the risks that cause disease in industry?" His reply, in effect, summed up the scope and limitations of the expert in occupational health. The essential activities of the doctor in industry are medical examination of the workers and advice on control of the environment. He needs to be ever on the look out for any harmful changes and make certain that standards of hygiene and safety are observed, such as the maximum permitted level of toxic substances in the atmosphere or the wearing of protective clothing.

As regards the workers, their first examination should be made on applying for work so that the doctor may identify those who are susceptible to a hazard—for example, people with a history of chest disease seeking employment in a cotton mill or a coal-mine where there are dusts that can affect the chest, nail-biters in a factory where lead is used, men with ear disease in work situations that require increased atmospheric pressure. Afterwards, preferably all workers that are employed should be examined regularly. In fact, industry often presents an ideal opportunity for applying modern methods of early diagnosis before the worker experiences any symptoms.

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An ancient ill—

In many countries the most important hazards in industry are still the obvious ones that have existed for centuries. Lead-poisoning probably occurred in prehistoric times and almost certainly in ancient Egypt around 4,000 B.C. Gradually the use of lead increased and, after the Industrial Revolution, lead-poisoning reached alarming proportions. To day lead-poisoning may occur in battery factories and among certain shipyard workers.

One of the symptoms of chronic lead-poisoning is intestinal colic preceded by several days of constipation. When the relationship to lead-poisoning is not recognized, the patient is perhaps treated with laxatives or worse, the condition is mistaken for appendicitis and an operation is performed accordingly. In late chronic lead-poisoning, the muscles most used from an occupational point of view become paralysed. Therefore, palsy in the form of wristen—drop the hand hangs down at the wristen—may be seen. These symptoms and signs represent a degree of exposure that should not occur these days and the doctor's purpose is to detect, by regular examination, those who are in danger of being poisoned. Among the medical evidence indicating undue lead absorption or lead-poisoning are effects on the red cells, the occurrence of an abnormal level in the urine, a fall in the amount of haemoglobin in the blood, a blue line of lead sulphide along the gums. Doctors must be on the watch for these signs, but surest of all is measurement of lead in the blood stream. We all have some lead in our blood—and there is an accepted normal range. The World Health Organization has concerned itself with defining this range. But the lead worker may go well above the level that indicates poisoning before he suffers from colic and other symptoms.

No worker should ever have a high level of lead in his blood. Regular estimations of lead in blood drawn from a

vein should give adequate warning of a rise towards the danger point. But it does happen. In Britain, alone, 80 cases of lead poisoning were notified in 1966—far fewer, probably, than actually occurred, though not all of them of course are necessarily industrial cases.

In the prevention of lead poisoning the first line of defence is control of the environment. Inhalation of lead dust and fumes is the principal risk; therefore processes involving lead should be enclosed, or efficient exhaust ventilation should be provided. Concentration of lead in the air should be measured. Commercial products containing lead should always bear a warning on the container. If these measures are not applicable the workers can wear approved respirators and the floors can be kept wet to keep down the dust. Management and workers must be educated so that they understand the dangers and the precautions that must be taken. Workers should keep themselves and their workplaces as clean as possible. Smoking and heating should not be allowed in contaminated areas. Commercial products containing lead should always bear a warning on the container.

The long road to health—

One would be justified in thinking that we have been rather slow to prevent or control diseases in industry that we have been aware of for so long—thousands of years in the case of lead-poisoning. "In the first place," says Professor Schilling, "It takes a long time to understand these diseases. Tests for earlier diagnosis have been introduced only recently. Then it takes many years to establish legal controls and their enforcement may tend to be weak."

The tests for early recognition of lead-poisoning have been introduced only in our own century, the first test about sixty years ago, and the most effective means to measure lead in the

blood was introduced about 20 years ago. And it was not until 1964 that the law in Britain required a haemoglobin estimation every three months in all lead workers. Measurement of lead in the blood is not yet a legal requirement.

There is also an economic factor—manufacturers often fear that some measure designed to minimize a risk may affect their trade. In the pottery industry in England, lead-poisoning was a serious hazard because of the process of dipping earthenware into a lead glaze. Although a leadless glaze was invented in the 1820, it was not until 1950 that the dangerous glaze was prohibited by law and that lead-poisoning was finally eliminated from the industry. Other means had been tried first—even to the extent of providing free milk for the workers—because the pottery manufacturers believed that giving up the lead glaze would be disastrous for their trade.

