# The State's Perception of Workers' Health in India – The Case of Occupational Health Research

Dissertation Submitted to the Jawahar Lal University in Partial Fulfilment of the Requirements for the Award of the Degree of

Master of Philosophy

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# CERTIFICATE

This dissertation entitled 'The State's Perception of Workers' Health in India – The Case of Occupational Health Research' is submitted in partial fulfilment of six credits for the degree of Master of Philosophy of this university. This dissertation has not been submitted to any other university and is my original work.

(Chris Mary Kurian )

We recommend that this dissertation be placed before the examiners for evaluation.

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## ABBREVIATIONS

| | |
|---|---|
| AALL | American Association of Labour legislation |
| ACGIH | American Council of Government Industrial Hygienists |
| AFL-CIO | American Federation of Labour |
| AIHA | American Industrial Hygiene Association |
| AIIHPH | All India Institute of Hygiene and Public Health |
| AITUC | All India Trade Union Congress |
| ANSI | American National Standards Institute |
| DGFASLI | Directorate General of Factories and Labour Institutes |
| FEV | Forced Expired Volume |
| GHS | General Health Service |
| GoI | Government of India |
| ICMR | Indian Council of Medical Research |
| ICSSR | Indian Council of Social Science Research |
| ILO | International Labour Organisation |
| IRFA | Indian Research Fund Association |
| MoH&FW | Ministry of Health and Family Welfare |
| MoL&E | Ministry of Labour and Employment |
| NAM | National Association of Manufacturers |
| NCF | National Civic Federation |
| NHS | National Health Service |
| NIOH | National Institute of Occupational Health |
| NIOSH | National Institute of Occupational Safety and Health |
| NSC | National Safety Council |
| OH | Occupational Health |
| OSHA | Occupational Safety and Health and Administration |
| OSHAct | Occupational Safety and Health Act, 1970 |
| PHC | Primary Health Care |
| PHCs | Primary Health Centres |
| PRIA | Society for Participatory Research in Asia |

| | |
|---|---|
| ROHC | Regional Occupational Health Centre |
| SPHC | Selective Primary Health Care |
| WB | World Bank |
| WCAct | Workmen's Compensation Act, 1923 |
| WTO | World Trade Organisation |

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The shortcomings of this work, I submit are mine alone.

Chris Mary Kurian

# INTRODUCTION

This dissertation titled **'State's Perception of Workers Health in India: The Case of Occupational Health Research'** is a foray into the area of workers health to understand the various processes and factors that interact with one another to create the understanding, and thus the efforts to preserve health at a given point in time in history, in a given society.

This pursuit has drawn inspiration from my life experiences in the city of Delhi. In the past few years Delhi has been witness to judicial activism in the name of environmental and public health concerns for the 'citizens' of the metropolis. The Supreme Court sought to remove urban pollution in Delhi, by way of removing polluting industries and relocating them to the outskirts of the city to protect the 'citizens' from the ill health due to environmental pollution arising from hazardous production processes. The astonishing aspect of this seemingly well-intentioned verdict was the complete silence on the health and survival of the workers toiling in those industries, struggling to eke out a living. Environmental and health concerns invoked for the 'greater common good' served to further dispossess the working class. Not only was there an appalling silence on the part of the State but also, a total negation of the fact that the first victims of the most severe debilitating effects of hazardous production processes are the workers who labour unprotected for long hours in those dangerous conditions. The State thus played a role in making the working class invisible in this whole discourse on health.

## CONCEPTUALISATION AND SCOPE OF THE RESEARCH

### Workers Health

According to Engels "....production and next to production exchange of things produced is the basis of all social structure; the manner in which wealth is distributed..... is dependent upon what is produced, and how the products are exchanged".

And the same is true for health. Workers' health in a society is not just the sum of biological, social, political and economic phenomena. It is created in an interactive

process of these various factors that have recursive linkages and is shaped by the nature of control workers enjoy over their work and life that is determined in the ultimate instance by the organization of production and distribution of resources.

'Occupational health' on the other hand tends to define workers' health as emanating out of specific hazards that the worker encounters at the workplace. Thus it defines health as the absence of disease accruing from sources of work. Its definition dichotomises health and ill health and life within and outside the workplace.

The understanding of health will be circumscribed within the parameters chosen to define it. The process of knowledge generation and intervention pertaining to health of working populations will then be outlined by the processes of complex interactions of organisation of production in a society (which includes ownership of the means of production, the level of sophistry of technology, choice of commodities to be produced, the methods of production and the organization of the production process,), the distribution of resources, the ill health resulting from the same, the understanding of disease causation along with the nature of the definition of health.

This dissertation is an attempt to delineate these complex interactions for the Indian context through a historical study of the transition of workers health to occupational health in the manufacturing sector of Indian industry and its implications for the working populations. The health of the working population of a country is an important reflection of the distribution of resources and the decision making power that they have. This is defined by the path of development undertaken by a nation which is further contingent on larger historical, social and political choices available to people.

## The State's Perception

The State plays a crucial part in determining the boundaries within which these resources would be distributed and who has access to them and how much. One of the cardinal characteristics of a Welfare State is its commitment to equity and social justice and the responsibility it takes upon itself to safeguard the health of all workers and create conditions conducive to the betterment and preservation of health of all.

The State's perception of workers health is understood from:

- Its stated intent in the Constitution in the form of the Fundamental Rights it bestows upon its people and the Directive Principles of State Policy that guide the state's intervention for the welfare of its people.
- Legislation promulgated by the State to intervene directly and regulate conditions of work to safeguard the health of working populations.
- Enquiries instituted by the State at different points in time to understand the conditions of the workers in order to assess the nature of intervention required.
- Institutions set up by the set for providing services, recording of statistics and information pertaining to health of workers, education and generation of knowledge in the area of workers health.

The dissertation includes a brief overview of all the above in the context of India with a detailed review of the content of knowledge generated in the area of workers health in two research institutions whose mandate is to train personnel and build a corpus of knowledge that would aid in effective intervention with regard to health of the working class.

## METHODOLOGY

This research is a review of secondary literature pertaining to the history of the development of the field of occupational health. The rationale for the understandings espoused in the dominant stream of the field have been studied and used to analyze the body of research generated at two government institutions, namely All India Institute of Hygiene and Public Health (AIIHPH) and the National Institute of Occupational Health (NIOH) during the period ranging from 1951 and 1998.

This body of research is analysed in the background of the cardinal trends in the pattern of industrialization in India, along with legislation promulgated by the State for safeguarding the health of the worker in the industry and planning of health services for the industrial worker in the manufacturing sector (Employees State Insurance Scheme and its services) that has been studied in detail and its links with the general health services have been analysed.

Within this canvas the effort then has been to ascertain the shifts that have occurred in the process of creation of knowledge in these two state sponsored institutions. The shifts are observed in the perspective and content of the research work done at the NIOH and AIIHPH. The shift in perspective is from a study of workers' health addressing the social context of workers lives and work to explorations adopting hardcore 'scientific' methods to research departures from 'normal' physiological and psychological functions of the human body caused due to effects of the exposure while engaging in hazardous work. Shift as is reflected in the material has been discernible after a careful study of more than 200 research studies and articles in addition to other documents that were reflective of the context in which these studies were carried out. This study has helped to confirm that paradigmatic shifts do not occur due to specific events or in specific moments in time, but are, nonetheless, closely linked with the movement in social processes. The process would entail the coexistence of overlapping and different perspectives and streams of thought through a period of time till one finally gains precedence over the other as the movement in social processes creates conditions for the coming of age of a paradigm.

## SOURCES OF DATA

I have relied upon data from primary and secondary sources in this dissertation.

a) Data from Government Sources: i) This includes sources of like the Economic Census, the Health Information of India, Pocket Book of Factory Statistics and the Labour Year Books of the Labour Bureau.

ii) The reports of enquiries or working groups instituted by the State have been utilized. The Report of the Royal Commission on Labour (1931), the Report of the National Commission on Labour (1969) and the Report of the Working Group on Occupational Safety and Health of the Tenth Five-Year Plan have been consulted.

b) Data from other sources: i) Several works documenting the history of the development of occupational health and its related services in the United States, the United Kingdom and India have been consulted, other than textbooks of occupational health that have been used to understand the content of the various sub disciplines of the area like occupational medicine, industrial hygiene, industrial psychology and safety and

ergonomics. The works of scholars like Vincente Navarro, Jaqueline K. Corn, Daniel Berman, Imrana Qadeer, K Seeta Prabhu and others that are critiques of the existing theory and practice in the area of occupational health and health services have been used to analyse the problems in the same.

c) Primary Data: The research works published by the AIIHPH were identified with the help of a compilation of the titles of the studies conducted in that institution till 1970. This was obtained after a trip to AIIHPH itself. The studies and articles were then collected from the available back issues of journals like the Indian Journal of Medical Research, the Indian Medical Gazette, Indian Journal of Social Work, Indian Journal of Industrial Medicine and others. In the case of the NIOH the studies were published in the annual reports of that institution. These reports were accessed at the library of the Indian Council Medical Research and the documentation center of the Centre for Education and Communication.

## LIMITATIONS OF THE WORK

The dissertation is limited in its scope in that it is just a preliminary exploration into the work done only in two of the institutions set up by the State. A fuller and more comprehensive work would have been possible had the institutions themselves been studied along with a pedagogical analysis of the curriculum they followed. But this is not presently within the purview of this dissertation due to lack of time and resources.

There is a severe paucity of material and documents pertaining to work in the area of occupational health in India. Further accessing materials and obtaining rare documents for photocopying from libraries like that of the Indian Council of Medical Research was rather difficult due to the protocol and on some occasions the non-availability of extra copies of such documents. The journey through this study has been fraught with problems of non-availability of articles and studies or annual reports of certain years of the period under consideration.

Many premier institutions conducting labour research suffered from a lack of materials in the field. The lower priority given to the field has made much of the work and the related institutions in the field obscure. Hence I had to make a trip to the AIIHPH about which there was meager information in the annuals reports of the Ministry of Health and Family

Welfare and it even lacks other means of disseminating information like websites. The documentation and recording facilities at the institution were in a state of neglect, thus most of the documents like annual reports and compilations of research and publications at the institution were not available.

## CHAPTERISATION

This dissertation has been divided into four chapters.

Chapter One addresses the history of the development of occupational health in the United Kingdom and the United States of America during the 19th and the 20th centuries. The knowledge that emerged to inform intervention during both the contexts is said to be a product of the stage of industrial development with transitions in organization of production systems, technology and commodity production; the nature of diseases and health problems among working populations and the costs they entailed for the capitalist society, the epidemiological theories that factored the understanding of disease causation and socio-political events and processes that created circumstances for generation and application of new knowledge. The review of this history leads to the conclusion that the State in a capitalist society plays the part of a regulator of the process of capitalist accumulation and its interventions are an effort to keep discontent and imbalances in the power equations under check. In a capitalist society medicine and the medical establishment in their present form have served as tools of control in the hands of the ruling classes. By focusing on narrower and more micro aspects of health and disease and resultantly obscuring the social and political causes of disease. Medicine has contributed to the maintenance of existing power equations and augmented the process of capital accumulation.

Chapter Two is a review of the role of the Indian State in the process of industrialization in India, the implications it had for the commodities produced, the quantum and nature of employment generated and the recent changes that have occurred in the patterns of production and employment in the country following the introduction of the New Economic Policy in 1991. These aspects serve as backdrop to examine the specific

legislation for regulating conditions of work in the manufacturing sector and the health services planned by the state in the form of the ESIS. It is argued that there are visible disjunctions in State policies and interventions in industrialisation, legislation and health services that have served the interests of the private sector in Indian industry. They have in the process also contributed in no small measure in rendering the working populations more vulnerable to indigence, disease and death that stem from unregulated and unsafe work in the absence of protective legislation and supportive social security.

Chapter Three consists of the review of research done at the Section of Industrial Hygiene and Physiology of the All India Institute of Hygiene and Public Health, Calcutta (1951-1970) and at the National Institute of Occupational Health, Ahmedabad, (1970-1998). Selected studies have been discussed in the case of the NIOH due to their repetitive nature and the details of the rest have been incorporated in the Appendix at the back. A complete list of the studies of both the institutions has also been appended at the end. The review is a mapping of trends in perspectives that have informed explorations at these two institutions and the changing methods employed to study problems in workers' health, choice of subjects and the content of the research. The implications of such knowledge for workers health are analysed. The chapter concludes that the dominant stream of occupational health which developed as a conglomeration of disciplines (like occupational medicine, industrial hygiene and safety) controlled by specialists in psychology, medicine and engineering has not only influenced but also guided the emergence of this field in India. But between the 1950s and the 1970s there was an 'alternate' stream of thought pioneered by Prof. MN Rao according to which the study of the social context of life and work that caused disease and disability was as important as the immediate causes of disease in the physical environment of the workers or the bodily symptoms as the tangible manifestations of ill health. His understanding of interventions both in the realm of prevention and cure envisaged the need for action at varying levels of the system. The State according to him plays an important role, in decisive interventions like creating regulations with the aid of a legal framework committed to workers' health and providing services and amenities. At the same time he realized that these functions of the State could be realized only within the constraints of the capitalist social structure.

After the 1970s this perspective gave way to an increasingly narrow definition of workers health very much within the dominant paradigm that has its origins in the industrialized nations like United States. This paradigm has its moorings in the germ theory wherein causes and effects of disease are identified through evidence of symptoms in diseased or disabled individuals, who are examined and specific causative agents of disease are isolated and studied in laboratories using complex techniques and technologies and treated through clinical interventions. The study of health problems of working populations as it exists in its present form at the NIOH is shorn of the social perspective that informed Rao' understanding, that sought the causes of ill health in the disabling aspects of the social structure. The research carried out today at the institute is now firmly entrenched in the paradigm of biomedicine being expert and laboratory centred.

I have argued in the current political environment of Structural Adjustment and Labour Reform characterized by an erosion of the welfare state, the nature of this research entrenched in the bio medical tradition reinforces rapid disappearance of the worker from the realm of public discourse. It strengthens the silence of the State on issues of that are fundamental in ensuring health of working populations.

# CHAPTER- ONE

## THE HISTORY OF OCCUPATIONAL HEALTH THEORY AND PRACTICE IN U.K AND U.S.A.

### INTRODUCTION

The history of the development of occupational health theory and practice in the United Kingdom and the United States has a very important bearing on the evolution of occupational health services, research, education and legislation in India. Britain being the former coloniser of India also at that time the leader in industry and thus in knowledge pertaining to industrial production and health of working populations nations played a pivotal role in tempering the development of modern industry here. The laws first introduced to safeguard the industrial worker in India were the replicas of the legal safeguards put in place by the British State in the home country. The United States of America is today the most advanced industrialised country in the world and is home to many powerful multi-national corporations engaged in multifarious industrial activities all over the world. The unfettered capitalist industrial growth in the U.S has played an important role in defining modern industrialisation in the 20$^{th}$ century, by pioneering new production processes and commodities. It has in the process determined the boundaries of knowledge generated and its application in the field of occupational health.

The United Kingdom was the site of the Industrial Revolution, a period in which production and distribution of commodities were reorganised. The resultant emergence of the wageworker selling his labour at the factory, laid the foundations of modern capitalism which, created circumstances of work and life that affected the health of the working populations in the new set up. The interventions made by the State to safeguard the health of the workers drew impetus from the primary concern of preserving the existent system of private enterprise, in the face of growing ill-health and mortality and resentment from the working class.

The character of interventions to safeguard the health of workers during the Industrial Revolution in the 19th century in England was shaped by the complex interaction of factors like the toll taken by high rates of morbidity and mortality due to infectious disease, the epidemiological theory of Miasma that factored the understanding of disease causation, the existence of medicine devoid of its present sophistry in techniques and methods, the then prevailing organisation of industry, the nature commodity production and the social and political environment of the time.

After the turn of the century and more so in the period between the two World Wars the United States of America emerged as an economic and political power to reckon with, dethroning, in the process, Britain from the position of the pre-eminent industrial power in the world and becoming the leader of the new phase of industrial development. The understanding of workers' health underwent a change in this phase of industrialisation and emerged as the separate discipline of occupational health consisting of specialisations like occupational medicine, industrial hygiene, ergonomics and physiology, safety engineering and industrial psychology.

This chapter focuses on this transition from workers' health to occupational health that is in effect a consequence of the transitions in various spheres that interacted with one another to shape research and intervention with regard to health of industrial workers. The reorganisation of industrial work was realised through new production systems involving more complex technologies with greater mechanisation, a composite, hierarchical division of labour and the science of modern management [1] that reoriented work systems. The factory with its faster pace of work and complex technology took the control of the work process out of workers' hands, making them more vulnerable to accidents and ill-health generated by greater mechanisation exposures to hazardous substances like chemical agents and new commodities like pharmaceuticals, pesticides, plastics etc. The new chronic diseases that emanated from work and chemical exposures now dominated the scene of ill health where mortality

[1] Braverman, H. (1974) The Habituation of the Worker in Labour and Monopoly Capital- The Degradation of Work in the Twentieth Century, Monthly Review Press, New York, pp.139

and morbidity from infecticus disease had once been prominent. This impinged upon the shift in epidemiological theory from Miasma to Germ Theory and later on Risk-factor epidemiology as explanations for disease causation. This further had a bearing on the ascendancy of the discipline of medicine and the development of industrial medicine as a speciality within the precincts of the medical and the industrial establishment. The efforts to mitigate ill health that was consequent of industrial work were spurred and moulded also at different times by the major events and movements in history like, the World Wars, the Great Depression and the New Social Movements in the 1960s and the 1970s that generated new needs and ideas that created threatening circumstances to the political supremacy and survival of the capitalist system, as shall be explained in the subsequent sections.

## INDUSTRIAL REVOLUTION AND WORKERS' HEALTH IN 19TH AND EARLY 20TH CENTURY BRITAIN

The history of the development of the field of occupational health as we know it today, is really the history of the process of industrialisation. England was the first nation where the seeds of the Industrial Revolution were sown.