Another complex-story is that of byssinosis a chest disease caused by inhaling cotton dust. For a very long time no one knew it existed. Some 40 years ago, Charles Turner Thackrah, a physician of Leeds and a pioneer of industrial medicine in Britain, stood in a street in Manchester and watched the workers stream out of the cotton mills. "I saw a degenerate race of human beings," he said, "stunted enfeebled and depressed." He contrasted them with the healthy-looking workers in the Yorkshire woollen mills and concluded that the Lancashire cotton workers were more dissipated and worse fed, housed and clothed. He was a Yorkshire man. He knew nothing of the harmful dust that was present in cotton mills but not in woollen mills and that, inhaled into the lungs, caused a chronic disabling disease of the chest.

Clearly recognizable.

Even in 1941 when the British Government first introduced compensation for byssinosis, the disease was poorly understood and still confused with chronic bronchitis. In the first six years of the compensation scheme, only 39 pensions were awarded out of a total of 15,000 men and women workers. Byssinosis was believed to be an unimportant and dwindling disease, a view held in countries through out the world that had large cotton industries. But then a group of doctors which included Professor Schilling began to examine the cotton workers. The characteristic symptoms of the disease were clearly recognizable—chest tightness, breathlessness, and cough on Mondays after the week-end break (in Mohammedan countries these symptoms occur on Saturdays). They found byssinosis in a large proportion of the workers—more than half of those in the card-rooms of one group of mills. Now about 1,500 workers in Lancashire are getting pensions for disability, and in many other countries, as a result of these studies, byssinosis has been found to be a common disease among cotton workers. Even in the United States, where the mill-owners refused to believe that byssinosis was a problem, it has now been recognized as a serious hazard.

Developing countries have much to learn from the experience of those whose industrialization took place earlier. Particularly in the textile industry, which often is one of the first to be set up, it is important that means for protecting the worker's health are incorporated from the start.

It is realized now that a substance present in the leaves of the cotton plant is reasonable for the disease. Inhaling the dust causes the air passages in the lungs to narrow. At first as the week passes, the worker gets accustomed to the toxic

substance only to develop symptoms again on returning to work each Monday. Later, when the disease has become chronic, symptoms are present all the time.

The permanent alert—

Constant vigilance on the part of employer, worker and doctor is the watchword in dealing with toxic hazards in industry. This applies to new hazards as well as old. Radiation risks are a case in point; great as these are, vigilance is such that few people suffer over exposure. In general, though, our monitoring system for detecting hazards as new industrial processes are developed is not very good, says Professor Schilling, and there is no substitute for careful observation. The substance used in a given process can be tested in the laboratory but a whole series of negative results is not enough. The environment in the factory must be monitored regularly to check concentrations of materials that might turn out to be toxic; the workers must be examined at frequent intervals to detect any signs of abnormality. To be certain that all is well, observations may have to extend over a long time. Mere absence of symptoms in workers exposed to a possible risk is not enough. The longevity of workers must be looked into, as well as their productivity. Mortality statistics must be studied, retirement pensioners must be watched in case they die ultimately of some condition that may give a clue; the amount of sickness absence must be kept under surveillance and the reasons for it ascertained.

If there is a motto for the doctor working in occupational health, it can only be "Take nothing for granted".

—Courtesy: WHO.

Noise—The Invisible Enemy

A. STRIGANOV.

Modern civilization depends on the machine, on the internal combustion engine, the jet aircraft, on a technology which entails noise. To find human beings who are not constantly exposed to artificial noise, the scientist today has to seek out remote tribes in the jungles of South America or Africa, or in the polar wastes. Everywhere else, noise, the invisible enemy, is virtually omnipresent. It escalates from mere nuisance to a level where resistance involves an effort of endurance, then may climb to a point where it becomes an assault on the body, causing both mental and physical disturbance. Yet the problem of noise is still far from receiving the attention it deserves.

Unlike other forms of attack on human beings, noise is not always punishable in law. Whether sudden, intermittent or continuous, noise is not as evident a form of assault as a blow on the head, but it is nevertheless likely to cause some kind of damage, almost imperceptible perhaps, but none the less dangerous for that.

According to Dr. Alan Bell of WHO, "noise is both an occupational hazard and a public nuisance". That noise creates problems in industry is, however, no recent discovery. Nearly three centuries ago the Italian medical writer Ramazzini noted in his book on occupational disease, *De Morbis Artificum* that workers engaged in hammering copper gradually became deaf. Later, in the 19th century, as the industrial revolution began to get into its stride, a considerable literature began to accumulate about noise and its effects on hearing.

Today, when the majority of workers are surrounded by some kind of machinery, the noise invasion is total, and the problems it raises are correspondingly greater. Industrial research in many countries has shown that noise in the work environment is the main cause of occupational deafness. Some form of hearing damage, either temporary or permanent, is likely to affect men subjected to constant noise in a workshop. The degree of deafness is not only related to length of service and extent and type of noise. The general level of noise and its composition play a part, as well as the length of exposure during the working day and during the individual's working life. Factors of non-occupational origin also count, the presence or absence of other ear complaints, individual sensitivity to noise, and the kinds of noise encountered in daily life.