Towards the end of the 16th century, the manufacture of cotton textiles came to England. Until the latter half of the 18th century, it thrived as a cottage industry[2]. New mechanical improvisations like the spinning jenny in the late 18th century revolutionized the spinning and weaving of yarn. Slowly, it led to the replacement of the entire class of farming weavers by the weavers who were wage earners[3]. There was now a perfect division of labour, which led to the development of different groups engaged wholly in spinning or weaving activities. Similar activity was observed in other industries like the metalworking and smelting, iron ore and coal mining industries. New sources of energy like coal and water, railways and technologies of road construction, water transport and communication systems also aided the transformation of production from an activity engaged in by small, largely self-

[2] Toynbee, A. (1884) Lectures on The Industrial Revolution in England, www.socig.ac.uk

sufficient artisans and their guilds to mass manufacturing of commodities and their distribution to markets far and wide.

Meanwhile, in the rural areas the Enclosure Movements between the 16th and 18th centuries led to the consolidation of small farms into the large ones and the taking over of common pasturage by the landlords. Feudal relations fell apart and the peasantry was pauperised[4]. The Enclosure Movement created a vulnerable landless, labour force, 'free' of feudal obligations and deprived of the aid they had access to earlier from the parishes, due to the reform of the Poor Law in 1834. This served as the push factor for the landless poor to flock the cities in search of employment in the new factories set up there[5]. The reform of the Poor Law in 1834 drew its raison d'être from the desire of the industrial capitalists to augment industrial production by employing in manufacture the cheap labour that the unemployed poor offered. In keeping with the demand of the new industrial middle class for a 'perfectly elastic supply of labour' as a precondition for further investment[6], the conditions in the newly established work houses were made more miserable for those receiving assistance from there and the able bodied were denied any kind of assistance. The Poor Law Reform coupled with the Enclosure Movement led to mass migration of landless labourers and peasants from rural areas to the new industrial towns. Consequently, there was a stupendous increase in the population of these towns within a short span of time.

The table below gives data on the rise of population in some of the cities that were important industrial centres between 1801-1831.

TABLE NO.1.1: THE RISE OF POPULATION IN SELECTED CITIES THAT WERE IMPORTANT WOOL AND COTTON MANUFACTURING CENTRE S OF ENGLAND (1801-1831)

| NAME OF CITIES | POPULATION IN 1801 | POPULATION IN 1831 |
|---|---|---|
| Bradford | 29,000 | 77,000 |

[3] Engels, F (1845) The Condition of the Working Class in England, Leipzig, Germany, www.marxists.org

[4] Toynabee,op.cit.

[5] Rosen, G. (1993) A History of Public Health- Expanded Edition, Johns Hopkins University Press, Baltimore, United States of America, pp.169

[6] Ibid. pp.172

| | | |
|---|---|---|
| Halifax | 63,000 | 1,30,000 |
| Huddersfield | 15,000 | 34,000 |
| Leeds | 53,000 | 1,25,000 |
| Whole of West Riding | 5,64,000 | 9,80,000 |
| London | 958,000 | 1,948,000 |

*Source: Engels,F. (1845) Condition of the Working Class in England, pp.9 and Rosen, G. (1993) Industrialism and the Sanitary Movement, in The History Of Public Health, pp.178*

Many artisans and small businessmen who hither to fore constituted the lower middle class in the economic hierarchy were also depressed to the ranks of the labouring population in England, since they lost out in the competition with the large factory owners. This vulnerable population in the towns constituted the new workforce in the factory. The worker now was no longer the artisan who owned the tools, the raw materials or the finished goods. He no longer controlled the process of manufacture and did not own any property of his own. He now worked for wages i.e. he sold his labour power. Thus the shift from petty commodity production to mass production resulted in the reordering of production activity resulting in new conditions of work and consequently, health for working populations. The following section shall dwell on the changes that took place in the life and work of the new workers.

## THE LIVING AND WORKING CONDITIONS OF THE LABOURING POPULATION IN ENGLAND IN THE LATE 18TH, 19TH AND EARLY 20TH CENTURY

The movement of the landless rural peasant to join the ranks of the industrial workforce in the towns brought about fundamental changes to his life. The workers in the mines and factories were exposed to new hazards of disease and injury at work, coupled with the debilitating effects of long work hours and low wages. Reports like those by Chadwick, Thackrah and Engels brought forth evidence of the abominable living and working conditions of the labouring population in England[7]. The workers were housed in ill ventilated, badly drained and filthy tenements amidst unemptied privies, rubbish dumps and cesspools[8]. Often five to fifteen persons were cramped into tiny, dark, damp and cold rooms. The towns grew without any planning, the

[7] Schilling, R.S. (1981) Developments in Occupational Health, in Schilling, R.S. (ed.) Occupational Health Practice, Butterworths, London, pp.3-26.

[8] Rosen,op.cit.180

manufacturers erected factories in accordance with their needs and when the workers streamed into the city, tenements were built for them by builders on a commercial basis. Concern for quality of housing and the needs of those who were to dwell in them were not on their agenda. There was little expenditure on sanitary arrangements since such spending was not considered to be remunerative[9].

The working conditions further immiserised the lives of these vulnerable workers. Nearly half of the workforce in England was under the age of eighteen; adult males formed less than even one quarter of the total workforce. Children and women were employed in large numbers, since they could be paid lower wages. They often pushed adult men into unemployment. The introduction of new machines also put many a worker out of work. Engels observes, " ...in 1841, in 35 factories 1083 fewer mule spinners were employed than in 1829, though the number of spindles in these factories had increased by 99,429....while the number of spindles increased by 10 percent the number of spinners diminished by 60 per cent "[10]. The new machinery also depressed the wages of the worker. The cotton workers were among the worst paid of the labouring class. The low wages were insufficient to procure even the minimum necessities of life like adequate food and clothing[11]. This coupled with the insecurity of employment coerced the workers to submit to the inhuman and dangerous conditions of work.

The work by now was reduced to forced, monotonous and mechanical activity, which provided no intrinsic enjoyment or satisfaction to the worker. They laboured hard, without leisure hours or breaks, under strict discipline imposed by the employer. The capitalists introduced night-work to ensure higher returns for their investments in machinery and other infrastructure, which added on to the debilitating state of health of the workers.

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[9] Ibid, pp.181

[10] Engels,op.cit.

[11] Ibid.

The change in work systems meant that the artisan was now a wage labourer who laboured at the factory, using machinery which introduced monotony, strict discipline, a lack of leisure hours, night work and insecurity of employment; in short a loss of control over work and life.

## DISEASES AND ACCIDENTS

All these circumstances of labour led to the enfeeblement of the over worked and underfed workers, making them susceptible to communicable diseases. The working class of Britain was ravaged by epidemics of cholera, diphtheria, measles, tuberculosis, typhus and typhoid that caused widespread mortality and morbidity. Pandemics of cholera raged over Europe in 1831-32, 1848-49 and 1853-54. Small pox and scarlet fever epidemics appeared from time to time in the urban communities during the 19th century[12].

The statistical information from the decennial census, and that from the registration of births and deaths drew attention to the health of the factory worker in England. The reports published by Charles Turner Thackrah showed that during the epidemics of cholera the disease sought out industrial workers and miners who were the inhabitants of the poorer districts. The large scale surveys by the likes of Chadwick and Snow also helped to locate the causation of illness in the living and working conditions of the poor characterised by unsanitary crowded ghettoes, meagre wages, long working hours and inadequate food. Infant mortality rates hovered around 150 per 1000 live births[13], and infant deaths were most common among the poor. Children of all ages were particularly susceptible to communicable diseases of childhood like scarlet fever, whooping cough and diphtheria.

In general the picture of the 19th century was one of high morbidity and high levels of mortality. Reports of Snow, Chadwick and Engels provided much evidence of the state of health in the new industrial towns.

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[12] Rosen, op.cit.pp.256

[13] Doyal,L (1979 ) Health, Illness and Development of Capitalism in Britain in the The Political Economy of Health, Pluto Press, London, pp.49-127

Many others dwelt specifically on the illnesses that workers in specific occupations suffered from. Percivall Pott observed the occurrence of scrotal cancer among chimney sweeps in the 18th century; During the same period, Charles Turner Thackrah (1832) published the first British work on occupational diseases among workers of different occupations titled 'The Effects of the Principal Arts, Trades and Professions and of Civic States and Habits of Living on Health and Longevity'[14]. William Farr of the General Registrar's Office used census population figures and recorded deaths in certain occupations to calculate mortality rates. This drew attention to the injuries and accidents that the factory and mine workers suffered from. Edward Headlam Greenlow (1814-1888) used the unpublished records of the General Registrar's Office to examine occupational mortality in detail and concluded that the death rates due to pulmonary diseases in the mining towns of Alston and Reith were higher than those in the town of Haltwhistle. He explained that the phenomena emanated from exposure of the people and the workers to the lead dust from the mines[15].

Engels states that the doctors in the industrial towns noticed diseases of the spine, twisting of the limbs which caused deformities to the extent of rendering the person cripple, wasting of the body, back pain and retarding growth among children. Those working in cotton industries exposed to cotton fibres in the carding room complained of 'blood spitting, asthma, chest pain, noisy breathing, cough, sleeplessness and in many cases consumption'[16]. The poor and physically weak workers were more susceptible to illness and injury at work. Children and women working in the lace factories suffered from pain and inflammation of the eyes, cataract and blindness. Similarly men and women working in the file-cutting and cutlery industry were sickened with constant headache, biliousness, anaemia and died on an average by the age of 35 years, consumed by diseases like tuberculosis and those caused by constant inhalation of metal particles at work. Dubos describes tuberculosis as the social disease of the 19th century and calls it the first penalty that the capitalist class had to

[14] Schilling,op.cit.pp.11

[15] Ibid. pp.11

[16] Engels,op.cit.

pay for the ruthless exploitation of labour[17]. It accounted for nearly a third of the deaths that occurred during this period. The pottery industry employed children on a wide scale and they were engaged in works such as dipping the finished articles in a fluid containing noxious elements like lead and arsenic. Bleeding of hands due to the fluid, allowed easy absorption of these poisons into the body causing epilepsy, poisoning, colic and paralysis[18].

TABLE NO.1.2 COMPARATIVE MORTALITY AMONG MALES OF 25-26 YEARS OF AGE FROM LUNG AND RESPIRATORY DISEASE FOR SELECTED OCCUPATIONS, 1880-1882

| OCCUPATION | MORTALITY | LUNG DISEASE |
|---|---|---|
| Clergymen | 100 | - |
| Farmer | 114 | 100 |
| Agricultural Labourer | 126 | 100 |
| Grocer | 139 | 130 |
| Carpenter | 148 | 155 |
| Coal Miner | 160 | 148 |
| Builder, Mason, Bricklayer | 174 | 208 |
| Wool Worker | 186 | 213 |
| Tailor | 189 | 217 |
| Printer | 193 | 288 |
| Cotton worker | 196 | 250 |
| Stone and Slate Quarrier | 202 | 268 |
| Cutler | 235 | 350 |
| Innkeeper | 274 | - |
| File maker | 300 | 360 |
| Earthen ware worker | 313 | 514 |
| Cornish Metal Miner | 331 | 528 |
| Costermonger, Hawker, Street seller | 338 | - |

*Source: Evidence of Dr.W.Ogle, RC o Labour, Digest of Evidence, June 1893, C7063, pp.38-39 in McIvor,A. (2000) 'Innocuous or Hazardous Toil: Cotton Textile workers and Occupational Health and Safety, c1880-1939'*

Toynbee comments ".....and till the power-loom was introduced the workman was hardly injured." Many authors have examined and commented upon the accidents and injuries that affected workers in various industries and trades. Reinarz in his work on

[17] Doyal op.cit.pp.54

[18] Engels,op.cit.

the English brewing industry in the late 19th and the early 20th century gives accounts of gruesome accidents wherein workers fell into uncovered brewing vessels[19]. Engels also accounts many incidents of workers being disabled and killed in the factories due to accidents caused by machines. For every five accidents happening due to other causes, two were caused by machinery as seen at the Manchester Infirmary in 1842[20]. William Farr calculated that the mortality rate in the country was 18.2 per1000 as compared to a mortality rate of 26.2 per 1000 in the urban districts, between 1831-39[21]. Doyal quotes a Medical Officer from Manchester who said that the average life expectancy among the upper middle class was 38 years as against the life expectancy of 17 years among the labouring class, the figures stood at 35 and 15 respectively for Liverpool. Thackrah also said that not more than 10 percent of the population of large towns enjoyed full health.

## STATE INTERVENTION FOR WORKERS' HEALTH

### Edwin Chadwick and The Poor Law Commission

The approach of the Chadwick to the poverty and disease of the working class was firmly rooted in the theoretical positions of the doctrine of philosophical necessity and that of political economy, represented by philosophers and economists like Bentham, Malthus, Ricardo and Adam Smith. The doctrine of philosophical necessity stated that poverty and idleness ought to be governed by reason and necessity and not by legal provisions as any effort to tamper with social processes was contrary to nature[22]. Any legal provision for the poor would only incite poverty and idleness. The dominant political economy of the time proclaimed that the motive for economic activity was the powerful force of self-interest, held and guided by the principle of free competition and the mechanism of the market. More productivity meant better well being and

[19] Reinarz, J (2000) 'Brews And Battered: Reassessing The History Of Occupational Health With Specific Reference Of The English Brewing Industry, 1870-1914' in Work Health and Illness: The Comparative History of Industrial Diseases, Accidents and Occupational Medicine, Centre for Medical History, www.*ex.ac.uk/shipss/medhist/abstract.htm*

[20] Engels, op.cit.

[21] Doyal op.cit.pp.50

[22] Rosen, op.cit., pp.173

unfettered private enterprise was considered the engine of social progress. But these economic desires and goals of progress could be realised only within a firm framework of law and order that would guide the economic and social actions of people in society[23].

Edwin Chadwick, who was a Benthamite and the Secretary to the Poor Law Commission in 1834, was examining means to reduce the poor rates, i.e. the benefits given to the indigent. However, his explorations into the causes of pauperism led him to conclude that disease led to social disruption and problems of alcoholism and prostitution and caused poverty. Thus he suggested that undertaking measures to prevent disease would be more economical than bearing the burden of increasing poor rates due to disease[24].

Chadwick and the Sanitary Reform Movement

The feasibility of disease prevention was reinforced by Chadwick's deep-rooted conviction that health was affected by one's physical and social environment, which if altered would result in control of disease. The survey conducted by Chadwick and his colleagues proved that communicable diseases among the working population were related to filthy environmental conditions which were due to lack of drainage, water supply and means to remove garbage from the streets. He also believed that recording statistics pertaining to causes of mortality would be exceptionally useful in preventing diseases. The statistics obtained from the compulsory registration of births and deaths in 1837, and the decennial census since 1801[25], showed the debilitating effects of disease on lives of the workers and on the economy through the loss of days of employment, costs of nursing care and provisions to be made for orphans and widows of those who succumb to these illnesses. The Poor Law Commission of 1838 reported "... the expenditures necessary to the adoption and maintenance of measures of

[23] Ibid.pp.174

[24] Ibid, pp.184

[25] Ibid.pp.182

prevention could ultimately amount less than the cost of the disease constantly engendered."[26]

The Select Committee On Health Of Towns (1840) opined that disease affecting the health of workers would lessen their abilities to work and would demand unproductive outlay to maintain them. The Committee also admitted that the measures to safeguard the health of the workers were "....urgently called for as far as claims of humanity and justice to great multitudes of our fellow men, and as necessary not less for the welfare of the poor than the safety of property and security of the rich." The health of factory workers had become an issue of concern in the wake of the epidemics and there was a fear that these could spread and afflict the upper classes as well. The Chartist Movement also stirred England in the 1840s and turned the spectre of a proletarian revolt into a very real possibility for the capitalists.

This recognition of the social, economic and political costs of the disease provided the stimulus for action to improve the conditions of life of the working population.

Legislation for Control

Ever since the beginning of the Industrial Revolution, there were voluntary efforts by benevolent and well-meaning employers to provide for better work and living conditions for the workers[27]. But these were stray and rare attempts. There were agitations by noted parliamentarians like Robert Peel, Lord Ashley etc.; in 1802, in the wake of epidemics in Manchester and the Parliament took the matter into its hands and passed the Health and Morals of Apprentices Act to improve the conditions of child workers in the cotton mills. Though this act was rather ineffective in achieving its objective, its importance lay in the fact that it was one of the earliest attempts by the state to intervene in the laissez faire economy to regulate it.

Various measures were taken during this time to safeguard the health of the working person. The studies conducted by Snow and Chadwick had helped to locate the causes of widespread mortality due to unhygienic surroundings and inadequate sanitation. The interventions as part of the sanitary engineering measures, at this time, focussed

[26] Rosen, op. cit.pp.184

[27] Schilling,op.cit.pp.9

on slum-clearance, provision of drainage and sewerage, adequate drinking water and housing etc. to alleviate disease. The success of these measures in disease alleviation was reflected in the lower levels of infant mortality, morbidity, death rates and greater life expectancy. These achievements had little to do with medical interventions and owed more to increased availability of food (accruing from increased food production and colonial gains) and better living conditions. These efforts were part of the Sanitary Movement in England. The Sanitary Reform Movement also lead to reforms like the passing of the ***Public Health Act (1848)***, and other such legislation, which recognised the importance of State intervention for health, which could not be left to the ravages of the market.

The passage of the ***Factory Act in 1833*** was the real beginning of factory legislation. The Act itself was realised after bitter conflicts between industrial and agricultural interests and the workers agitation that demanded for better working conditions, prohibition of child labour and a 10-hour workday[28]. The Act, as it finally came out, only provided for some legal protection to children; prohibiting their employment below the age of 9 years, and setting the limit of a 9-hour workday for those between 9 years and 13 years of age. The ***Mines and Collieries Act of 1842*** was also passed prohibiting employment of women and boys younger than the age of 10 years underground. The ***Ten Hour Act*** was passed in ***1847***[29]. Further changes were introduced into the ***Factory Act*** subsequently. The ***Factory Act of 1850*** established a statutory working day for women and young persons and the ***Factory Act of 1855*** gave new duties to the certifying surgeons to investigate industrial accidents and to certify young persons freedom from disease and their fitness for work[30]. But these acts covered only the textile workers and most of the industrial population was left out.