Many kinds of workers face a noise risk—they include men in heavy industry, construction and transport, foundries, boilermaking, weaving, shipbuilding, tunnelling and blasting. The most evident effects of noise range from distraction and annoyance to serious loss of hearing. The initial signs of impairment are difficult to detect except by audiometric examination and often those affected are themselves unaware of the deterioration. Hearing defects vary with the person and the work situation.

A sound is essentially a vibration, and its intensity is described in decibels (dB). A sound at 5 dB strikes the human ear as faint, while 100 dB is aggressive. Experts are not unanimous regarding maximum noise levels, but there is fairly wide agreement that above 85 dB there is a risk of permanent deafness. Some specialists maintain that no worker should be exposed to 135 dB or more without appro-

priate protection. Certain national legislations limit the permissible maximum levels to 75 or 85 dB for workers doing an eight-hour shift daily in noisy surroundings. The table below indicates the approximate intensity, in decibels, of a number of familiar daily noises :

A whisper	: 20 dB	Motorcycle without	
A watch ticking		silencer	: 120 dB
at 1 metre	: 30 dB	Lathe	: 85-95 dB
Conversation	: 60 dB	Punch press	: 95-105 dB
Street noise	: 40-70 dB	Circular saw	: 100-110 dB
Sports car	: 80-95 dB	Sand blasting	: 118 dB
		Riveting	: 130 dB

Laboratory and factory studies show that noise affects the worker, as an individual and in certain circumstances may also lower his output, depreciate efficiency and moral and become a causative factor in accidents. Noise surroundings create anxiety, irritability and fatigue, particularly among susceptible individuals. Noise can bring about temporary changes in many activities of the body, including the central nervous system and the stomach.

Twofold effect.

Noise, therefore, creates a two-pronged challenge to industry, for it not only affects workers' health but sabotages productivity. In fact some experts claim that the losses caused by hearing impairment among workers are greater than those caused by any other occupational illness. There is not only the impairment as such to be considered, but also the cost of compensation claims, decline in output, and an increase in the number of accidents. Before the last war, office noise was estimated to be costing business firms in the United States about \$2,000,000 a day through loss of efficiency. Since then, the figures is said to have doubled.

In spite of all this, many countries still neglect the problem, even though it is possible by modern techniques to prevent most cases of occupational deafness, and to reduce or eliminate noise efficiently and at low cost, while at the same time improving working conditions.

In general, the best way of dealing with any hazard is by suppressing it at the source, either by substitution or engineering. In the case of noise, a machine may be substituted for a more silent one; welding can replace riveting, while metal can be cleaned chemically instead of by high-speed polishing. Metal parts may be replaced by rubber or plastic. A well-maintained machine makes less noise, than one which is in need of lubrication, or has worn parts that need to be changed. Absorbant linings help to keep general noise low. The noise of a machine can be reduced by enclosure, or by segregating heavy plant in certain parts of the factory. Management can also help by task rotation among workers, or by reducing the length of shifts.

Where such solutions are not practicable, there should be greater emphasis on methods of personal protection, including the use of ear-plugs, ear muffs, and helmets,

It is very important for the health of workers in noisy surroundings that they receive audiometric tests before placement, and have periodic hearing checks by medical services. Audiometry assists decisions about placement, helps in the detection of hearing loss and the identification of particularly sensitive workers, and can be used as a measure of the efficiency of steps taken to suppress or reduce noise.

New legislation—

Although some industrialized countries still seek to deal with the noise problem by the method of persuasion alone, a

steadily growing number of countries have become alert to the danger, and have adopted legislation, established exposure standards, and introduced compensation schemes.

These laws and regulations tend to differ from one country to another. In the United Kingdom, for example, the 1960 Noise Abatement Act widened the scope of statutory provision, so that control became easier to enforce. Detailed regulations in the USSR cover the design and operation of machines, vibration control, the replacement of operations involving percussion by non-percussive systems, sound-proof cabins, sound-absorbing materials, methods of measuring noise, medical examinations, permissible levels of noise, and even the design of ear protectors.

In Austria, noisy machines or manufacturing processes must by law be separated from other parts of the factory. In Finland, noisy processes must be broken into "on-off" periods, or at times slowed down, if the nuisance cannot be adequately dealt with by other means. Regulations in Czechoslovakia include a recommendation that noise should be lowered wherever possible by the introduction of automation and remote control. In Turkey, workers not directly involved are forbidden to enter noisy machine rooms.