The ***Factories Act 1864 and 1867 and the Workshops Act of 1867*** brought under control other unregulated industries like the match, lace, pottery, hosiery, iron, copper and brass foundries and all establishments employing workers more than 50, in the

[28] Ibid.pp.244

[29] Ibid.pp.244; Schilling, op.cit.pp.9

[30] Schilling,op.cit.pp.13

case of the former and less than 50 in the case of the latter[31]. A section of the working class also gained some political weight through the ***Second Reform Bill of 1867*** that enfranchised all male householders in urban districts[32]. Trade Unions were given legal protection from 1873 onwards. The workers thus armed with power to vote and to organise strove to improve their working conditions. Further, acts dealing with prevention of lead poisoning (1883), ventilation, sanitation and safety in factories were also passed. In Britain, the state gradually built up a statutory medical service for the factory workers, through ***The Factories and Workshops Act of 1878.*** This service consisted of about 1800 part time certifying surgeons, most of whom were GPs and were supervised by Medical Inspectors of Factories. The mandatory provision regarding appointment of Factory Doctor was abolished in ***1972*** by an act of Parliament and was replaced by the ***Employment Medical Advisory Service***[33].

There were now new developments in the field of science, like those in chemistry and electrical power and their use in industrial production which led to many more technological changes in the arena of factory work and goods manufactured; exposing workers to new hazards and diseases not encountered before. There were thus newer laws over the following period in the early 20th century to regulate these problems in industries. The ***Principle of Notification*** was introduced in ***1895*** for important industrial diseases like anthrax, aniline, mercury, phosphorous, lead and arsenic poisoning, and the investigation of occupational diseases was one of the added duties of the certifying surgeons[34]. The first ***Medical Inspector of Factories*** was appointed in ***1898*** to deal with these notifications alongwith the rising incidence of diseases like phossy-jaw in match industries and lead poisoning in white lead works[35]. The real push for voluntary provisioning of medical services by employers for their workers came with the ***Workmen's Compensation Act*** in ***1897***[36]. The owners of large enterprises appointed industrial medical officers to monitor the health and provide

[31] Rosen, op.cit.397

[32] Ibid.pp.398

[33] Ibid.pp.398; Schilling, op.cit.pp.14

[34] Schilling, op.cit.13-14

[35] Ibid.pp.14

[36] Schilling., op.cit.pp.14

services to the workers. But this was done with the clear cut objective of protecting themselves from large compensation claims that the workers may stake against them. The workers, therefore, viewed the industrial doctor with suspicion since they perceived him to be the employer's man[37].

Then there were the ***Mines Accident Act*** and the ***Coal Mines Act*** passed in ***1910*** and ***1911*** respectively. They required the training of personnel for rescue work, provision of certain hygiene facilities to reduce dust etc. The ***Factories Act of 1916*** authorised the Secretary of State to compel employers to provide for the health and the hygiene of workers through provision of protective clothing, first aid, washing and dressing facilities. All the previous acts and legislation were finally consolidated to form the ***Factories Act of 1937***, which strengthened the provisions for health and safety of workers and also made occupational diseases reportable.

Throughout the late 19th and the early 20th century there were a number of studies conducted and many works were published regarding the occupational health problems of workers in Britain. Notable among these were: 'Hygiene, Diseases and Mortality of Occupations' (1892) by J.T. Arlidge, 'Dangerous Trades' by Thomas Oliver, A study on 'Lead Poisoning and Lead Absorption' by Legge and Goadby (1902) and 'The Health of the Industrial Worker' by Collis and Greenwood (1921)[38].

## THE SHIFT FROM WORKERS HEALTH TO OCCUPATIONAL HEALTH

The case of the intervention in workers health during the industrial revolution in England that has been discussed above serves the purpose of illustrating certain key issues.

Intervention in the area of workers health stemmed from the desire to control the economic costs and social disruption that disease and disability was leading to. Hence the primary concern was with the workers capacity to produce and the debilitating effect that disease had on it. Chadwick had pointed out that disease was the cause of poverty and want. Disease and disability caused due to accidents also fomented discontent among the workers. The various protest movements like Chartism, led by

[37] Ibid.pp.14

[38] Schilling, op.cit.pp11.; Rosen, op.cit. pp.400

the working class or those of which the working class was an important part also manifested the resentment of the poor in England. They posed a significant threat to the hegemony of the industrialists and landed classes, which could not be overlooked. Thus there was a need to check communicable diseases and conditions of overwork and undisguised exploitation. Communicable diseases, as has already been seen earlier in this chapter were perceived as related with conditions of work and life. They were more widespread and knew no boundaries, in that they were not restricted to the pauperised workers of the English factories and mines. The diseases were also seen to spread to the rich as well. This factor also contributed to the urgency with which the diseases were checked.

Secondly, the epidemiological theory, that is, the knowledge of causation of disease that guided the understanding of the administrators and enquirers at that time played an important role in determining the form of inquiry and the nature of intervention to ameliorate the diseased conditions. Thus the Miasmatic theory of the sanitarians led them to intervene through sanitary engineering measures and legislation which served the purpose of addressing some crucial factors like work hours, amenities at work, living conditions, housing etc. The interventions were rather effective in serving the purpose of addressing factors that contributed to the problem of communicable disease that were more visible in terms of the morbidity and mortality caused. On the contrary the diseases seen to be accruing specifically from the profession that the workers were engaged in like scrotal cancer among chimney sweeps or lead poisoning among pottery workers or blindness among lace workers were non-communicable and were seen to be cordoned off, restricted to a small group of workers. These diseases went rather unnoticed due to the limited mortality that they caused which was not a 'significant enough' number. The communicable diseases were seen to cause greater morbidity and mortality and they entailed greater social and economic costs, hence they were addressed more urgently than the other diseases and problems accruing from specific occupations.

After 1870 a significant fall was observed in the adult mortality rate due to communicable diseases[39]. The following table gives data of the fall in the annual death rate due to Typhoid in England and Wales.

TABLE NO.1.3: AVERAGE ANNUAL DEATH RATE FROM TYPHOID FEVER (PER MILLION PERSONS) IN ENGLAND AND WALES

| 1871-1880 | 1881-1890 | 1891-1900 | 1901-1910 | 1911-1920 | 1921-1930 |
|---|---|---|---|---|---|
| 332 | 198 | 174 | 91 | 35 | 25 |

*Source: Rosen, G. (1993) Bacteriological Era and Its Aftermath, in The History of Public Health, pp.316*

Doyal attributes this fall in deaths from communicable diseases to a number of factors including sanitary engineering measures, effective sanitation and sewage facilities, public health legislation, increase in wages and increased availability of nutrition. Modern medicine had very little to do with it. In fact, medicine at this point in time was 'a poorly developed empirical art, used more to console the ill rather than to cure'[40].

With the disappearance of these obvious causes of death and disease and the ascendancy of the Germ Theory[41] marking the beginning of the Bacteriological era, the environmental causes of ill-health that were considered to be very important in the Miasmatic theory of disease got relegated to the rear. The latter, with the help of sanitary statistics had demonstrated the clustering of disease along economic differentials. But with the advent of the Germ Theory specific diseases were identified and were now attributed to single causative agents. With this shift in theory, the epidemiology of populations and environmental exposures and the social dynamic of

[39] Doyal, op.cit.pp.56.

[40] Baru, R. (1998) Private Health Care- Social Characteristics and Trends, Sage Publications, New Delhi, pp.20

[41] The advent of the bacteriological era may be traced from the works of likes of John Snow (1855), Jacob Henle (1840), Louis Pasteur (1865) and Koch (1882). As per Koch's Postulates disease was caused by single causative agents that could be isolated from the site of disease and cultures in the laboratory. These organisms could then be experimentally transmitted to produce lesions and observed. These guiding principles for lab-based diagnosis form the basis of curative intervention. Preventive interventions were limited to immunisation.

disease that were the central focus of miasmatic enquiry disappeared. The adherents of the traditional philosophy of public health also lost prestige and power in the medical hierarchy. The form of enquiry also now metamorphosed from large surveys in the life situations of the affected people (in this case mostly industrial workers) to the isolation of the laboratory. With Koch's Postulates the gaze on disease transformed from one that examined the social and environmental dynamics to one that looked at disease in isolation and as existing only within a part of the body caused by specific microorganisms. So much so that when researchers like Joseph Goldberger and Edgar Sydenstricker of United States of America, found that pellagra was due to dietary deficiencies in sharecroppers and that it was related to their poverty, they faced much opposition[42]. With the Germ Theory came the ascendancy of medical care, curative intervention and the growth of institutions like hospitals, pharmaceuticals and specialisation of medical care. But once the scourges of communicable disease were under control the force of the germ theory paradigm faded. Preventive efforts became limited to immunisation.

## DEVELOPMENTS IN THE 20TH CENTURY

During the Second World War the stupendous growth of the chemical industry resulted in exposures to an increasing number of toxic chemicals and physical agents at the workplace.

TABLE NO.14: REPORTED CASES OF INDUSTRIAL DISEASES (DEATHS AND INJURIES), 1901-1939

| Disease | 1901-1905 | 1921-1925 | 1935-1939 |
|---|---|---|---|
| Lead Poisoning | 2093 | 108 | 677 |
| Phosphorous Poisoning | 6 | - | - |
| Arsenic Poisoning | 9 | 12 | 18 |
| Mercury Poisoning | 32 | 13 | 20 |
| Anthrax | 129 | 125 | 144 |

[42] Susser, M. & Susser, E. (May, 1996) Choosing a Future for Epidemiology: I. Eras and Paradigms in American Journal of Public Health, Vol.86, No.5, pp.668-673.

| | | | |
|---|---|---|---|
| Epitheliomatus Ulceration | 324 | 821 | - |
| Aniline Poisoning | - | 31 | 47 |
| Chrome Ulceration | - | 142 | 526 |
| Total | 2239 | 1730 | 2253 |

*Source: Factory Inspectors Reports, 1901-1939, in McIvor,A. (2000) 'Innocuous or Hazardous Toil: Cotton Textile workers and Occupational Health and Safety, c1880-1939*

These exposures contributed to the development of illnesses in two ways. One was the high-dose, short-term exposures culminating in acute illnesses or death. In the second half of the 20th century the concern grew regarding low-dose, short-term exposures that led to chronic diseases, often lethal diseases like cancer after long latency periods[43]. The growing recognition of such toxic effects fostered the growth of a prevention strategy that involved the study of the toxic substance and experimental evidence of its toxicity obtained from laboratory tests on animals or human tissues. The long drawn process of research, the expense and the delay in the application of the new chemical or process technology are some of the problems that are posed by these tests. Data from the National Academy of Sciences[44], of the USA showed in the 1983, that there were over 65,000 chemicals in use and about 700 new ones were introduced each year and may be potentially harmful for human beings exposed to them in certain circumstances. Emmett states that there is a relative paucity of data on the extent of workers' exposures to such toxic agents. The National Occupational Hazards Survey conducted from 1972-1974 by the National Institute for Occupational Safety and Health found about 8000 hazards, mostly chemical agents in the 5000 urban business establishments surveyed. Exposure to multiple hazardous agents was the rule in all these establishments. Emmett states that the approach to occupational health is rooted in the pathological tradition, with the aims of regulation and control resting on prevention of definable occupational disease. Possible interactions between the

[43] Green, G.M and Baker, F. (1991) Work, Health and Productivity: Overview, in Green, G.M and Baker, F (ed.) Work, Health and Productivity, Oxford University Press, New York, pp3-18

[44] Emmett, E.A. (1991) Physical and Chemical Agents in the Workplace in Green, G.M and Baker, F (ed.) Work, Health and Productivity, Oxford University Press, New York, pp.35-44.

chemicals that may retard or enhance the development of disease are numerous and calculations of the same are thus practically impossible.

After the Second World War rising chronic disease mortality overtook the mortalities from infectious diseases. Diseases like cancers, peptic ulcers, coronary ailments like ischaemic heart disease, took almost epidemic proportions especially among the middle-aged men. These diseases of completely unknown origin confounded the epidemiologists. The epidemiologists were forced to move away from a model that examined only specific causes of disease and now sought explanations for these diseases in the web of causation model. The epidemiologists found variations in disease as related to social class, geography and economic cycles[45]. This paradigm then attempted to define factors that contributed to 'risk' of contracting the disease. Stress at the workplace, lifestyles, food habits, smoking habits and behaviour in terms of aggressiveness, impatience, hostility and explosive speech patterns were identified as factors that contributed to causation of chronic diseases. The preventive efforts focussed around health promotion and behavioural change of those who fell in risk categories due to 'unfavourable' behaviour. Thus the focus on populations for prevention is limited to the individuals within them and prevention at societal levels gets reduced to dealing with people en masse. Pearce[46] is of the opinion that the key issue in this shift of epidemiological theory is the shift in the level of analysis that has moved from populations to individuals. This is typified by a lack of interest in population factors as causes of disease, a lack of interest in the history of epidemiology and a lack of integration with other public health activities.

Epidemiology is now used as a set of generic methods of measurement of disease occurrence. The population studies of epidemiology also are used to study decontextualised risk factors rather than studying population factors in their social and historical contexts. Such epidemiology is characterised by bio-physiological reductionism and domination by biomedicine.

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[45] Ibid., pp.44

[46] Pearce, N. (May,1996) Traditional Epidemiology, Modern Epidemiology and Public Health in American Journal of Public Health, Vol.86, No.5, pp.677-683.

Pearce quotes McKinlay in saying that such epidemiology generates repetitive studies that are dogmatic about study design and look at causation through a maze of confusing risk factors. He is of the opinion that such studies take to victim blaming and take on a lifestyle approach to risk behaviours. They seldom assess the relative contribution of non-modifiable genetic factors vis-à-vis the modifiable social factors. They decontextualise risk behaviours and produce interventions that can be harmful. These developments entailing shifts in public health theory also affected the way health of working populations was looked at.

The case of the United States is illustrative of this shift that is associated with the change in epidemiological theory of disease causation along with changes in organisation of production and technologies used therein.

## THE HISTORY OF DEVELOPMENT OF OCCUPATIONAL HEALTH IN THE UNITED STATES

### INDUSTRIAL GROWTH IN THE UNITED STATES IN THE EARLY 20TH CENTURY

The early twentieth century was a period of rapid industrialisation in the United States of America. A number of factors account for the rapid industrial growth that the American economy witnessed during this period of history; like, the application of new technology to manufacturing and extraction of raw materials, discovery and utilisation of many natural resources like coal, iron ore, natural gas etc., the building of large a transport system, a large supple of cheap labour, the growth of foreign and domestic markets and favourable government policies like protective tariffs and indirect subsidies[47].

Industrialisation and urbanisation affected the health of workers in factories, cities and mines due to increased exposures to toxic materials and dangerous machinery. Ignoring working conditions in factories and mines led to a rising toll of deaths due to

[47]Corn, J.K. (1992) A Historical Perspective on Government Responsibility for Occupational Health, in Corn, J.K. (ed.) Response to Occupational Health Hazards- A Historical Perspective, Van Nostrand Reinhold, New York, pp.1-22.

diseases and accidents caused by toxic hazards and machinery[48]. The work force in the factories was also plagued by other problems like low wages, long work hours and job-insecurity.

Industrialisation in the US was characterised by the rapid growth of giant monopoly corporations and the expansion of mining and manufacturing activities with the accompanying problems like those of an unsafe and unhealthy working environment[49]. These large industries employed unskilled workers in large numbers. There was plenty of cheap labour available due to constant arrival of vulnerable immigrants in large numbers from various parts of Europe.

The employers and the government turned a blind eye to the existence of old diseases like mercurialism, plumbism, silicosis and phosphorous poisoning, afflicting workers toiling in unsanitary and ill-ventilated mines and factories, exposed to all kinds of toxins and contagion. Though these diseases were ill defined at this point in time, their existence was very visible[50].

Since the end of the Civil War in the U.S. in 1865, there were alternating conservative governments, which promoted the unrestrained growth of corporations. These were periods distinguished by 'reduced role of government, large scale economic and corporate restructuring with trusts and mergers, tax reduction and increasing of wealth concentration in the hands of a few'[51].

Besides, the political and economic power of the corporations and their contributions in developing the US as an economic superpower resulted in the courts and the political establishment supporting them in the event of disputes with labour. The employers believed that they were not obliged to assume any responsibility regarding the health of the workers. The periods of republican rule, which were also periods of backlash against labour and strong propaganda of an anti-left ideology. All this further enabled the corporations to amass huge profits and take over other rival companies

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[48] Ibid.pp.2

[49] Berman, D.M. (1978) Death on the Job- Occupational Health and Safety Struggles in the United States, Monthly Review Press, New York, pp.8

[50] Corn, op.cit.pp.4

[51] Jaheil, R. (1998) Health Care System in the United States and its Priorities: History and Implications for Other Countries, in The Croatian Medical Journal, Vol.30, No.3, pp.316-331.

forming large oligopolies and monopolies. The United States Steel Corporation was the country's first billion-dollar business[52] in 1901.

## INTERVENTION IN THE AREA OF HEALTH OF WORKING POPULATIONS IN THE U.S. IN THE 20TH CENTURY- THE HISTORY OF MODERN OCCUPATIONAL HEALTH

### Accidents Injuries, Deaths and Compensation

The statistics of industrial accidents and the high incidence of deaths during the first two decades of the 20th century reflected the abysmal conditions of work and the irresponsibility of the employers. In the year 1913, a total of 23,000 deaths were reported in a workforce of 3,80,000,00[53]. The Government organisations did not respond much to these incidents of death and disease in the industry. The interest of the growing American print media in the issues of workers' safety and health helped to alert the American people to these issues. The Russell Sage Foundation sponsored the Pittsburgh Survey in 1906-1907, in Pennsylvania. The survey revealed that between July 1906 and June 1907; 326 men were killed in Allegheny County, 84% of who were under 45 years of age and 58% of them were under 30 years of age[54]. Incidents like the mine disaster in West Virginia in 1907 that killed 362 coal miners[55] and the fire at the Triangle Shirtwaist Company, 1911 in New York city that killed 145 immigrant women workers were publicised greatly by the American press. The federal government now began paying greater attention to the issues of working populations especially in the industry. It made funds available for setting up occupational hygiene programmes[56]. The mine disaster at Virginia led to the creation of the Bureau of Mines in 1910 and the Office of Industrial Hygiene as part of the United States Public Health Service in 1914[57].