Control of noise at the source is part of the regulatory system in force in some States in America, while some national legislation, as in Austria and Canada, makes the provision of ear protectors and hearing aids mandatory. In many countries, including Australia, Denmark, the United Kingdom, Norway and the USSR, special organizations and commissions have been set up to study the problems created by noise. Since noise is part and parcel of our civilization, it should be the concern of everybody who has to deal with health matters.

—Courtesy: WHO.

The Economic Justification of Public Health Activities

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“ AN EXPENDITURE DEPARTMENT ”

Inevitability of Health Costs.—There are two related objections that are occasionally heard with regard to public health activities. One is that the establishment and growth of Public Health agencies and programmes have resulted in increasing costs to the public. The other is that public health workers are at a disadvantage in that *they cannot point to their successes*. This latter statement is made in contrast to the position of the private physician who with justification can point to the saving of many specific lives by his judicious medical and surgical management. Granted that the Public Health workers cannot point out particular individuals who have been spared illness and premature death by public health programmes, this is more than compensated for by the possibility of measurement in a larger and ultimately more dramatic sense. It must be realised that the fruits of our labours are in essence quite different from those of therapeutic medicine and that accordingly the bases of measurement cannot be expected to be the same. Public Health work is not fundamentally concerned with the repair of damage already done. Rather, we deal with the prevention of damage in the first place and the promotion of positive health. Furthermore, by virtue of the irrefutable fact that, *although healthy living is expensive, illness is even more so, it should be*

possible to demonstrate that preventive and promotive health activities after a sound financial investment to the individual and to the community.

Most intelligent people appreciate the reduction in human suffering that has resulted from the Public Health movement. It must be realized, however, that the further removed one is by time and space from the threat of personal suffering, the less consideration is apt to be given to it. In other words, in public health work, our very success tends to mark our value. It is appropriate, therefore, that the public and its elected representatives is given cause to appreciate the wisdom of expenditure for health from an altogether different view point.

As will be pointed out elsewhere, the cost of all governmental services have persistently increased. Proportionately speaking, the expenditure for public health services represents an area of considerable expansion. This has naused many to point to public health programmes as an added economic burden to the tax payer. It is important to point out and to demonstrate that an increased *sum of money spent wisely for health services* represents not an increase but *actually a decrease in the net bill for personal and community welfare.*

The construction and maintenance cost of public water purification and sewage disposal plants are admittedly great. These costs, however, do not represent an addition to our economic burden because their absence would cost us a similar, if not a greater, sum for individual facilities and for increased medical care and lost earnings resulting from the illness that would not be prevented. A single or repeated outbreaks of typhoid fever, for example, would cost a community much more in the long run than the installation of engineering and other measures designed for their prevention. A sound financial policy for public health services therefore

must take into consideration not only the humanitarian and social gains but also the economic advantages to be derived therefrom. The problem then is to bring before the public consciousness and to organise costs which in any case are destined to occur, either as bidden individual expenditure or as socially beneficial public appropriations.

Problem is two-fold:—

1. Public consciousness;
2. Organised costs.

A beneficial public appropriation.

Economic value of life—

Beyond the inevitability of these expenditure is the added factor of the economic value of the lives made possible or continued by public health endeavours. To many, the thought of placing a monetary value on human life appears to be indecent, immoral, or inhuman. By and large, our reactions to life and death are based primarily upon emotion and sentiment, and ordinarily we deliberately avoid any thoughts that have an economic flavour or that border on the materialistic. Yet, to be realistic, it must be admitted that life does have a monetary value. The death of a parent brings to society as a whole, as well as to the particular family involved, an economic as well as a continental loss quite real and irreparable. This may manifest itself in a lowered standard of living for the family, the necessity of public financial aid, or the loss of a trained worker.

Many have tried to evaluate man or, in other words, to put a price upon his economic worth. One of the earliest attempts was that of Sir William Petty (1623—1687), who originated many ideas later used by the political economist Adam Smith in his *Wealth of Nations* and others.

Later, Sir William Farr and Irving Fisher made more scientific computations, using the life table technique, which by their time had been developed. This approach has been

even more completely pursued in recent years by Dublin and Lotka, whose several publications of considerable social significance have been drawn upon freely in the following discussion.

The man body may be considered as similar to a medicine. Like other medicines its proper function depends on the movement and interaction of various physical and chemical parts, complicated and augmented, however, by a third and much more complex factor—biological reaction. To resort to a crude analogy, the body might be likened to an internal combustion engine with limbs in place of pistons and the organs of internal secretion acting as the carburetor. Super-imposed upon these is the supervisory function of the human mind which might be compared with the governor on an internal combustion engine. In a like manner, the human body may be regarded as an economic unit brought into existence for measurable, potential, productive purposes.