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[52] Berman, op.cit.pp.6

[53] Corn, op.cit.pp.4

[54] Corn, op.cit.,pp.6; Berman, op.cit.pp.20

[55] Ibid.pp5

[56] Ibid, pp.4; Schilling, op.cit.pp.16

[57] Corn, op.cit.,pp.5

According to Berman the steel sector in the United States was the most dynamic sector in the late nineteenth and the early twentieth century. The developments in that sector affected the other sectors as well.

The US Steel Corporation's plant in South Chicago alone accounted for 46 deaths and 386 permanent disabilities among workers in the year 1904. The accidents were reported in magazines like 'Everybody's' who described the accidents and so did John Fitch in 1911[58]. The workers died when they fell into vats of molten steel or were showered by the molten metal when there were sudden blasts in the furnace.

The high and ever rising casualty rates could be attributed to the efforts to expand production by speeding up the pace of work and increasing the workweek coupled with the introduction of new technologies that involved taking dangerous responsibilities for tonnes of molten steel and other materials[59]. Production was carried out under a strict chain of command. Deskilling of workers was accompanied by a lowering of wages. The blacks and immigrants performed the dirtiest and the most dangerous jobs. All these above mentioned changes increased the nervous strain that the workers were subjected to while working under environmental conditions of high temperature and metallic dust. The diseases and injuries that the workers suffered from were caused by exposure to dust, heat and sudden changes in temperature.

As a result of all the above-mentioned changes, the steel industry was able to bring labour costs down from 22.5% to 16.5% of the total production costs and expand profits manifold between 1890 and 1910[60]. But these profits were realised at a tremendous cost of the health and lives of many workers.

Labour protests also marked this prosperous journey of the American industry. Major steel corporations like Carnegie Steel resorted to violent repression of strikes in the period between 1802-1902 in Pennsylvania. The political climate of struggle against inhuman work conditions and impoverishment of the working class all over the world provided hope to workers struggles in America as well. The workers discontent with

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[58] Rosner, D. (April, 2000) When Does a Worker's Death become Murder? American Journal Of Public Health, Vol.90, No.4.

[59] Berman, op.cit.,pp.12

[60] Ibid.pp.13

working conditions, pressure from the media, and the rising costs of lawsuits along with the costs of lost production led the industrial establishment to evolve ways to bring down the rates of casualties. The fear of the growing popularity of unions and socialism and the need to gain social legitimacy among the people of America, led the corporate sector in steel and other industries to undertake welfare programmes for workers and precipitated in the steel industry taking the lead in the 'voluntary safety movement' which was completely financed and controlled by the industry itself with no government or labour intervention.

In 1910, US Steel also devised the Voluntary Accident Relief Plan[61] the most patent aspect of which was the paying of fixed amounts as compensation for job-related injuries causing death or disability in lieu of workers rights to sue the corporation for the damages. The compensation measure was supported by the use of more sophisticated engineering hardware and instructions to workers regarding the application of safety techniques. Installation of simple safety equipment and enforcement of rudimentary safety practices resulted in the large corporations saving money in accident costs. During the period from 1900-1908 US Steel spent $5 million on safety devices and education with a resultant 40% fall in accident rate and a 35% reduction[62] in related costs. Once the compensation costs stabilised and there was a lull in labour dissent the corporate safety movement seemed to take a backseat.

The Compensation Safety Apparatus

The first decade of the 20th century thus witnessed the emergence of business-sponsored associations like the National Civic Federation (NCF) and the American Association for Labour Legislation (AALL) in 1900 and 1906 respectively. They tried to negotiate with the labour unions in order to avoid strikes and confrontations[63]. The AALL was also active in promoting uniform legislation in all states regarding industrial diseases, injuries, inspection and compensation. But the state laws passed were almost unenforceable. There was dissatisfaction among the workers over the fact

[61] Ibid,pp.15

[62] Ibid , pp.76

[63] Berman, op.cit. pp.18

that common law made it nearly impossible for them to collect damages from the employer since the onus of proving him guilty lay on the former. The common law was governed by the legal doctrines[64] of 'assumed risk', that of 'contributory negligence' and the rule of the 'fellow servant'. In the former the worker was seen to be aware of the risks involved in the job and took it up by his own choice hence the employer was not responsible for the accidents or disability he suffered. According to the second doctrine the worker would not be allowed to file a suit if it was seen that he had contributed in any way to the accident. Finally the fellow servant rule laid the responsibility of the accident on the fellow workers. Thus the law in effect protected the employer.

In some states, employer liability laws had been instituted. The spiralling costs and the added embarrassment of trials for employers in such states were a cause for much worry. Hence, the corporate agenda could ill-afford to play down or ignore the issue of working conditions and compensation.

The struggle waged by the socialists and trade unions affiliated to the left brought the issue of working conditions and health to the centre stage. The corporate sector responded by sponsoring a spate of studies that then stressed on the importance of a system of workers' compensation. The NCF organised a Department of Compensation for Industrial Accidents and their Prevention. It was the major agency that lobbied for a compensation system along with the AALL. Various meetings were held and political support was secured, but the participation of workers representatives was not solicited. The unions were also reluctant to join the NCF's initiatives to draw model compensation plans due to their earlier experiences with the steel industry, where the management had indulged in attacking unions and also drawn compensation plans that were not beneficial to the workers.

Most states adopted the model laws that were designed by the Compensation Department of the NCF. The National Safety Council was then formed in 1912[65] as a national coordinating agency and enjoyed the patronage of eminent capitalists from the steel, railroad and insurance industries. It also had members from the state

[64] Rosner, op.cit.,pp.538; Ibid. pp.19

[65] Berman, op.cit.pp.21

governments and federal agencies but no unions were part of the National Safety Council. There were other organisations like the National Council on Compensation Insurance (NCCI) that represented the insurance business and the American National Standards Institute (ANSI) that played an important role in the development of what became the Compensation-Safety Apparatus, founded between 1910-1920. According to Berman, the ANSI is an umbrella organisation that legitimised the standards that were developed by the private industry. It devised the 'USA Standard Method of Recording and Measuring Work Injury Experience- Z16.1'. The committee that devised this standard consisted of 33 business and insurance trade associations, 14 government representatives and only one representation from the labour union AFL-CIO whose representative was eventually not nominated[66]. This measure continued to understate the incidence of work place injuries and deaths and did not have any category for occupational disease.

The Compensation-Safety Apparatus was a skeleton programme of private workers' compensation and state run industrial inspection programmes. It succeeded in withholding the issue of working conditions from the public agenda and created the impression that something was being done to improve the conditions of the injured workers[67]. It was decided that private companies would carry out the insurance and thus the compensation-safety apparatus was an arrangement most suitable to the interests of the managements and the private insurers.

This compensation system stabilised compensation costs at 1% of the payroll since it ignored the issue of occupational disease, long-term disability and workers' rehabilitation completely. The system in effect shifted 90% of the financial burdens of work-related accidents to the workers, their families and the public. While the responsible government agencies and private corporations overlooked these tasks[68].

In the lack of State support for occupational health legislation, or in the areas of knowledge generation the private sector in industry defined the form and content of

[66] Berman, op.cit.pp.80

[67] Ibid, pp.22

[68] Berman, op.cit.pp.22

occupational health in the United States at this time. Thus, the understanding of safety in the industry during this period was employer-defined. The corporate sector being very powerful, it succeeded in influencing the state organs to interpret laws in their favour. These interpretations and definitions refused to give credence to workers experiences; instead, accidents were blamed on workers' carelessness as was evidenced in the doctrines governing common law. Decision-making processes regarding organisation of work were now in the hands of the management. Reorganisation of production that resulted in long hours, an incredible pace of work and fatigue definitely contributed to accidents, but these issues were never questioned and were presented as an integral part of industrial activity, which the worker was aware of when he undertook the employment. Occupational diseases were left untouched by the compensation safety apparatus. Compensation for the injuries and deaths caused at work were provided in lieu of the right to safe and healthy working conditions. Companies were thus absolved of their responsibility in accidents and injuries suffered by workers. This system of compensation dominated the occupational health and safety policy of the United States till the 1960s.

## THE DEVELOPMENT OF OTHER DISCIPLINES IN OCCUPATIONAL HEALTH-OCCUPATIONAL MEDICINE, INDUSTRIAL HYGIENE, SAFETY AND ERGONOMICS AND INDUSTRIAL PSYCHOLOGY

### Industrial Psychology

Occupational health received much attention at the time of the First World War in Britain as well. The British Industrial Fatigue Board[69] instituted during the war conducted many studies that created a whole new area of research in industrial psychology that became widely popular in the American industry.

Psychological testing was developed during the First World War in the United States and was used successfully to recruit men who made ' satisfactory officers and non-

[69] Ibid, pp.23

coms'.[70] During the First World War a number of corporations in the US utilised psychological testing among them Metropolitan Life, American Tobacco and National Lead to mention a few. Carnegie Institute of Technology established the first psychological consulting service for industry in 1915[71]. Aptitude testing was used to determine in advance the suitability of workers for various positions by classifying them according to degrees of manual dexterity, intelligence, accident proneness and conformance to the profile desired by the management.

"The cardinal feature of the disciplines of industrial psychology and of industrial physiology was their concern with the conditions under which the worker may be best brought to cooperate in the scheme of work organised by the industrial engineer.[72]"

The problems addressed are the problems of the management namely, absenteeism, high turnover rates, resistance to pace of work, indifference, neglect, cooperative group restrictions on output and overt hostility to the management. It addresses the problems that are raised by reactions and responses of workers to the work. Hugo Munsterberg at Harvard said that the role of the psychological science in the industry was to select workers from among the pool offered in the labour market, their acclimatisation to work routines of civilisation.

The concepts of motivation and cognitive performance in industrial psychology as they developed in a context of capitalism have been used to improve and assess workers' efficiency and work performance hence, his or her utility to the cause of industrial production and capitalist accumulation. Concepts like attitude, motivation, perception, morale and intelligence and their related tools were put to use in the area of industrial production to choose those most suitable for a particular job and eliminate the workers who didn't suit the required criteria. Individual differences and responses were studied through aptitude testing leaving the social side of the interactions of the

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[70] Cronbach, L.J. (Jan, 1975) Five Decades of Public Controversy on Mental Testing in American Psychologist, pp.1-14.

[71] Braverman, op.cit. pp.144

[72] Ibid., pp.140

workers and the collective arrangements within which they lived[73]. Experimental and statistical techniques applied to studying responses and efficiency of workers reflects the predominance of a positivistic epistemology.

The concept of 'accident proneness' examined personality traits of workers and resorted to labelling. Syndromes associated with specific characteristics, were to be dealt with or treated by psychiatrists. Thus problems that were essentially caused due to the social environment and the conditions in which the workers worked were ignored and attention was focussed on a set of narrow psychological causes that were to be located in the workers mind and body. The labelling of workers as suffering from 'accident syndrome' or 'moonlighting'[74] also implied the medicalisation of a social problem and relegating it to the sphere of the industrial physician's or the psychiatrist's 'expert control'. This approach emphasised the immediate causes of the accidents that involve individuals and obfuscated the realities of production systems, work organisation, supervision, faulty technology and profit motive that drive capitalist production and that underpin the phenomenon of industrial accidents when examining it at a population level. Accidents were attributed to 'light heartedness ' or 'psychomotor retardation' or 'excitability' of the worker. And pulmonary problems like pneumoconiosis or asthma were blamed on psycho-physiological reactions or depressive reactions and anxiety.[75] Extrapolating from individuals and applying the results to produce generalisations for collectivities cannot amount to sound epidemiological enquiry, it can at best lead to interventions that seek to examine and eliminate the vulnerable individuals from the workforce or blame the victims for the accidents and disabilities they suffer.

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[73] Nayar, K.R. (1991) Inter-disciplinarity in Social Sciences in Health: A Re-examination of the Linkages between Social Psychology and Health, Centre for Social Medicine and Community Health, School of Social Sciences, Jawhar Lal Nehru University, New Delhi, India.

[74] Berman, op.cit., pp.23

[75] Ibid., pp.23

Occupational Medicine and Industrial Hygiene

Occupational Medicine developed in the United States as a separate discipline with the contributions from pioneers like Alice Hamilton, who worked extensively on the prevalence of occupational disease in the United States. She was the Director of the Commission set up to inquire into the prevalence of industrial disease in the state of Illinois[76]. She surveyed lead poisoning in smelters in 1911 and wrote extensively about the diseases that the workers suffered from. She also examined organic solvents like carbon disulphide poisoning in viscose rayon industries, radium used in the manufacturing of watch dials, mercurialism in mercury mines in California and silicosis in copper mines in Arizona[77]. It was the first such commission in the world. She remained in this unsalaried position from 1911 to 1921 when her program was cancelled after pro-business Republicans regained control of the White House. As a result of its findings, several workers' compensation laws were passed in Illinois. They introduced a new notion that workers were entitled to compensation for health impairment and injuries sustained on the job. Hamilton worked in the face of strong opposition from her colleagues in the medical profession and from the entrepreneurial class. Federally funded research spearheaded by Hamilton led to safety reforms such as increased ventilation in the workplace. She attained increased safety measures for workers by convincing capitalists that quick turnover rates fostered an inefficient workforce. Hamilton explored occupational disorders and their social consequences. Relying primarily on epidemiology and the emerging laboratory science of toxicology, she pioneered occupational epidemiology and industrial hygiene in the United States.

After the her pioneering work on white lead, the government in the 1920's, relinquished control of lead research, handing the reigns over to the very industries that produced leaded products. From this point on, the research emphasized occupational effects over public safety. In exploring this phase of lead poisoning research, Warren describes the career of Robert Kehoe, a scientist employed by the leaded gas industry. Kehoe promulgated that blood-lead levels were natural and

[76] Corn, op.cit. pp.8

[77] Schilling, op.cit., pp.17

acceptable to a certain point, giving the public a false sense of security based on occupational standards. The lead industry's control of research demonstrated that the origins of research have the power to influence a nation's safety.

From its very inception occupational medicine has been seen to be very close to management. Navarro quotes one of its founders Dr. CD Relby saying that industrial medicine is a speciality in service of the management. He also cites the words of the head of the Council of Occupational Medicine of the American Medical Association said in 1961 that the physician's place in industrial medicine is auxiliary to the main purpose of the business: profit and production[78]. Berman defines industrial hygiene as a 'ghettoised institution' started by the American industrial establishment that set up the Compensation-Safety Apparatus, in order to control the definition of health and illness in the industry. The physicians according to him were recruited by the management from private practice and started off with biases common to their class. Their primary role in the industry was to keep compensation costs down. This also accounts for the low prestige of the specialisation among doctors. They eventually come to share the profit making motives of the management. Medical training they receive does not contribute to an understanding of the other political issues involved in their roles as physicians in the industry. Their role also is to eliminate workers with obvious defects[79].

Berman gives an exhaustive account of the discipline of Industrial Hygiene and its practitioners. The American Industrial Hygiene Association (AIHA (1938))[80] and the American Conference of Governmental Industrial Hygienists (ACGIH (1939)) are the two major groups of industrial hygienists in the country. The former is backed by the private sector and the members of latter consist of industrial hygienists working for state enterprises.

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[78] Navarro, V. (1986) Medical History: Justification v. Explanation in Navarro, V (ed.) Crisis, Health and Medicine- A Social Critique, Tavistock Publications, New York, United States of America, pp.85-211.

[79] Berman, op.cit.pp.97

[80] Ibid, pp.78

In the 1930s the industrial hygienists and occupational medicine professionals developed the concept of dose-response relationship[81] of exposure to toxins and other harmful substances like asbestos fibres. This concept implied a linear relationship between severity and length of exposure and the bodily response in the exposed persons. This concept was used to assert that below a certain concentration, risk accruing from the exposure to the substance would be negligible. This implied measurement and quantification. Various instruments were developed to measure the concentration of substances in the environment at the workplace. The earliest efforts concentrated on measurement of airborne hazards and determination of concentrations that would not cause injury to the workers.

In the 1940s the ACGIH also made the first attempts to determine dangerous levels of exposure to contaminants called Threshold Limit Values (TLVs)[82]. These were 8-hour time-weighted averages of an airborne contaminant to which workers could be exposed daily without adverse effects. These concentrations arrived at from toxicity tests on animals and exposed workers. This activity of determining numerical values for acceptable occupational exposure limits was value laden and highly controversial. Besides the fear of these limits being manipulated by the industrial interests through their involvement in the process, the limits were criticised for being based on unscientific evidence, without adequate consultation of members and corporate involvement that was reflected in the use of corporate consultants in the process, undocumented communications and unavailable scientific documents[83]. The ACGIH defended the values that it had published in the Industrial Hygiene Newsletter by saying that these values were to be reviewed annually and were arrived at based on 'available scientific evidence and industrial experience'. They asserted, "Threshold Limits should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations."[84] The TLVs

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[81] Corn, J.K. (1992) Evolution of Mandatory Standards, in Corn, J.K. (ed) Response to Occupational Health Hazards- A Historical Perspective, Van Nostrand Reinhold, New York, pp.28

[82] Corn, 1992, op. cit., pp.34

[83] Corn, op.cit., 1992. pp.41

[84] Transactions of the Fifteenth Annual Meeting of the American Conference of Governmental Industrial Hygienists, Los Angeles, 8 -11 April, 1953 as quoted in Corn, 1992, op.cit., pp.37.

provided guidelines when few other guidelines or standards existed. As the science of toxicology developed it was used to set TLVs by the Threshold limits Committee of the ACGIH. This committee consisted of industrial hygienists who were either government employees or employees of universities and non-voting consultants representing private corporations, very occasionally was labour included in the process[85]. Similarly, the American National Standards Institute also developed safety standards for the Department of Labour of the Federal Government and 180 of its standards were adopted as the official standards in 1969; just a year before the Occupational Safety and Health Act was passed. In the late 1960s 100 large corporations, 160 trade associations, 6 trade unions and many government agencies participated in the various deliberations of the ANSI's committees. The funds for the operations of the ANSI came from the coffers of the corporate sector. According to Berman the ANSI standards tended to be lenient towards business as was mentioned earlier in this chapter.

The managements of the companies directly employ industrial hygienists. The latter are not given sufficient power or the resources to carry out their work properly. The Occupational Health Survey of the Chicago Metropolitan Area provides evidence to the effect that "company employed industrial hygienists have little positive effect on the environment of those plants[86]."