A machine designed for the production of ball bearings, for example, is of no intrinsic value in itself, its true value being measurable only in terms of its capacity to produce ball bearings, thereby justifying its existence. Similarly, except in a completely paganistic and hedonistic society, the mere existence of life is of little, if any, value. As pointed out by the Committee on Health Problems in Education, it should be realised that life and health in themselves have real value only as they promote efficiency and happiness, and that, in the final analysis, it is the quality of life that counts and not the quantity. Of themselves, life and health are valueless, their true value depending upon the activities engaged in by virtue of them.

To return to the example of the machine, it is necessary for it to pass through several phases or steps before it is even ready to be of productive value. First it must be built, which presupposes the existence of a factory in which it may

be constructed. Its construction, therefore, involves from the start a considerable capital outlay for factory site, labour and tools. On completion, the machine is not yet of true value. It must be prepared for use or function. This involves a series of installation expenditure for its inspection and checking, for transfer to the site where it is intended to function, and for oiling, tuning up, and other preparations. Following this, the machine is ready to become productive, and the extent and efficiency of its usefulness depends on its original quality or lack of structural defects, the correctness of installation, and the manner in which it is routinely cared for while in use. It must be carefully and repeatedly lubricated, fed the proper fuel, inspected, overhauled, repaired, and given proper rest intervals rather than constant grinding use which would lead to metal fatigue. During this period of use, therefore, certain amount of expenditure and effort is constantly required to maintain the machine, and its ultimate value can be determined only after the value of that expenditure and effort is deducted from the gross value of its productivity.

With man as with machines, there are always *debit* as well as *credit* items during the period of productivity. It is the hope and goal of the manufacturer that his machine will continue to function with relative efficiency at least long enough to produce sufficient items for sale to effect all the debits incurred by the capital investment and the installation and maintenance costs. In other words, from the moment the machine is purchased, the curve of the cumulative investment in it continues to rise, the curve of cumulative productive value lagging for a considerable period. It is not until these two curves cross that the manufacturer can breathe easily and begin to reap a net benefit from the use of the machine. If any untoward circumstances develop before the two curves cross, the manufacturer stands to lose a considerable investment.

Many things may go wrong after purchase. The machine may have been unsuspectedly defective, it may have been damaged during transportation and installation, or it may have worn out prematurely due to improper use or care. These are but a few of the undesirable potentialities the manufacturer must constantly guard against. Even after the curves cross, all is not necessarily clear sailing because, the longer the machine is used, the greater is the tendency for parts to wear out and for maintenance and repair costs to increase. Sooner or later a time is reached when these costs become greater than the value of the items produced and the two curves cross again. Continued use is no longer profitable. The machine has now passed into the phase of obsolescence or, in the case of human beings, senility. More idealistically, it may be considered the period of retirement or senior citizenship.

Factors entering into the value of a Human Life.

Period of Initial Capital Investment—(1) Value of Economic incapacitation of the Expectant Mother.—All adult females as well as males have an economic productive potential. For the majority of women this potential is effected in either or both of two ways: employment for wages or occupation as a housewife. Ordinarily the latter is not thought of in an economic sense since it rarely involves the transfer of an agreed upon sum of money for services rendered. None the less, the house-wife and mother fulfils a function of real economic value. In fact, her absence would necessitate the employment of a paid substitute. The average period of incapacitation of child bearing might be estimated roughly at three months, the actual degree of incapacitation varying throughout the period of pregnancy and with individuals.

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(2) *Prerated value of the risk of maternal death.*—If the efforts of a house-wife and mother have an economic value and if, as will be developed, she herself represents a considerable investment, her death as a result of child-bearing will constitute a monetary loss to her family and to society.

Man Power.—There is now a general and widespread realisation of the importance of public health as a factor contributing to the progress and prosperity of any country, and every State Government in India is engaged in devising measures for improving Public Health. It is common place that the chief wealth of a nation is the health of the people, and where the level of public health is low, the country remains inevitably backward. 'Manpower', of which we hear as much now-a-days, does not consist of more numbers but, in the physical efficiency of individual human beings who collectively constitute a nation. Both production of wealth and the military strength of a country depend on manpower. In a competitive age like this, man-power is all important if a nation wants to hold its own among other nations. If to day some of the nations in the East and the West are holding a pre-eminent position in the Committee of nations, it is chiefly due to the efficiency of their man-power which has contributed to their economic wealth and military strength. The Second World War has amply demonstrated the truth of this Statement.