The discipline of occupational medicine is last on the list of priorities of specialisations in the academic curriculum of medical schools. The control that the big business has exercised on the development of this discipline has resulted in suppression and ignoring of research into dangerous conditions in the industries[87]. The medical practitioners recruited by the industry often subscribe to a view biased in favour of the business and have an anti worker attitude. Their relative lack of autonomy in the field and having to make decisions in favour of the industry makes their job less prestigious. In many cases the physicians hired by the industries play the

[85] Corn, op.cit., pp.41

[86] Berman, op.cit, pp.100

[87] Ibid, pp.94

role of keeping down compensation costs by understating the disability, or screening out the unhealthy workers in the pre-employment medical tests.

Navarro criticises occupational medicine as it is practised in a capitalist society, for an ideological framework, which according to him serves the purpose of reproducing the existing order. Regulatory agencies in the area of occupational medicine attempt to protect the worker from environmental exposure to harmful agents. Thus a tussle takes place around the allowable levels of exposure to such harmful substances. But the process takes place in an ideological dichotomy between the environment and the worker. The discipline and the regulatory process emanating from its understanding circumvent the social power relations that determine the environment of exposures, the nature of the work process and the workers. These power relations determine the manner in which the worker participates in the work process, the autonomy and control over decision-making that he enjoys. By drawing attention only to the toxic substance the discipline obfuscates the larger disabling social, economic and political environment, which may be, root causes of the ill health that the worker experiences as a result of his work[88].

Safety Engineering

After the 1930s safety engineering also became integral parts of the discipline that industrial hygiene was[89]. The cases of the Occupational Health Nurse and the Safety Engineer as part of industrial hygiene are similar to that of the industrial hygienist. They have little formal authority at work; most of them receive very little training at schools. The availability of federal training grants for Occupational Health Nursing is also very meagre and there is little interest within the nursing profession in industrial problems. The area of safety engineering is accorded low prestige in industry. The desire to identify with the management and realise their goals of getting greater importance and prestige, leads to their making decisions, which would bring

[88] Navarro, V. (1986) Work, Ideology and Science: The Case of Medicine Navarro, V (ed.) Crisis, Health and Medicine- A Social Critique, Tavistock Publications, New York, United States of America, pp.157

[89] Corn, op.cit.,pp.15

maximum benefit to the industry. Thus, their services are utilised by the management to control the work through optimal ergonomic design of machinery and work processes, in order to bring maximum cost-benefit to the industry instead of focussing on accidents and diseases as issues of human suffering.

Having examined the context within which these disciplines have emerged and the framework within further knowledge is generated and regulatory action is taken; let us now turn our attention to the specific role of the American State in intervention in the area of occupational health.

## PATTERN OF STATE INTERVENTION IN OCCUPATIONAL HEALTH IN AMERICA

State intervention in the case of the United States was deemed necessary in the area of occupational health only when issues of national interest like economic progress and reconstruction towards the end of the Depression, or the very survival of the nation was at stake as in the case of both the wars. The First World War also stimulated some occupational health activities in the war industries of America. The Congress established the ***Working Conditions Service*** to inspect war production sites and advise the companies on reduction of hazards, with the end of the war this service was also terminated. The period followed by the war was one of high tariffs, reduced taxation, laissez-faire and suspension of the minimal occupational health legislation that existed, with a conservative government at the helm. This service ended with the war[90].

During the Great Depression in the 1930s occupational health was accorded very little importance[91]. The widespread unemployment and vulnerability of labour led to a low rate of unionisation among the workforce and employment gained precedence over issues of safety and favourable working conditions. So much so that an incident as gory as the death of 470 workers (mostly black) and the disablement of 1500 while

[90] Corn, op.cit.pp.12

[91] Ibid. pp.12

digging a hydroelectric tunnel at Gauley Bridge[92] in West Virginia failed to gather much attention from the American Government.

The New Deal Programme (1935-46) guided by the principle of government responsibility for human welfare was designed to rescue the US from its worst economic depression. Hence social and economic legislation including the legislative changes instituted in the area of occupational health was part of the program for reform and recovery.

- ***The Social Security Act (1935)*** - Allocated funds for research and grants in aid to states for industrial hygiene among other public health activities.
- ***The National Labour Relations Act (1935)*** - Guaranteed workers the right to organise and bargain collectively.
- ***The Public Contracts Act (Walsh-Healy Act, 1936)*** - Established labour standards for government contracts including standards for health and safety of workers.
- ***The Fair Labour Standards Act (1938)*** - Set a minimum wage banned child labour and banned workers under the age of 18years from working in dangerous occupations.

The Division of Industrial Hygiene undertook the task of implementing standards propounded by the Social Security Act. It took up in-house training of people in the field of occupational health. But the state industrial hygiene units were facing problems of inadequate funds, lack of interest in occupational health of the sate legislators and inaccurate reporting of industrial diseases and accidents. There were technical problems like lack of accurate sampling instruments and analytical tools, tools to detect industrial diseases and methods to detect small amounts of toxic materials in the factory environment.

During the Second World War, once again there was renewed enthusiasm to curtail war accidents and conserve labour. The war created a huge demand on increased production and the country faced shortages of both skilled labour and materials. Hence health of the workers was to be protected to keep them productive. The Office Labour Production of the War Production Board reported that labour hours lost due to accidents were ten times of those lost by strikes accompanied by financial losses

[92] Berman op.cit. pp.27

amounting to nearly $2 billion[93]. Since the lack of safety and sanitary working conditions were considered the chief causes of low labour productivity the War Production Board established the Industrial Hygiene and Safety Section of the Office Labour Production. State Industrial Hygiene units were retained the responsibility for occupational health and it did not become institutionalised in the federal government. The networks of Industrial Hygiene units were established in nearly every state during the war. The Chairman of the National Committee for the Conservation of Manpower in War Industries said "....the national safety program was from the beginning and still is, directed solely to the objective of increasing production and saving of compensation costs or even the much important prevention of human suffering and social distress. ... we do not ask management or labour to look upon the work injuries in terms of pain or money cost, but rather in terms of production loss and delayed delivery or urgently needed war supplies." But this interest in occupational health dwindled as soon as the war over[94] and these health and safety requirements never became institutionalised.

## THE OCCUPATIONAL HEALTH AND SAFETY ACT, 1970 (OSHA)

The 60s was a remarkable period of internal churning and popular questioning of given societal values, in both the USA as well as Europe, and witnessed the emergence of, what later came to be known as, the new social movements- e.g. environmental movement, women's movement, students' movement etc. The labour movement also derived newfound energy from the turbulent and dynamic political climate.[95] Workers' struggles now supported research independent of corporate patronage. The findings of these studies and the new found militancy of labour struggles questioned the compensation safety apparatus and pushed for the passage of a new act for radical reform of work places and conditions. The coal miners struggling for state compensation for black lung came together forming their own Black Lung Association and associations of widows and the disabled supported actively by

[93] Corn, 1991,op.cit.pp.20

[94] Ibid, pp.23

[95] Jahiel, 1992, op.cit.pp.324

physicians, scientists and lawyers. The pressures exerted by the organisation of these workers contributed to the passage of the Coal Mine Safety Act of 1969 and the Black Lung Benefits Act of 1972[96].

There was support from the federal government in the form of reports that recommended enhanced spending for dealing with occupational health hazards. The Oil, Chemical and Atomic Workers, the Steel workers, the AFL-CIO, the United Auto Workers and some senators pushed very strongly for the passage of a comprehensive law for occupational safety. These efforts were resisted by the National Association of Manufacturers (NAM), the National Safety Council, the National Civic Federation and the US Chamber of Commerce[97]. Republican Government's need to assuage the unrest among the workers and to gain legitimacy in the midst of a volatile political atmosphere contributed to the enactment of the Occupational Health and Safety Act (1970)[98].

The act required of the employers to provide a workplace 'free from recognised hazards that are likely to cause death or serious physical harm to employees'. The Labour Department's Occupational Safety and Health Administration (OSHA) promulgated the standards for prevention and regulation of workplaces and work conditions. The OSHA can inspect workplaces and propose penalties for defaulting employers. The workers can call for inspection without prior notice to the management and anonymity is guaranteed to the worker making a complaint, if he wishes it. The National Institute of Occupational Safety and Health (NIOSH) is the agency whose advice is sought to set standards[99]. All the standards set by the NIOSH initially were borrowed directly from those created by the industry-supported institutes like the American National Standards Institute and by the TLV committees of the ACGIH as was described earlier in the chapter. Despite the fact that the ACGIH had warned that the TLVs were not to be used as standards, the OSHA promulgated them

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[96] Berman, 1978, op.cit, pp.32

[97] Ibid, pp.32

[98] Ibid, op.cit.pp.33

[99] Ibid, pp.33

as legally enforceable safety standards. There were many attempts to obstruct the process of setting new standards by the OSHA.

Other than the problems related to passage of new standards, the OSHA is also plagued by problems like low budgetary allocations for enforcement, restrictive regulations, low fines and influence of powerful political and business figures, which many a time works in favour of the employers[100]. The late 70s being a period of recession and high rates of unemployment also led to few convictions for the violations at the work place. Navarro notes that 80% of the labour force in the United States belongs to the working class. He quotes the US Department of Health, Education and Welfare in saying that there is greater morbidity and mortality among them. At least 4 million of the workers contracted occupational disease every year, and there were nearly a hundred thousand deaths of working people every year, with 28,000 deaths caused each year due to work-related accidents. A survey conducted on 1million workers in Chicago, by The Bureau of Occupational Health and Safety in the United States revealed that nearly 50% of them were exposed to serious and urgent health hazards on the job[101]. Most of the data according to Navarro clearly explains that these deaths and illnesses are preventable and continued to occur due to the callous disregard of the economic and political institutions for the health and the safety of the working population. The head of the OSHA stated that this was due to the absence of meaningful legislation and had its roots in the social and economic composition of the society.

The report of the Office of Technology Assessment states "limited research on exposure levels appears to show positive effects for hazards that were subjects of new or revised OSHA regulations like vinyl chloride, asbestos, cotton dust and lead."[102]. Yet in all these years of existence the OSHA has succeeded in promulgating only 24

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[100] Ibid, pp.35

[101] Navarro, V. (1976) The Underdevelopment of the Health of Working America: Causes, Consequences and Possible Solutions in Navarro, V (ed.) Medicine Under Capitalism Prodist Croom Helm, United States of America and Great Britain, pp. 82-102

[102] Corn, 1992, op.cit.pp.20

full standards, the hearings for which were lengthy and fraught with contradictions. The standards were also denounced by the labour movement, which felt that the role of the NIOSH was usurped by the ACGIH[103]. The TLVs were criticised for suspected for manipulation by the industrial interests through their involvement in the process, for being based on unscientific evidence and corporate involvement being reflected in the use of corporate consultants, undocumented communications and unavailable scientific documents.

The Act has contributed to the improvement of working conditions in many industrial establishments. It has also led to a questioning of the role of the company doctor and there have been initiatives to build a body of research outside the precincts of corporate patronage and has brought the issue of working conditions in industries on the public agenda. There is a heightened and more realistic awareness among working people and others in society about the magnitude of the problems at work places.

From the 1970s there was a perceptible shift in the activities of national agencies in that they now utilised risk assessment as a tool for regulatory decision-making. In 1976, William Lowrence[104]explored problems underlying the issue of safety itself. He said that estimation of levels of risk and their acceptance are two different kinds of activities. Measuring risk is an empirical and scientific activity while accepting risk involves passing judgements, which is a political, normative activity. The mixing of these two activities in the United States has led to much bitterness among concerned groups. Since the OSHA not a single standards has been passed without conflict.

David Lowrance says, "Safety cannot be measured. Only when those risks are weighed on the balance of social values can safety be judges: a thing is safe when its attendant risks are judged to be acceptable."[105] Modern risk analysis has twin roots in mathematical theories of probability and scientific methods of drawing causal links between adverse health effects and hazardous activities. These mathematical models have been criticised for predicting varying ranges of risk, extrapolation from animals

[103] Ibid, pp.40

[104] Ibid, pp50

[105] Corn,1992, op.cit.pp. 133

and from high doses to low doses. Risk assessment gained acceptance as an analytical tool for regulatory decision making when there was a shift in environmental policies to regulate carcinogens and toxic substances.

Risk assessment has been used as a tool in the area of standard-setting, which has been a fiercely contested area. Corn cites the example of the standards for Benzene. The exposure limit was lowered from 10 ppm to 1ppm with a ceiling of 15 during any 15-minute period. The OSHA had concluded that it was not possible to ascertain a threshold for benzene induced carcinogenicity or to establish a safe level for benzene, hence this standard was accepted by OSHA based on its 'lowest feasible level policy', since higher concentrations could be harmful. The American Petroleum Institute challenged this standard. In 1980, the Supreme Court asked the OSHA to vacate the standard since it was unable to prove that benzene created significant health risk in the work place and that lower standards could eliminate that risk. This decision profoundly affected all the following regulatory policies since utilisation of quantitative risk assessment and the test of significant risk are now part of setting standards to regulate toxic chemicals.

The implementation of the OSHA still entails lot of resistance on the part of industry and the insurance companies; the long drawn battle of asbestos is a prominent example of the same.

## THE ASBESTOS EXPERIENCE

In the first four years, after it was set up, the OSHA was reluctant to pass any new controversial standards under the republican government. But there was now more space for workers' voices to be heard. The story of the standards setting for asbestos shows how difficult it is to get authentic research about a profitable but hazardous commodity.

The awareness of the hazards associated with asbestos has existed for long, since the works of Pliny the Elder. In 1906, a British physician reported the first modern account of death of a worker by asbestos. By 1918 American and Canadian insurance companies had stopped giving personal life insurance policies to the asbestos workers. After the First World War, there was a rapid expansion of the Asbestos industry in the

United States. Johns-Manville was the largest corporation manufacturing asbestos in the US. The industry suppressed information regarding the extent of asbestosis among their employees despite the fact that their data showed 67 of the 126 people examined to be suffering from the disease. The Report of the Chief Inspector of Factories in Great Britain showed the prevalence of lung cancer among individuals who suffered from asbestosis. Fifty-two papers published independent of the asbestos industry showed the carcinogenic effects of asbestos along with it being the causative agent for asbestosis among workers exposed to it. Eleven papers sponsored by the industry presented exactly the opposite findings. In the 1960s Dr. Irving J Selikoff conducted research independent of the industry and with the Asbestos Workers Union and their findings helped in creating the atmosphere for the passage of the OSHA. This was followed by an asbestos scandal at the Tyler plant belonging to Pittsburgh-Corning. The examination of air samples there revealed higher concentrations of fibres than the permissible standard of 12 fibres per cubic centimetre. The management was let off on a paltry fine payment of $210 for violations like failure to examine whether workers wore respirators or not. This led to the pressuring of the government by the organised section of workers. Finally, the Secretary of Labour caught between the workers and the industry passed a standard of 5 fibres per cubic centimetre in 1972, as against the 2-fibre limit demanded by the former and the 12-fibre limit asked for by the latter. After much more resistance from the NIOSH and the Mt. Sinai researchers (where Selikoff worked), the OSHA agreed to bring down the limit to 2 fibres in 1976.

Pittsburgh-Corning sold its asbestos plant. Both Pittsburgh-Corning and Johns-Manville were sued for $100 million for their failure to protect workers. Of the 689 workers studied from 1959 at the Johns-Manville plant at New Jersey 96 died of asbestos related diseases. It had 271 suits on the disease and many more plaintiffs in 1978. The other plants faced lawsuits and strikes. In 1986, Navarro[106] reported that of the 4 million people who had suffered heavy exposure to asbestos 25% were expected

[106] Navarro, V. (1986) The Labour Process and Health: A Historical Materialist Interpretation, Navarro, V (ed.) Crisis, Health and Medicine - A Social Critique, Tavistock Publications, New York, United States of America, pp.128

to die of lung cancer, 7-10% of mesothelioma, cancer of the lining of the lung and another 8-9% were expected to die of gastro intestinal cancer.

## CONCLUSIONS

### Work Process and Ill Health

The nature of health and ill-health in capitalists societies like the U.K. and the U.S.A. is determined, in the ultimate analysis, by the manner in which the system of production and the work process is organised. The work process under capitalism is characterised by ever-increasing specialisation, which results in fragmentation of work, compartmentalization of worker to one specific task, de-skilling, hierarchicalization of workers and complete loss of control of the workers over their work process. This loss of control entails the crucial decisions regarding production of commodities- where to work, when to work and how to work- passing over from the worker to the capitalist.[107] Large-scale machinery has helped the capitalist in this process and the capitalist has become the master of the entire production process while the worker is reduced to being a mere 'factor of production'. As a result, the work has lost all it's intrinsic enjoyment for the worker and become a repetitive and monotonous activity. The reorganisation of work according to Fordist production lines and principles of scientific management propounded by Taylor[108] has aggaravated the loss of control the worker suffered as a wage earner in the factory. The introduction of newer and more complex technologies like those of automated production systems and creation of new industries like rubber, chemicals, plastics etc. have further alienated the worker from the knowledge and decision making processes concerning choice of commodities to be produced, choice of technology and the process of production. These changes in the production process have led to the expropriation of the health of workers making them vulnerable to repetitive strain injuries, poisoning from toxins, chronic diseases like cancer, problems of stress and mental disturbances, cardiovascular diseases etc.

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[107] Ibid, pp.119

[108] Braverman, op.cit. pp.81&pp.147

Work in a capitalist society is presented as a rational and natural outcome of unavoidable and unchangeable industrialisation and technological advancement and health problems are seen as a natural part of the wear and tear of work. The type of work done is not seen as a result of specific power relations that exist in society. [109] Massive propaganda ensures that the capitalists' interpretation of health and disease becomes the dominant and thus the 'popular' understanding in the society. Biomedicine has also been instrumental in obscuring the role that social relations of production and the loss of control over work have played in the expropriation of health.

The Role of Biomedicine

The paradigm of biomedicine in capitalism has served the purpose of obscuring the social, political and economic co-ordinates that underpin health and illness in human society. This is partly due to its epistemological moorings in the Germ Theory; which defines disease as a state that could be attributed to identifiable, isolable, specific causative agents in the environment or within the body, the effects of which are manifested as symptoms in specific body parts of the affected individual. The Cartesian notion of the body within this paradigm brings in an engineering approach to the process of curing, which then reduces it to mere repairing of separate body parts. The authority of prescribing the curative solutions to the ill health of the individual is vested in the medical practitioner.

Thus medicine has played a role in masking of the power relations that underlie health and illness. The 'scientific' status of modern medicine with proclaimed attributes of objectivity and neutrality bestows upon it a sanctity, which is used to veil the exploitative relations that exist at the work place and outside. It has consequently been effectively co-opted by the industrial establishment to suit its agenda of defining ill health caused due to work processes as a consequence of hazardous exposures to varying doses of toxins or as a result of faulty lifestyles and behaviours that the workers indulge in as a matter of individual choice. Thus medical practitioner and scientists have been handpicked, supported and sponsored by grants and scholarships,

[109] Navarro, (1986), op. cit. pp.150

to create a body of knowledge that safeguards its interests in making profits as was seen in the case of the asbestos industry, or in the role of the Compensation Safety Apparatus in setting up and controlling the institution of industrial medicine.

State Intervention in Capitalism

The patterns of State intervention that are discernible from the descriptions in this chapter show that the capitalist State has hardly intervened in the area of workers' health as a proactive agent. It has intervened only when the discontent arising out of disease and suffering could no longer be wished away or contained, as in the case of the passage of the OSHA. Or when the ill health of workers affected their productivity and entailed losses greater than the cost of controlling disease, to the State or the capitalist class as a whole, as in the case of Sanitary Reform Measures in England during the Industrial Revolution. The other occasion of state intervention was observed when concerns of 'national interest' demanded suspension of clash between the working class and the capitalists, as was seen in the times of the World Wars and the Depression in the U.S.A.

The timing, nature and specific focus of state intervention in both the U.K. as well as the U.S.A. show that the State in a capitalist society plays the role of facilitating unhindered capitalist accumulation and provides legitimacy to the system by mediating among the interests of different sections of the society, in order to maintain peace and harmony for the survival of the system.[110] Welfare interventions by the capitalist State are on the outset fraught with these contradictions. They perform the function of creating effective demand to accelerate capitalist growth and also, managing discontent among the working class. This is amply clear from the nature and pattern of intervention by the State in both England and the United States.

[110] Narayana, K.V. (October 19th, 1991) Political Economy of State Intervention in Health Care, Economic and Political Weekly, Vol.26, No.42.

# CHAPTER- TWO

# THE PROCESS OF INDUSTRIALISATION AND THE EVOLUTION OF HEALTH SERVICES AND LEGISLATION FOR WORKERS IN INDIA

## INTRODUCTION

In this chapter I shall primarily argue that the dissatisfactory state of affairs regarding workers' health in India can be attributed in a large measure to the dual character of the Indian State; wherein, on the one hand, it conceived and attempted to achieve the goals of equality and social justice worthy of a welfare state it proclaimed itself to be after the Independence and on the other hand its agenda was heavily influenced and tempered by the powerful class interests of the bourgeoisie. Thus the emergent pattern of the development of health services, medical education, research and legislation for protection of workers health, evidenced a major disjunction in terms of both, the gaps between the rhetoric and the design of the policy, as well as, the stated intent in policy and actual achievements at the level of implementation. If anything, the state's intervention in these areas particularly it's policies and legislation regarding industrial development and labour welfare have pushed for the institutionalisation of the already segmented labour force, rendering a section of the working population especially vulnerable to the vagaries of the market. The policies of liberalisation, privatisation and globalisation that have been pursued by the State over the last one decade have only served to exacerbate the already deplorable conditions of work and life of workers. The emphasis on cuts in social expenditure by the State, greater informalisation of work, advocacy of hire and fire policies and 'jobless growth' have had deleterious effects on the lives of working populations resulting in their further immiserisation, greater vulnerability and reduced bargaining capacities to pressurise for an improvement in conditions of work.

In this chapter I shall focus on the role of the State in planning for industrial development, health services and regulatory legislation for the industrial worker in the manufacturing sector. I will also examine the living and working conditions of the

workers in the manufacturing industries. The chapter will be divided into the following parts:

- Industrial Policy, Employment Trends and Growth in the Manufacturing Sector in India
- Legislative Provisions for Regulation of Working Conditions
- Living and Working Conditions of the Workers in the Industrial Sector- Manufacturing Industries
- The Place of Workers' Health in Health Planning by the State

## INDUSTRIAL POLICY, EMPLOYMENT TRENDS AND GROWTH IN THE MANUFACTURING SECTOR IN INDIA

The modern industry in India began around the middle of the nineteenth century. The imperatives of colonial exploitative regime- requiring penetration of hinterland to extract raw materials as well as supply finished goods- compelled the British to lay an advanced transport system with highways and railways and invest in some basic industries like coal and iron ore.[1]

By 1880 there were three important industries in India, namely- cotton, jute and coal. Aditya and Mridula Mukherjee[2] observe that during the inter-war period, many consumer goods industries and intermediate and capital goods industries like, (textiles, sugar, matches, paper, cement, iron and steel) were set up by Indian industrialists. Qadeer and Roy[3] note that during this period an 'unregulated' sector, mainly consisting of traditional activities in beedi, shellac, carpet, wool, mica and match was also being pulled into the market economy. Apart from this, a large number of small industries were being set up in

[1] Qadeer, I. & Roy, D. (1989) Work, Wealth and Health- Sociology of Workers' Health In India, Social Scientist, Vol.17, No.5-6, pp.45-92

[2] Mukherjee, A. & Mukherjee, M. (1990) Imperialism and the Growth of Indian Capitalism in the 20th Century in Shah, G. (ed.) Capitalist Development- Critical Essays, Felicitation Volume in Honour of Prof.A.R.Desai, Centre for Social Studies (Surat), Bombay Popular Prakashan Private Ltd., Bombay, India, pp.77-114.

[3] Qadeer and Roy, op.cit.pp.50

areas like match, tanneries, paper, pottery, cement, beverages, sugar, dyes, cement and machinery.

Despite impressive growth and expansion during the period between the two World Wars, at the time of her independence in 1947, India still had a very small secondary sector and remained predominantly an agricultural country. The share of the labour force in the manufacturing sector was 8.7% of the total labour force while that of the modern factory sector was not even 2%.[4] Moreover, the production as well as the productive capacity of industries manufacturing 'intermediate products' like coal, cement, steel, power, alcohol, non-ferrous metals, chemicals etc. was considerably below the requirements (except cement). And as far as the capital goods sector is concerned, only a small beginning had been made.[5]

## POST-INDEPENDENCE INDUSTRIAL POLICY AND GROWTH OF MANUFACTURING INDUSTRY

Rapid industrialisation was one of the topmost priorities of the government that inherited the Indian state from the British. There was a broad consensus within the ruling establishment, and indeed beyond, that without sufficiently rapid and comprehensive industrialisation, the goals of economic growth and self-reliance, poverty removal, economic advancement and creation of a modern nation would remain elusive.

The lack of heavy and capital goods industries and basic infrastructure, the weakness of private capital with regard to establishing these industries, which require huge initial investment and have a long gestation period, coupled with the socialist moorings of the dominant section of the political establishment led by Nehru paved the way for a pattern of industrialisation which was to be planned, governed and directly led- through positioning of the public sector on the 'commanding heights' of the economy- by the State. The capitalist class largely approved this pattern of industrialisation. In fact, the recognition of the pivotal role of the state in the industrial development of an underdeveloped country like India was originally propounded in 1944, in the Bombay

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[4] Krishnamurthy, J. (1982) quoted in Chattopadhyay, P (1991) India's Capitalist Industrialisation: An Introductory Outline in Berberoglu,B. (ed.) Class, State and Development In India, Sage Publications, New Delhi, pp.141-156

[5] Mishra and Puri (1998) Problems of Indian Economy, Himalaya Publishing House, Mumbai, pp.276

Plan, formulated by eight of the top industrialists in the country. It is apparent that there was a wide-ranging consensus on the path of industrial development chosen by the state. Thus, in December 1947 the government called an Industries Conference, which was attended by representatives of central and provincial governments, industrialists and labour. The conference, other than recommending division of industries into public and private sectors, adopted a tripartite agreement, which provided for three-year industrial truce between the management and labourers.[6]

The Industries Conference 1947 was followed by the Industrial Policy Resolution (IPR) of 1948. IPR 1948 laid stress on the importance of public sector as being pivotal to the industrial development of the country and industrial peace as being the key to realise the goal of increased industrial efficiency and productivity. IPR 1948[7] declared, "The state must play a progressively active role in the development of industries." The first five-year plan document also averred that "it is best for the public sector to develop those industries in which the private enterprise is unable or unwilling to put resources required to run the risk involved, leaving the rest of the field open for private enterprise." declared, "The state must play a progressively active role in the development of industries." The first five-year plan document also averred that "it is best for the public sector to develop those industries in which the private enterprise is unable or unwilling to put resources required to run the risk involved, leaving the rest of the field open for private enterprise." The National Commission on Labour[8] delineates the main postulates of the labour policy between 1948 and 1968. The labour policy during this period justified peaceful direct action of workers if justice was denied, intervention by the State on behalf of the weak party and encouragement of mutual settlement of disputes along with collective bargaining.

However, it was the Industrial Policy Resolution, 1956, which provided the basic operative framework for the future industrial growth in India. It stressed the need to accelerate the speed of industrialisation with public investment to achieve the goal of

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[6] Ibid, pp. 276

[7] National Industrial Policy (1985), Lok Sabha Secretariat, GoI Press, New Delhi, pp.2

[8] The Report of the National Commission on Labour (1969), GoI, MoL,E &Rehabn, pp.11-12.

socialist, equitable development to overcome poverty. This was to be brought about by a planned focus on the development of heavy industries, expansion of the public sector and the growth of the co-operative sector. IPR 1956[9] divided industries into three categories:

(a) State Monopoly- In the first category, those industries were included whose future development would be the exclusive responsibility of the state. Seventeen industries were included in this category. These can be grouped into five classes: (i) defence industries (ii) heavy industries (iii) minerals (iv) transport and communications, and (v) power. Out of these, four industries – arms and ammunition, atomic energy, railways and air transport, were to be government monopolies. In the remaining 13 industries, all new industries were to be established by the State. However, existing units in the private sector were allowed to subsist and expand.

(b) Mixed Sector of Public and Private Enterprise – 12 industries were included in this section: all other minerals (except minor minerals), road transport, sea transport, machine tools, ferro-alloys and tool steels, basic and intermediate products required by chemical industries such as manufacture of drugs, dyestuffs and plastics, antibiotics and other essential drugs, fertilisers, synthetic rubber, chemical pulp, carbonisation of coal, and aluminium and other non-ferrous metals not included in the first category.

(c) Private Sector – All industries other than those listed in category A and category B.

In consonance with the objectives spelt out in the IPR 1956, the Second Five Year Plan gave topmost priority to the public investment led heavy industry based path of industrialisation. It was based on Mahalanobis model, which advocated the establishment of basic and capital goods industries on a large scale so that a strong base for industrial development in the future could be built. The strategy was spelt out in the Plan in the following words: "If industrialisation is to be rapid enough, the country must aim at developing basic industries and industries which make machines to make the machines needed for further development."[10] The Third, Fourth and Fifth Five Year Plans

[9] Mishra and Puri, op. cit., pp.296

[10] Ibid, pp.277

continued with almost the same pattern of investment with emphasis on building heavy industries like iron and steel, heavy engineering, and machine building industries.[11]

Within this overall scheme of industrial development, the Mahalnobis Committee also called for initiation of steps for the dispersal of industry through promotion and encouragement of small-scale (SSI) and cottage industries. Small-scale industries, requiring less capital and technological sophistication were seen to have a tremendous employment potential in a capital scarce and labour abundant country like India. The basis for identifying small-scale industries came from the Industries (Development and Regulation) Act, 1951 which exempted units employing less than 50 workers *with* power and less than 100 workers *without* power from registration. This exempted sector came to be known as the small-scale sector. Another criterion adopted for defining a SSI is the amount of fixed capital investment in a unit. Prior to 1975 the investment limit for a SSI was Rs. 7.5 lakh and in the case of an ancillary unit Rs. 10 lakh (This limit has been raised upwards from time to time. In addition, a tiny sector was also announced in 1991. In February 1997, the investment limit was Rs. 3 crore for a SSI and Rs. 25 lakh for a tiny industry. Recently, the investment limit for SSIs was hiked to Rs. 10 crore).[12] These industries were given the benefits of reserved product lines, easy access to institutional loans, differential taxation, subsidies and restriction on volume and items of production by the large sector.

Mishra and Puri[13] point out that the category 'small-scale and village industries' includes myriad types of units, from the age-old household industries to modern mechanised small-scale units. Some of the most important types industries in this category are: modern techniques based small enterprises, artisans' workshops engaged in activities, such as repairing of various implements, machinery and vehicles etc., handicrafts producing goods of high-skill workmanship like wood and ivory carving, carpet making, metal works etc. and village and household industries producing common consumer goods such as pottery, leather products, hand-woven textiles, silk materials etc. by hand or using simple tools.

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[11] Ibid, pp.279

[12] Ibid, pp.328

[13] Ibid, pp.329

In a review of industrial development over the thirty years of planning, the Sixth Plan noted that industrial production had increased by about five times during this period. More important than this quantitative increase in output was the fact that the industrial structure had been widely diversified covering broadly the entire range of consumer, intermediate and capital goods.

The National Commission on Labour[14] observes that post-independence Indian industry underwent significant diversification. Industrial activity engaged not only in the production of traditional commodities like cotton, jute, tea etc. but also into fertilisers, heavy chemicals, electrical and electronic equipment, machine-tools, plastics, transport equipment, aircrafts, automobile parts etc. There was also a shift from consumer non-durable manufacture to production of consumer durables. Chattopadhyaya makes a similar observation and adds that this was coupled with an increased industrial output of over six and half times between 1951-1985.[15]

Employment also increased from 2.9 million in 1951 to 6.2 million in 1985 in registered factories.[16] But the Economic Survey of 1987-88 showed that the share of the workforce in the industry was slightly above one-fifth of the total labour force and within the manufacturing sector factory employment accounted for less than one-fourth of the total employment in 1984-85. The workers in the manufacturing sector constitute 30% of all wage earners in India. Wage earners as a whole numbered 55 million with those in the manufacturing sector numbering 12.4 million in 1981 and 17 million in 1989.

While there was growth in industrial output and employment in the three decades of planned development, it did not result in improved working and living conditions for the vast majority of the working population. Even the National Commission on Labour had to admit that while the money earnings of the workers had gone up, that hadn't necessarily meant a rise in the standard of living.[17] As we shall see in the following section, one of the reasons for this is the divergence between the industrial policy of the

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[14] Report of the National Commission On Labour, 1969, op.cit., pp.11-12

[15] Chattopadhyaya, op.cit, pp.142

[16] Ibid, pp.142

[17] Report of the National Commission On Labour, 1969, op.cit., pp.31

State and the legislation promulgated to protect the interests of the workers. The State took upon itself the responsibility of creating basic industries only, which by nature are capital intensive and require less number of workers. The task of creating employment was left to the private sector, especially the small-scale sector. But the very design of the protective legislation for workers in India is such that only a miniscule percentage of the working population comes under its ambit. Much of the small-scale industry is outside the purview of the legislation and consequently, the workers employed in them have no protection whatsoever from the law which has resulted in the segmentation of the working population in India. There has been no attempt by the State to redesign the legislation in such a fashion that all the workers working in manufacturing industry can have access to the protection it offers.

The basic framework of IPR 1956 remained more or less intact till the mid 80's, with only minor changes being proposed in the Industrial Policy Statement (IPS), 1973, IPS, 1977 and IPS, 1980. However, it is significant that these changes were in the direction of opening up new vistas for the private sector to expand its activities.[18]

The 80's witnessed the beginning of the process of neo-liberal reforms in the Indian industry. The thrust of the reform measures in the 80s was towards making the domestic industry internationally more competitive. As Chandrashekhar[19] notes, "During the 1980s, reform was slow and was focussed on dismantling internal controls and increasing the flexibility of domestic capital." However, with the announcement of the New Economic Policy (NEP) 1991, a whole new paradigm was introduced in the economic policy framework in general and industrial policy in particular. The central goal of the liberalisation programme, introduced in the NEP, was to facilitate private investment, both domestic as well as foreign, in the Indian industry. It was argued that to take the Indian industry to a whole new growth trajectory, private investment needs to be stimulated on a massive scale through proper incentives and a conducive atmosphere[20]. The set of measures aimed at creating a conducive atmosphere for private investment

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[18] Mishra and Puri, op. cit., pp. 299

[19] Chandrashekhar, C.P. (21st-23rd 2001) Neo-liberal Reform and India's Industrial Performance during the 1990s Paper presented at 'People's Convention Against Globalisation', New Delhi.

[20] Ibid.

include, among other things, dismantling and privatisation of the public sector, commercialisation and privatisation of the social sectors like health, education, water supply, sanitation, electricity and social security, extending the scope of the right to hire and fire and legalising and extending the practice of contract and casual labour.[21]

## STRUCTURE OF EMPLOYMENT AND TRENDS IN EMPLOYMENT GROWTH IN THE 1990S

The need for a comprehensive health security system for the working people in India stems from the composition of the labour force, which consists of a mere 7% of organised labour, according to the National Planning Commission, 1990. The Alternative Economic Survey[22] points to the falling rate of growth of employment in the organised sector in the decade of the 1990s. The manufacturing sector especially shows a falling rate of growth in organised sector employment. The Planning Commission states that the employment growth in this sector shows a deceleration from 2.42% in 1973-77 to .06% in 1983-88. In the regime of the New Economic Policy, the growth rate of employment in general and organised sector employment in particular is on a steady decline and casualisation is on rise, making the working population more vulnerable and affecting, negatively, the quality of the employment. 29.4 percent of the workforce in non-agricultural enterprises is in manufacturing sector. Employment in industry (factory sector) was 99.26 lakhs in 1997-98 compared to 81.26 lakhs in 1990-91- an average growth rate of 2.5 percent per annum[23] The growth rate in the organised sector was even worse- growing at the rate of a little over 0.5 percent per annum between 1991-1999. For each unit of investment industry now employs only 20 percent of what it used to earlier.[24]

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[21] Kabra, Kamal Nayan (2001) Second Generation 'Reforms' towards Crony, Casino, Corrupt and Comprador Capitalism, Alternative Economic Survey, 2000-2001, Rainbow publishers Ltd., New Delhi, pp. 11

[22] Chaubey, P.K. (2000-2001) Alternative Economic Survey, Alternative Survey Group, Rainbow Publishers Ltd., New Delhi, pp. 35-42.