Epidemics like Cholera, smallpox, and plague take a heavy toll of human life in this country. Malaria and Tuberculosis are equally devastating in their effects. A variety of other fevers and diseases account for a considerable percentage of deaths.

In this connection it is pertinent to refer briefly to the main causes which have led to the unsatisfactory health position of this country. Of course, no country is free from

disease and the human species is heir to numerous ills. But, it cannot be denied that the ravages of disease can be minimised if sufficient care is exercised by the people.

One of the primary causes that has often been mentioned as responsible for the low state of public health in India is the low standard of living. This low standard of living is obviously due to low incomes and in point of national income India's position is definitely bad.

It will be seen that India occupies the last place in the list in regard to income. Even the smallness of individual income would not, however have produced such deplorably low standards of living if they were wisely spent. The masses in India are not noted for wise spending, either because of their ignorance or because of some traditional habits.

Conclusion.—It is production that lays the golden egg of any nation's prosperity; and any serious interruption of this flow of products from farm and factory or mine is a debit to national wealth and effects standards of living to some degree. Hence it is cheaper to make an investment in positive health than in disease. The chief wealth of a nation is the health of its people. These two factors are directly related and effects each other. Health is an essential component of social development and social development by to-day's standards are judged by its economic growth particularly through rapid industrialisation. But disease depresses energy and ill-health prevails—which in turn lowers standard of output and productivity tending towards fall in economy and lower incomes sub-standards of living—No nation can run an effective health programme in the absence of a balanced economic growth. Hence promotion of health through Public Health Measures is a sound financial investment in the individual and to the community in general.

Health, Labour and Productivity

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It is most opportune World Health Organisation have chosen "Health, Labour and Productivity" as the theme for 1969.

At all times this trio has been intimately related, but now more than ever, to us in India it has special significance and meaning.

Productivity of its peoples, is the very basis of the wealth, well-being and status of a nation in the comity of nations. "Produce or Perish" is the call of our national leaders. Government and private industries are harnessing all available sources for providing machinery and plants for production. Our beloved Panditji said "Factories are temples of New India".

But it is the man that produces and not the machines.

Labour by men and women, physical and intellectual, is the very basis of productivity and success or failure of all manufacture or processing, marketing or merchandising, depends entirely on the men that participate in it and are involved in it.

If then, productivity is dependent on labour, it is nature that good labour would give good results.

By good labour is meant, labour that can work hard and efficiently. This the labour can, only if it is healthy and hence the theme—"Health, Labour and Productivity".

Health of those that work is studied and implemented by occupational Health Officers. They are medical men with a bias in Public Health, with specialised knowledge of industry, its environments, in factory and out side, work processes, its hazards, the demands of work on human beings and endeavour and assist it establishing the optimal climate, where man works with minimum strain necessary for maximum work out put, without any deleterious effect on the body now or in future.

The main function of health services in industry is to keep the men in best possible physical and mental health, to ensure, that the production, that gives them good wages and builds up the nation, is at maximum possible level. Sickness absenteeism is a costly luxury for the individual, industry and nation.

Health of the worker is general and occupational. In general health aspects, the work is part of the nation and reflects national standards.

Hence it is very essential general national health standards must continuously improve. Towards this goal International agencies like World Health Organisation tackles Malaria, Filariasis, Small Pox in addition to providing specialist services and training.

Nutrition is the basis of good health and many international agencies provide food and vitamins. The Philosophy behind it is not only compassion, but the belief that nutrition will improve health, good health will enhance productivity.

In addition to general health, in case of workers, occupational health service also called industrial medicine is very essential. In industry man has to be matched for the job at the time of selection, then maintained in good health by periodical medical evaluation, arranging for appropriate, adequate treatment of diseases at their beginnings.

Care has to be exercised that the plants and processes, do not produce any physical or chemical hazard to the health of the operatives. Another contribution, health services make to productivity, is work physiology, which studies energy cost of work and ensures with minimum effort maximum out is achieved.

Occupational Health is application of all medical and para-medical sciences, to man at work, to ensure he is maintained in optimal, physical and mental health to continuously enhance his productivity.

An ill man can never produce. A healthy person can produce.

Let us invest in health and reap in productivity. Investment in health of workers is not on humanitarian grounds. It has practical, financial beneficial results.

In-Plant Medical Department A Dynamic Concept

DR. G. ARJUNDAS, M.D.F.R.C.P. (EDIN.)

Health of the worker in any occupation has come to occupy its rightful place of importance in all developed countries. All these countries first started first-aid stations in plants to look after the injuries or emergencies that took place during working hours. Later the concepts of medical services underwent revolutionary changes and today the medical services in any occupational services have the following functions:—

(1) Medical Examinations of potential employees regarding the fitness for suitable jobs.

(2) Medical Examination of employees periodically even when they are quite alright, to assess progress of their health and detect latest diseases.

(3) Follow up of Medical Examination of employees afflicted with illness, as often as possible, to observe their progress.

(4) Preventive inoculation/vaccinations to employees periodically to prevent the preventable diseases.

(5) Periodical check up and observance of workers at their work-site to note the local dangers regarding the possible hazards of injury.

(6) Periodical check up of various processes in industry to assess hazards of occupational sickness which may occur immediately or much later in life.

(7) Periodical advice to employees on maintenance of nutritional standards, care of their families, advantages of family planning, assessing their out-of-office hours "activities", etc.

(8) Last although not the least is treatment of illness and injury that may occur from day to day.

If one considers the above principles it can be easily seen that this is applicable to a worker in a factory, a clerk in an office, an agriculturist in a farm, a planter in plantation, a crewman in aeroplane or ship, a miner, a sewage worker, an electrician, even a doctor in his profession. This universal applicability in some form or other is due to the basic commonsense rules laid out.

To implement such a detailed medical programme first necessity is to have a medical officer. It is desirable that any institution with a reasonable number of employees should have the services of a Medical Officer, part time or full-time. Most of the Medical Officers have basic training regarding preventive medicine but all will need to train themselves again in this new process of thinking as a occupational Medical Officer. It is too often seen that a Medical Officer is employed to satisfy a statute and all he is asked to do is to visit a factory for a few minutes, few times a week to attend to curative problems. The industries should encourage the doctor to maintain the day-to-day medical folders and to arrange to implement the eight principles listed to the extent possible. The budget allotted for this in most firms is meagre. A medical department in a factory can never show a direct profit in the books. The profits of a medical department will be reflected indirectly in the increased out-put, decreased absenteeism and better health and morale of the workers.

Employees' State Insurance Corporation based on the National Health Scheme of Britain caters to a limited but an important part of industrial population. The ideals are far reaching and excellent if only they can be implemented. The E. S. I. centres are at present involved

mainly in curative treatment which is probably the least important. In our country we can open any number of hospitals and dispensaries and they will remain over crowded. The only way to change this picture is to prevent diseases. More than 60 per cent of people attending hospital and dispensaries are suffering from preventable diseases. If these are prevented we can take away 60 per cent of our load on hospitals and dispensaries and devote more time to the other 40 per cent of cases who need greater attention. Malnutrition, undernutrition, infestations with worms, infections with diphtheria, whooping cough, poliomyelitis, typhoid, cholera, small-pox, dysentries, jaundice, eye infections, malaria, kala-azar and several other diseases at present take away a lot of space, time and money, the country can ill afford. A medical officer in any industry has the advantage of having a captured community under his care. He can follow these people over periods of time. His personal day to day contact elicits confidence and respect in the workers. In practice of medicine such a personal relationship is as important as the capacity of the medical officer. Such a function cannot be filled by a huge corporation like the E.S.I. Even the panel system existing in some places has not led to desired personal relationship.

In the present context of our medical facilities and socio-economic condition it is better to rely on our in-plant Medical Officers to handle the health and hygiene and safety of the employees in the factories and other industries. The cost of setting up such a medical department in an industry is justified in the long term saving in production loss, due to absenteeism or chronic sickness and save a lot of money from litigations in later days. I will cite an example here. There was an employee who developed a cataract and was operated and was left with poor vision. One year before the operation some oil had splashed into his eyes and this was recorded as

an industrial accident and he was treated for the same. He staked a claim with the Company saying that oil in the eye, one year ago, led to changes in his eye and lens, hence into cataract with resultant loss of vision. He claimed permanent disability compensation from the company, which is very high. This case came back to medical department for opinion and discussion. Luckily the medical department had examined him routinely every 2 years and in the record previous to the oil splashing there was an entry saying he was having early cataract in that eye. It was proved that the cataract had been there much before oil splashing and hence there was no claim possible under Industrial Injury Compensation.

During periodic health examination of an employee it was noticed that he was losing weight progressively over last 4 years. Although clinical examinations revealed no abnormality, he was subjected to blood tests and X-Ray chest. Blood cancer called Leukemia was discovered in its early stages. The employee himself had no complaints and felt quite well.

During mass X-Ray surveys of employees it is not uncommon to find a few cases of active lung tuberculosis who are apparently healthy and look normal.

One can imagine the havoc that may be created for employees and the consumers if the food packers in factories developed communicable diseases like typhoid.