[23] Kumar, T.R.(2001) Industrial Policy and Growth, Alternative Economic Survey, Rainbow Publishers Ltd., New Delhi. pp. 79

[24] Kumar, Arun (2001) The Macro View, Alternative Economic Survey, Rainbow Publishers Ltd., New Delhi. pp. 21

In fact the only sector of the industry, which has shown significant growth rates in employment in the 90s is the small-scale enterprises sector. The number of SSI units has increased from 2.72 million in 1995 to 3.33-3.36 million in 2000-2001. The workforce employed in these units has also increased from 15.26 million in 1995-96 to 18.38-18.56 million in 2000-2001 - an average increase of about 4.5 percent per annum[25].

In his analysis of NSS and Census data on employment, Kundu[26] analyses the work participation rates and concludes that there has been a slower growth in jobs available on a regular basis in the organised sector. There has been a simultaneous increase in the part-time or casual work in the informal sector. This is evidenced by the fall in work participation rates by usual status and a rise in work participation rates by current status. He argues that much of the employment is taking place through sub-contracting using self-employed or casual workers. Kundu also noted that most of the industries are coming up in the peri-urban or rural areas surrounding big cities. The reasons being the ready availability of land, easy access to unorganised labour market, less awareness and less stringent environmental protection regulations in these areas. The poor are either dislocated from the precincts of the main city and given habitation or forced to settle in these peripheral areas out of little other choice and are recruited in these factories.

In the following section I shall analyse protective legislation for regulating conditions of employment of labour in India and the implications of the same.

## WORKERS' HEALTH-LEGISLATIVE PROVISIONS FOR REGULATING WORKING CONDITIONS

### Workers' Health- Constitutional Provisions and ILO Conventions

The Constitution of India provides guidance for legislative and executive action. The Fundamental Rights that it provides to the citizens of India and the Directive Principles of State Policy give guidelines for safeguarding the worker. Article 24 of the Constitution

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[25] Das, Keshab (2001) Small Enterprises and Trade Policy, Alternative Economic Survey, Rainbow Publishers Ltd., New Delhi. pp. 82

[26] Kundu, A. (June 14th, 1997) Trends and Structure of Employment in the 1990s- Implications for Urban Growth, Economic and Political Weekly, Sameeksha Trust, Mumbai, pp.1399-1405.

prohibits employment of child below 14 years for work in any factory or mine or in any hazardous employment.[27] Article 39 requires the State to direct its policy to ensure that the health and strength of workers, men and women, and the tender age of children are not abused and that citizens are not forced by economic necessity to enter avocations unsuited to their age or strength. Article 42 directs the State to make provision for securing just and humane conditions of work and maternity relief. Thus under the Constitution, it is imperative that measures should be taken to ensure that all the workers irrespective of their place of employment are assured of Occupational Safety and Health. The Government of India has so far ratified[28] 39 ILO conventions for safeguarding the health of the worker, encompassing subjects such as worker's fundamental rights, worker's protection, social security, labour welfare, occupational safety and health, women and child labour, migrant labour, indigenous and tribal population. In the field of occupational safety, health and working environment, ILO has framed 13 conventions and an equal number of recommendations so far. Out of these, the Government of India has ratified 2 conventions namely Radiation Protection Convention (No.115), 1960 and Benzene Convention (No.136), 1971. Some of the recent conventions and recommendations have a strong bearing on emerging occupational health and safety laws in the country.

Convention 155 requires every member-State to formulate, implement and periodically review a coherent National Policy in consultation with representatives of employers and workers. The policy should aim at prevention of accidents and injury at work places by minimizing the causes of hazards inherent in working environment. The convention also identifies action at National and unit levels in relation to appropriate control measures against exposure to harmful substances, provision of measures to deal with emergencies, seek co-operation and inform the workers on matters connected with safety and health.

Convention 161 encompasses occupational health services. This convention requires that a National policy be framed on Occupational Health Services with particular reference to prevention of occupational diseases and health surveillance. The policy is to be finalized

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[27] Report of the Working Group on Occupational Safety and Health for the Tenth Five-Year Plan (2002-2007), Planning Commission, GoI (September 2001), pp. 10

[28] Ibid. pp.11

by a tripartite consensus involving entrepreneurs, workers and the government. These services should have functions such as identification and assessment of the risk for the health hazards in the work places and of the monitoring of health of workers. The provisions require that workmen be provided with information, education, training on the relevant aspects of the work and advised on first aid treatment and health programmes.

Convention 174 and recommendations 181, defines "hazardous substance", "threshold quantity" "major hazard installation", "major accident", "safety report", "near miss". The convention requires that a national policy against the risk of major accidents be framed after consulting the employers and workers, implemented and periodically reviewed which should promote the use of the best available safety technologies. The competent authority shall establish a system for the identification of the major hazard installations depending on the types of substances. The employers are required to establish a well documented system for identification and analysis of hazards, technical measures, organizational measures, emergency plans, measures to limit the consequences of a major accident and lessons to be learnt after discussions with the workers' representatives.

Convention 176 projects a new philosophy of prevention. The convention through stronger union of workers' representatives adopts a refreshing new approach to health & safety, which firmly places responsibility on employers. The employers should control the risk at source or minimize it by designing a safe system of work. The convention gives workers several important rights, to report accidents, dangerous occurrences and hazards to employer and inspectorate, to ask for inspection & investigation by the employer and inspectorate, to get information about the hazards they face, to obtain relevant information from their employer and the inspectorate, to refuse dangerous work and to elect safety representatives.

**Legislation for Safeguarding Health of Industrial Workers**

In India the earliest legislation for regulation of conditions of labour were introduced by the British in the form of the Factories Act that was first introduced in 1881and amended several times later on and then the Workmen's Compensation Act in 1923[29]. Much of the labour policy in the pre-independence period was influenced by the needs of the colonial

[29] Report of the Royal Commission on Labour in India, GoI, Central Publication Branch, Calcutta, 1931

economy. It was shaped by necessities such as creation of a labour force committed to industry, to stem competition that the Indian industry began to pose for the British due to the advantage of low cost that unregulated labour afforded it and to cater to Britain's war time needs of unhindered supply of commodities[30].

According to D'Souza, post-independence industrialisation in the country had to be labour intensive hence regulations were required to preserve the limited skilled labour force that was available. But the plentiful availability of unskilled labour led to their being left to the vagaries of the market forces. D'Souza sees the basic structure of labour law in the country as one, which tries to create legal relationships between the employer and the employee and create a dominant status of the skilled labour force and neglect the unskilled labour to create a fragmentation in labour markets.

Protective legislation for labour is neither uniform for all sections of labour nor does it apply to the same extent in all the circumstances of employment. An examination of the laws pertaining to the manufacturing sector reveals that every sector of labour is governed by a different set of laws, which lays down varying sets of standards for the protection and welfare of different sections of the labour force. These regulations are very basic specifications regulating the circumstances of work and collective bargaining rights. Within this, the law makes numerous exemptions and creates space for the promulgation of special laws for certain other sections of labour. Thus there is a resultant segmentation of the labour force. The legal basis of such segmentation is founded on various tests or criteria.[31] These could pertain to the number of workers employed at the establishment, the activity carried out by the concerned unit, the agency of recruitment, region where the act would be applicable and the workers within a certain wage limit who would be able to access the protection and privileges that the legislation would provide.

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[30] D'Souza, (1995)op.cit., pp.10

[31] D'Souza R. (1994) Informalisation of Work and the Legal Process in Davala, S. (ed.) Unprotected Labour In India- Issues and Concerns, Friedrich Stiftung, New Delhi, pp.142

The terms 'organised' and 'unorganised' may refer to industrial units that come under the purview of the Factories Act and may also refer to workers who are covered by protective legislation and enjoy the earlier mentioned privileges. By virtue of legislation and definition of establishments that fall within or without the purview of the laws regulating the industry the existent units maybe categorised as part of the organised sector or the unorganised sector. The organised sector firms refer to those with 10 or more workers operating the unit with power or 20 or more carrying out production activity without power[32]. These factories should be registered and inspected under the Factories Act. The provisions of the Act, may however, be extended to factories employing less workers by a State Government by issuing Notification under Section 85[33] of the Act. So far, this power has been used to cover power looms, saw mills, rice mills, oil mills, flour mills, chemical units, pesticides formulating units, printing presses etc. under the provisions of the Act by different States[34].

The Factories Act is enforced by the Inspectorates of Factories under the State Governments and the administration of Union Territories, who also have the power to make statutory rules to supplement the provisions of the Act. The Ministry of Labour in the Central Government is accountable for enforcement of the Act and ensuring uniformity of application. It also ensures coordination of the activities of the Factory Inspectorates through a technical organization under its control known as Directorate General Factory Advice Service and Labour Institutes (DGFASLI).

Similarly a worker may belong to the organised sector if he is not temporary/ casual or contract labour. A temporary worker is entitled to a permanent status after 240 days of continuous work and will then be able to enjoy the earlier mentioned privileges if he is part of an organised sector establishment. Workers employed in the same job may have different statuses in terms of differential wages. They may not be allowed to join unions or form them and will not be able to secure the ESI or PF and may not be entitled to other benefits like annual leave[35].

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[32] Davala, S (1994) Labour in the Unorgansied Sector: Issues and Concerns in Davala, S. (ed.) Unprotected Labour In India- Issues and Concerns, Friedrich Ebert Stiftung, New Delhi, pp.1

[33] Report of the Working Group on Occupational Safety and Health, 2001, op.cit.pp.20

[34] D'Souza, R. (1994) op.cit. pp. 141

[35] Ibid, pp.141

Mark Holmstrom[36] has studied the relations between the organised and the unorganised sectors. His work focused mainly on the boundary between the two in the manufacturing industries involved in the production of chemical, engineering, metal work, plastic and electronics. He defines the unorganised sector as a residual category comprising of everyone except the permanent organized sector workers. There is further a shadowy boundary between the workers in the unorganised sector in the manufacturing employment, and the vaster army of small peasants and labourers in the country and. the casual construction workers. There is a difficulty in studying the workers in the unorganised sector due to the immense diversity that exists among them; the workers in the modern organised sector are more or less similar. Also the latter are also conveniently available in collectives in a common or fixed place unlike the former.

Holmstrom in his work notes that the division of the work force into these two sectors became sharper after independence and has been particularly pronounced after 1960, after the policy for the development of the Small Scale industry was announced. This is when the unorganised sector emerged as a distinct part of the manufacturing industry and a separate class of casual or temporary labour was also seen emerging in the organized sector firms. These changes were affected by factors like technological changes, labour legislation, union pressures and changing assumptions and perceptions of work,[37] juxtaposed on a country that still had remnants of colonial conditions.

The encouragement of the small sector by the government has contributed to this segmentation in no small measure. Small-scale industries are those below a certain investment limit, (Rs.10 crore at present). They are entitled to certain benefits like reserved product lines and easy loans. Many small sector industries are part of the organised sector. There is a large grey area of firms that should actually be organised but are not due to the lacunae that this provision for the small sector creates. Small firms could be owned by individuals with multiple interests who switch their capital from one

[36] Holmstrom, M (1986) Introduction, in Industry and Inequality- The Social Anthropology of Indian Labour, Cambridge University Press in association with Orient Longman, London and Bombay, pp1-25.

area to another. Or small firms may be owned by very big companies.[38] Myriad ways of evasion of laws by the employers have put workers out of the ambit of protective legislation. These include constantly laying off workers before their stipulated 240 days of work are over and then reappointing them. The private sector has tried to gain maximum benefit out of the legislation by putting out more and more work to workers in the small firms and turning them into contractors, making fictitious divisions in the companies. Also, there are reserve armies of temporary and casual workers in middle and large firms in the organised sector. There are several legal and fiscal thresholds, which obscure the differences between the organised and the unorganised workers. This kind of exclusion has resulted in the segmentation of labour in the country[39].

In her analysis of the legislation instituted for the protection of workers' health in India, Radha D'Souza[40] examines the conceptual and administrative limitations of the various acts. Namely the Workmen's Compensation Act, the Factories Act and the Employers' State Insurance Act. All the acts are seen to be falling short of the ILO Conventions by excluding vast sections of employed persons either by pegging benefits like compensation or treatment (in the case of ESI) to wage limits or specific scheduled manufacturing activities covered by the acts. For example the WC Act covers only those workers who earn Rs.1000 or less, but also fall within the definition of the workman, resulting in the exclusion of casual workers, white-collar workers and clerical employees. This exclusion of casual workers in effect encourages the informalisation of work thus reinforcing the vicious cycle of informalised work and denied compensation[41]. The act also covers just a narrow database of industries, as they existed in 1923.

The ESI act on the other hand is applicable only to factories as defined under the Factories Act of 1948. The establishment must be engaged in a manufacturing process, should not be a seasonal establishment, should engage 10 or more workers with power

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[38] Holmstrom, M (1986) Industrial Labour in India in Industry and Inequality- The Social Anthropology of Indian Labour, Cambridge University Press in association with Orient Longman, London and Bombay, pp.26-75.

[39] Singh, op.cit.pp.14

[40] D'Souza, R. (1995) Occupational Health and Safety Legislation in India, FIL Working Papers, No.9, University of Oslo, Norway, pp13.

[41] Ibid.pp.18

and twenty or more without power and the workmen claiming compensation have to be engaged in the manufacturing process, excluding workers in the small sector and workers earning over and above the wage limit of Rs.6500 per month. This narrow definition of the Factories Act has augmented the segmentation of the labour force legally exempting those units outside its definition from any kind of safety standards, inspections or minimal working conditions. Hence the most vulnerable of workers labouring under sweatshop conditions get excluded. Such workers can litigate only under the Indian Employers' Liability Act 1938 or Fatal Accidents Act, 1855 both of which are archaic and provide little in the form of protection to the worker. The ESI act may cover contract workers only if the establishment of the contractor employing them falls under the preconditions laid by the act. They may not claim compensation from the principal employer, in the event of an accident or injury.

At the conceptual level the WC Act does not define an accident or injury. Its provisions are based on disablement and loss of earning capacity. The employer is also not liable to pay compensation if the worker was under the influence of alcohol at the time of the accident, or the worker disobeyed instructions. They are no statutory provisions under the acts to make it mandatory for the workers to be trained to operate and use safety devices. Injuries listed under the act pertain to the industrial activities of textiles and engineering that existed in the 1920s. They have little to do with the injuries caused in the new technologies and industries that grew post-independence like the chemical and microelectronics industry. Besides, the injury has to be proven as having occurred out of and in course of employment. The presence of this clause often proves to work in the defence of the employer. Thus for all practical purposes these workers are also left out of the ambit of the act.

The compensation paid to the worker is not based on actual losses he incurs. There are fixed estimates of loss of earning capacity and thus compensations paid are made on the basis of extent of physical disability, in the exclusion of any consideration regarding the kind of work that the worker was engaged in. For e.g., the loss of a limb may not entail loss of earning capacity for a supervisor but it would be detrimental to the survival of a worker who used to work on a scaffolding at heights in the industry.

Occupational disease has not been defined by the acts. There is a list of 34 occupational diseases but there are no standardised biomedical criteria for diagnosis and detection. Thus the detection of the diseases is dependent on the skills and biases of the concerned medical practitioner. The law prescribes that for a disease to be acknowledged as emanating from occupational causes, it should be directly attributable to work that the worker is engaged in and not to the general environment. This completely disregards the fact that occupational diseases are rather difficult to diagnose and the key to their detection lies in sustained, prolonged monitoring which can be made possible only through a health service system oriented towards registering occupational case histories, recruiting medical practitioners equipped with sufficient technical skills to diagnose work related diseases. In the absence of such a system the onus lies on the worker to prove that the disease he is suffering from is in fact occupational. The ESI or WC acts also do not acknowledge a loss of earning capacity accruing from occupational disease. Instead the workers' inability to work may be recorded as inefficiency and absenteeism until the disease manifests itself as an irreversible serious illness.

Other legislations applicable to factories:

- The Environment (Protection) Act, 1986
- The Water (Protection and Control Pollution) Act, 1974 and the Water (Prevention and Control of Pollution) Rules, 1995
- The Air (Prevention and Control of Pollution) Act, 1981 and the Air
- (Prevention and Control of Pollution) Rules, 1995.
- The Hazardous Wastes (Management and Handling) Rules, 1989.25
- The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
- The Explosives Act, 1884
- The Gas Cylinders Rules, 1981
- The Explosives Rules, 1983
- The Static and Mobile Pressure Vessels (Unfired), 1981
- The Insecticides Act, 1968
- The Indian Boilers Act, 1923

The Factories Act was amended in 1976 to make it mandatory for the factories employing more than 1000 workers to appoint qualified safety officers. But the framing of specific rules in this context was left to the states. However the duties of the safety officers in the industry are only advisory and not binding on the authority of the factory. The Factory Inspectorate has no role in enforcing periodical health examination of the workers. After the Bhopal Gas Tragedy, certain far-reaching amendments, pertaining to hazardous processes, health and safety in the chemical industry, were introduced in the Act in 1987. These included[42] constitution of a site

[42]Working Group on Occupational Health and Safety, op.cit. pp.21

appraisal committee, compulsory disclosure of information by the occupier, mandatory medical examination of workers exposed to hazardous processes, laying down of permissible limits of exposure to chemical substances, participation of workers in safety and health management and granting the workers the right to be forewarned about imminent dangers. However no responsibility for the same was entrusted with the employer[43]. The onus again lay with the workers or the inspectorate. The additions made to the Act aimed at emergencies and disaster management rather than long-term effects of chemical substances on the health of the workers. A list consisting of twenty-nine industries was included under the schedule of the Act. This amendment also entitled workers to the right to be informed about matters relating to their safety. The factory manager is bound by these provisions to notify any notifiable disease listed in the schedule consisting of 29 occupational[44] diseases. The list of occupational diseases in the various acts is not identical which, once again, creates confusion regarding the possibility of filing for compensation.