The rapidly changing chemical hazards in the modern era of chemical revolution add increasing potential dangers to the worker and consumers. Dyes, Tetraethyl lead, pesticides, fungicides, insecticides can all be lethal to any one who

does not handle them properly. Radiation medicine, Aviation medicine, space medicine, submarine medicine are all but several of the newly acquired sciences.

Such an ever increasing skill and knowledge of medical men can be useful to the persons affected, through well qualified in-plant physicians. All other systems should be subsidiary to this basic unit consisting of an in-plant medical officer and an occupational health centre. Larger hospitals for in-patient treatment and strategically located diagnostic centres run by the Government can help the in-plant physician to do the best for the employees inside and outside the plant.

In programming of any new venture the organisers should find the budget and place for a medical centre. This medical centre should involve itself continuously in preventive health education and examinations, preventing malnutrition and social maladjustments. Such preventive programmes will go a long way to contribute to general uplift of health status of at least the industrial and other workers. The concept can then be spread to the agricultural sectors as a part of function of Co-operative Societies.

**THE ROLE OF REGIONAL LABOUR INSTITUTE,
MADRAS, IN THE PROBATION OF BETTER
HEALTH AMONGST THE INDUSTRIAL
WORKERS**

S. CHAKRAVORTI,

Regional Labour Institute, Madras,

The concept of industrial hygiene practices for the maintenance of health of the personnel in various industries is rather relatively new in India. It is true that quite a few studies have already been carried out in some specific industries to assess the environmental conditions in relation to the occupational health of workers, still there is a great necessity for more extensive work in the fields of industrial hygiene and occupational health for protection of workers engaged in various complexes against sickness, impaired health or discomfort and inefficiency.

Under the successive five-year plans there has been a tremendous increase of industrial plants in India. The complex factors arising out of the new and old industries of diversified nature, which may affect the health of working personnel require to be solved in the light of precise knowledge of health hazards prevalent in the industrial environment. Hence, it is of paramount importance the control of the working environment can be effectively carried out only by a thorough study and evaluation of the conditions therein.

With a view to implement this programme the Regional Labour Institute, Madras, was set up in 1962 as a wing of the Central Labour Institute, Bombay to cater to the needs of the industries of the four states of Tamil Nadu, Andhra Pradesh, Mysore and Kerala. This Institute has been conceived for the scientific study of human factors involved in ensuring health, safety and welfare of the industrial population.

In the initial stages, the aids from various international organisations, such as the International Labour Organisation and the Colombo Plan were utilised for equipping the various sections of the Institute with scientific apparatus which are now fully made use of for the conduct of the studies, surveys, demonstrations and training programmes. In 1965 the Institute was shifted to the new building at Adyar.

In the present set up of the Regional Labour Institute, Madras, there is a full-fledged section of the Industrial Hygiene Laboratory which can take up problems associated with thermal stress, noise levels, illumination levels, chemical hazards and ventilation for the ultimate objective to the elimination or control of these factors. During the last six years twenty-two studies and surveys have been carried out by this Institute in various types of industries, such as engineering, foundry, fertiliser, paint, explosive, insecticide, etc. Recently, a study has been carried out in the plantations to evaluate the environmental conditions during spraying of fungicides and insecticides by the plantation workers. Apart from these, a study on clinical and environmental aspects of Byssinosis in textile mills has been completed in association with the Indian Council of Medical Research. These surveys and studies have helped to focus the attention of the management considerably to the diverse health hazards prevalent in the respective industries. It is encouraging to note that the resultant recommendations for the control of the health hazards have been, to a great extent, implemented by the enlightened management for the protection of the health of workers.

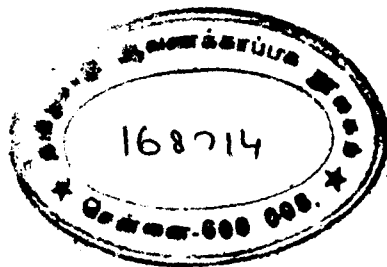
The Regional Labour Institute, Madras, under the Ministry of Labour and Employment, Government of India functions as an advisory body. In this context, most of the surveys and studies have been conducted primarily at the

request of the management or at the instance of the Chief Inspectors of Factories of the states. The results or findings of a study are not divulged without the implicit permission of the management, and this principle is scrupulously followed.

The future studies which have already been planned include, amongst others, environmental studies in ceramic and asbestos industries, a biochemical study in the Typecasting foundries and a study on thermal stress in a big public sector undertaking.

Industrial Safety is an integral part of industrial health and the Institute also conducts training courses in Industrial Safety.

The Regional Labour Institute will readily assist Industry to assess the working environment and advise on its improvement with a view to secure the health of the workers. With this in view, Industry, both in the public and private sectors, is welcome to make full use of the facilities available in the Institute.



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