The WC Act creates a Compensation Commissioner to adjudicate disputes on the payment of compensation. But the act is fraught with problems like burden of proof, inspection and long drawn litigations, which result in the workers, more often than not, settling the disputes out of court. The Act also does not make any provisions for monitoring, surveillance, diagnosis, treatment or rehabilitation of affected workers. Nor does it provide for any legal aid to workers. Litigations are seen as the problems of individual workers, unlike many other issues that may be seen as issues of collective bargaining.

The procedure for making compensatory claims also varies from Act to Act[45]. Under the ESI the employees are responsible for notifying the employer about a claim, which is then to be recorded in an accident register. On the other hand, under the Factories Act the responsibility of notification to the inspectorate is vested in the employer. At the same

[43] D'Souza,( 1995), op.cit, pp.22

[44] Working Group on Occupational Health and Safety, op.cit. pp.21

[45] D'souza, 1995, op.cit.pp.13

time the employer is also responsible for notifying the corporation regarding the incidents of occupational illness and accidents in the unit. in case of occupational diseases the worker has to go through the convoluted process of getting a Special Medical Board set up to examine his case and compute loss of earning capacity, irrespective of whether the worker has been treated by the ESI hospital or other wise. There are no linkages between the ESIC and the Factories Inspectorate to conduct joint studies or surveys. The Factory Inspectorate is expected to carry out its responsibilities actively under conditions of inadequate staff for the purposes of inspection[46]. The Act also does not give workers the space to bring any charge, civil or criminal, against the employers for violation of statutory regulations. The ESI Act provides that a worker in receipt of disablement benefit for more than 6 months may be discharged by the employer. The same would be applicable in the case of a worker seeking treatment for any of the scheduled occupational diseases for a period over 18 months. The Model Standing Orders[47] applicable to workers also stipulate that a workman may be discharged for continuous ill health. Such provisions only serve to curb the initiative of workers to report such incidents for fear of loss of employment. The absence of provisions for vocational rehabilitation and health monitoring fall short of the standards set in the ILO Convention on Employment Injury Benefits, No.121, (1964).

Hence the legislation existent for the protection of labour is in many senses obsolete and in contravention to many other regulations controlling other aspects of health and employment. This provides ample space for evasion of laws on the part of the employer and for formalisation and institutionalisation of the vulnerable and unstable status of health, work and life of those employed in the lowest paid, most hazardous jobs.

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[46] Working Group on Occupational Health and Safety, op.cit. pp.76

[47] Model Standing Orders are framed under the Industrial Employment (Standing Orders) Act. They are minimum conditions for employment contracts prescribed under the Act. They maybe improved by the intervention of employers and unions but may not opt for anything less than the standing orders (D'Souza:1995).

## ENFORCEMENT AGENCIES – DGFASLI, CLI AND FACTORY INSPECTORATES

A paper by Stirling Smith[48] of the Labour and Society International, states that there is evidence of 100,00-150000 deaths annually in India due to workplace accidents and exposures. He also estimates that there are 2 million new cases of occupational disease every year. But the Ministry of Labour claims that there were only 1623 cases of death due to the same in 1993.

Table No.2.1 STATE WISE INDUSTRIAL INJURIES IN FACTORIES DURING 1994- 1998

| SN | STATES | 1994 | | 1995 | | 1996 | | 1997 | | 1998 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N.F | F | N.F | F | N.F | F | N.F | F | N.F | F |
| 1 | Andhra P. | 4388 | 100 | 9812 | 94 | 4252 | 134 | 4298 | 199 | 3649 | 104 |
| 2 | Assam | 353 | 6 | 278 | 13 | 206 | 1 | 165 | 8 | 100 | 5 |
| 3 | Bihar | 1160 | 44 | 1380 | 51 | 1287 | 56 | 873 | 32 | 1018 | 46 |
| 4 | Goa | 295 | 4 | 382 | 4 | 243 | 3 | 193 | 4 | 197 | 7 |
| 5 | Gujarat | 15489 | 195 | 10642 | 192 | 11615 | 200 | 11824 | 246 | 11611 | 214 |
| 6 | Haryana | 771 | 28 | 704 | 35 | 468 | 35 | 416 | 34 | 400 | 32 |
| 7 | Himachal Pradesh | 319 | 4 | 308 | 5 | 87 | 25 | 52 | 5 | 28 | 12 |
| 8 | Karnataka | 4283 | 23 | 4283 | 23 | 3552 | 49 | 3896 | 37 | 3644 | 68 |
| 9 | Kerala | 1805 | 10 | 1805 | 10 | 1773 | 23 | 1304 | 13 | 1356 | 37 |
| 8 | Madhya P | 9027 | 71 | 8416 | 83 | 9620 | 62 | 7543 | 69 | 7071 | 53 |
| 9 | Maharasht-ra | 24046 | 157 | 20629 | 195 | 17557 | 180 | 15120 | 198 | 16739 | 163 |
| 10 | Orissa | 3083 | 29 | 3249 | 42 | 2267 | 32 | 2067 | 41 | 1888 | 20 |
| 11 | Punjab | 788 | 24 | 517 | 34 | 468 | 35 | 416 | 34 | 308 | 28 |
| 12 | Rajasthan | 6190 | 40 | 2818 | 9458 | 1986 | 64 | 2698 | 68 | 2891 | 61 |
| 12 | Tamil Nadu | 9218 | 43 | 7014 | 37 | 7014 | 37 | 4063 | 49 | 3720 | 46 |
| 12 | Tripura | 5 | 0 | 1 | 0 | 2 | 0 | 3 | 0 | 3 | 0 |
| 14 | Chandigarh | 3 | 0 | 0 | 4 | 0 | 2 | 10 | 1 | 3 | 1 |
| 15 | Delhi | 561 | 9 | 495 | 13 | 306 | 18 | 102 | 12 | 183 | 91 |
| 16 | Pondichery | 1045 | 3 | 584 | 2 | 723 | 3 | 880 | 6 | 917 | 2 |
| | **Total** | 82856 | 790 | 73317 | 891 | 63430 | 969 | 55934 | 1055 | 55736 | 990 |

*Source: Health Information of India, (1997-98)*

[48] Smith, S (1999) Occupational Safety and Health India: An Attempt to Estimate the Real Number of Work Related Deaths, Centre for International Labour Studies, University of Manchester.

Table No. 2.2 DATA OF OCCUPATIONAL DISEASES IN SELECTED STATES

| S.NO. | STATE/UNION TERRITORY | OCCUPATIONAL DISEASES |
|---|---|---|
| 1. | Assam | Nil |
| 2. | Gujarat | 52 |
| 3. | Haryana | Nil |
| 4. | Himachal Pradesh | Nil |
| 5. | Madhya Pradesh | Nil |
| 6. | Orissa | 1888 |
| 7. | Punjab | Nil |
| 8. | Rajasthan | Nil |
| 9. | West Bengal | 23 |
| 10. | Chandigarh | Nil |
| 11. | Delhi | Nil |
| | **Total** | **1953** |

*Source: Health Information of India, (1997-98)*

The DGFASLI Organisation[49] has been providing technical support over the years in drafting of Central Rules/Model Rules, carrying out studies, surveys, safety audits and conducting training programmes, workshops and seminars in this sector for the past over three decades.

The National Safety Council[50], has been conducting training programmes (national and unit levels), safety audits, disseminating information, producing awareness material and organising campaigns for the construction industry for over a decade now. Besides, the DGFASLI, on behalf of the Ministry, carries out the important function of providing training to Factory Inspectors and coordinating their training outside the country. Training in safety and health for personnel from industries is carried out by the five Labour Institutes of the DGFASLI - The Central Labour Institute at Mumbai and Regional Labour Institutes at Kanpur, Kolkata and Chennai. These institutes employ professionals from various disciplines such as engineering, management, hygiene, occupational health, industrial physiology, ergonomics, industrial psychology etc. These institutes are also having facilities for conducting research and consultancy studies in various areas of safety and health.

[49] Working Group on Occupational Health and Safety, op.cit. pp.76

[50] Ibid, pp.77

The working group on Occupational Safety and Health of the Tenth Five Year Plan[51] states that the enforcement agencies like the Factory Inspectorate, the DG FASLI and the National Safety Council have not developed enforcement strategies through collective deliberations and analysis of the situations. Inspections have been generally left to the individual Inspectors without adequate guidelines. The report notes that if all the establishments, manufacturing and commercial, are brought under the coverage of the safety and health statutes, the annual routine inspection of these units with the available strength of inspectors of factories is not possible.

Table No.2.3 NO. OF REGISTERED FACTORIES AND NO. OF INSPECTIONS IN SELECTED STATES AND UNION TERRITORIES IN 1998

| S.NO. | STATES/UTS | NO. OF REGISTERED FACTORIES | NO. OF INSPECTIONS |
|---|---|---|---|
| 1. | Andhra Pradesh | 32081 | 10140 |
| 2. | Assam | 2209 | 1077 |
| 3. | Bihar | 61228 | 15521 |
| 4. | Goa | 527 | 227 |
| 5. | Gujarat | 25214 | 17222 |
| 6. | Karnataka | 6381 | 6381 |
| 7. | Kerala | 17124 | 14819 |
| 8. | Madhya Pradesh | 14718 | 9025 |
| 9. | Orissa | 2477 | 2227 |
| 10. | Punjab | 13549 | 8714 |
| 11. | Tamil Nadu | 26767 | 17388 |
| 12. | Tripura | 1298 | 675 |
| 13. | West Bengal | 11441 | 4427 |
| 14. | Chandigarh | 539 | 146 |
| 15. | Delhi | 6350 | 1037 |
| | **TOTAL:** | **224578** | **109026** |

*Source: Report of the Working Group on Occupational Safety and Health for the Tenth Five-Year Plan (2002-2007), Planning Commission, Government of India (September 2001), Annexure 8.*

[51] Working Group on Occupational Health and Safety, op.cit. pp.76

Table No.2.4 NO. OF FACTORY INSPECTORS AND CERTIFYING SURGEONS IN STATES AND UNION TERRITORIES IN 1998

| S.NO. | STATE/UNION TERRITORY | NO. OF FACTORY INSPECTORS | NO. OF CERTIFYING SURGEONS |
|---|---|---|---|
| 1. | Andhra Pradesh | 0 | Nil |
| 2. | Assam | 2 | 2 |
| 3. | Bihar | 1 | NA |
| 4. | Goa | 1 | Nil (1996) |
| 5. | Gujarat | 1 | NA |
| 6. | Haryana | 0 | 1 (1998) |
| 7. | Himachal Pradesh | 0 | 1 (1996) |
| 8. | Jammu & Kashmir | 0 | NA |
| 9. | Karnataka | 1 | NA |
| 10. | Kerala | 1 | NA |
| 11. | Madhya Pradesh | 1 | NA |
| 12. | Maharashtra | **3 | NA |
| 13. | Manipur | *- | NA |
| 14. | Meghalaya | *- | Nil (1999) |
| 15. | Orissa | 1 | 20 (2000) |
| 16. | Punjab | 3 | NA |
| 17. | Rajasthan | **1 | Nil (1996) |
| 18. | Tamil Nadu | - | 8 (1998) |
| 19. | Tripura | - | 8 (1996) |
| 20. | Uttar Pradesh | *2 | NA |
| 21. | West Bengal | 6 | NA |
| 22. | Andaman Nicobar Islands | *- | 4 (2000) |
| 23. | Chandigarh | - | NA |
| 24. | Dadra & Nagar Haveli | *- | NA |
| 25. | Delhi | **1 | 1 (1998) |
| 26. | Pondicherry | 1 | 1 (1998) |
| | **TOTAL:** | 27 | 46 |

*Source: Report of the Working Group on Occupational Safety and Health for the Tenth Five-Year Plan (2002-2007), Planning Commission, Government of India (September 2001), Annexure 8.*

*Figures pertaining to 1996

** Figures pertaining to 1997

## The Role of the Labour Movement

The labour movement in India has not been able to develop effective strategies for coping with the consequences arising out of the fragmentation of the labour force in India. Thus the labour movement, due to its inability to organise large sections of unprotected labour in India, has been unable to pressurise for policies and laws that would serve the purpose

of strengthening the collective bargaining capacity of the working class for better working conditions and greater control over the work process and their lives.

Qadeer and Roy[52] dwell upon the main aspects of the labour movement in India in its struggle for health. According to them the workers in India have suffered from the disadvantage of lower bargaining powers due to the slow expansion of industries, limited employment opportunities in the organised sector and the traditional basis of agriculture. The splits in the Left parties in the 60s also dealt a blow to the trade union movement in India. The relative power of the employers and their utilisation of social and economic divisions among the workers have led to the weeding out of unions with a working class ideology and have allowed the survival of those that act in their interests and thus maintain industrial peace. The trade union movements greatest weakness has been its inability to organise the workers in the small and informal sector, the most vulnerable populations who do not have any security of employment, are not covered by any protective legislation, do not get paid even the minimum wage and thus have practically no bargaining capacity to demand for better working conditions or protection.

By their own admission prominent trade union leaders like Bagaram Tupule[53] admit that there is pressing need for "active and effective linkages of trade unions with the unorganised sector without which trade unions do not have much future." This lack of unity he says has impinged on the ability of unions to strategically fight the emerging challenges.

## WORKING AND LIVING CONDITIONS OF WORKERS IN THE INDUSTRIAL SECTOR- MANUFACTURING INDUSTRIES

The Royal Commission on Labour was the first of its kind instituted by the colonial government to examine the working conditions and the nature of the modern factory sector in India.

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[52] Qadeer, I. & Roy, D. (May-June1989) Work, Wealth and Health- Sociology of Workers' Health in India, Social Scientist, Tulika Publications, New Delhi, Vol.17, No.5-6, pp.45-92

[53] John J.& Menon, S. (Jan-April 2000) Trade Unions should Build effective Linkages withy the Unorganised Sector, in Labour File- Labour'99 Centre for Education and Communication, New Delhi.

Despite an admitted paucity of data the report succeeded in putting together various information regarding the various facets of an industrial worker's life. It described the working environment in jute and cotton textile mills as being full of dust with inadequate measures to check the same. The relationship between dust from these production activities and pulmonary diseases was well recognised. The workers in most factories worked in circumstances of extreme discomfort in high temperatures. The general cleanliness and sanitation in the factories was also unsatisfactory and there was insufficient provision of latrines for men and women. The workers were also deprived of other essential services like a regular supply of clean drinking water, first-aid facilities, canteens and crèches. These problems were seen to be more severe in the unregulated factories where contract labour was employed. Despite prohibition by the Factories Act, 1922, many children below the age of twelve continued to be employed in highly exploitative conditions[54]. The report cited the case of shellac, wool sorting, mica cutting, carpet weaving, bidi making and the tannery industries to name a few.

In the absence of reliable statistics the Commission used available evidence to conclude that there had been a considerable increase in the risk borne by the average operative due to increased mechanization and speeding-up, coupled with an unfamiliarity with machines on the part of the inexperienced worker employed by the expanding industries.

The National Commission on Labour[55] makes similar observations 38 years later when it examines the condition of workers in independent India, after two decades of planned development have passed, with special focus on industrialisation as the key to progress. It makes observations regarding the emergence of a stable industrial workforce beginning to take root in the urban areas unlike its predecessors whose ties with the village took them back and forth. The increase in productivity and greater incentives encouraged the worker in the organised sector to stay back in the city and fight for his rights. The report also mentions that earlier factory jobs were more or less limited to certain castes. But now there were new entrants from other castes and lower and middle classes in the city

[54] GoI, (1931), op.cit.pp.95-96

[55] GoI (1969), op.cit.pp.31-35

opting to work in the factories. Yet jobs, like tanning in leather industries, considered to be unclean, were still opted for by the lower castes.

As far as changes in conditions of life go, the report notes that though the money earnings of the workers have gone up, they haven't necessarily meant a rise in the standard of living. Though the worker is protected by statutory regulations from retrenchment, the rampant unemployment makes him rather insecure. The better off among the workers have got access to certain amenities like electricity and gas. The prices of commodities have put certain foodstuffs out of his reach while making some other, like ready to eat foods, more accessible. But the housing conditions seem to be rather unchanged. Though there have been government and private industry efforts to provide housing the tenements are poorly constructed and are very few in number, enjoyed by a miniscule section of the workers. The employers in the small sector cannot afford to provide such amenities to their employees. Most of the workers are housed in more unhygienic, crowded slums in single rooms, without sufficient cleaning, washing, sanitary and drinking water facilities. This lack of civic amenities has serious implications for workers health and efficiency according to the National Commission. The report perceives housing and transport to be joint problems. The prohibitive land prices and rents near their place of work leaves slums as the only option for habitation for the workers. The worker faces similar hardships in obtaining essential commodities entailing a loss of time and energy. All these aspects of his life give him a sense of what he is deprived of and his aspirations for a better life remain rather unfulfilled, leaving him dissatisfied. The Report clearly recognises that all these factors and experiences shape his attitude towards work.

After the National Commission on Labour in 1969, no other national level surveys or studies on the same lines had not been attempted by the government till very recently. The Report of the Second National Commission of Labour has recently been submitted to the government, but has yet to reach the public domain. The Working Group on Occupational Safety and Health notes that no systematic studies have been attempted by the government to ascertain the working conditions of the unorganised sector in industry[56].

[56] Working Group on Occupational Health and Safety, op.cit. pp.69

Information regarding working conditions in the manufacturing sector at present can be obtained only from micro studies conducted by certain organisations. Several independent studies indicate that the workplace exposure levels in Indian industries far exceed the threshold limit values.

A study by the NIOH in 1989-90[57] revealed that 39.1% of the workers in the ginning industry suffer from work related problems like breathlessness, dry cough etc. due to exposure to cotton dust. The prevalence of Asbestosis in asbestos miners is of the order of 11.5% and the millers showed a prevalence of 21.1%.[58] This is when the problems emanating from work in both these industries is well documented and recognised even in the Royal Commission's Report. The workers in these older industries are unprotected despite common knowledge of the diseases that work generates in them. The situation in the newer chemical industries is far worse since many of the hazards that they pose are not even recognised by the concerned authorities and the law. Micro studies by PRIA reveal that the damage caused by work in the chemical, pharmaceutical and other industries often presents itself in symptoms like headaches, swelling, gynaecological disorders etc. which the worker would tend to ignore and may not necessarily relate with work. Private practitioners may not diagnose other medical complications like miscarriages as resulting from work. If at all the worker wishes to claim compensation for the same then she has to go through the onerous and difficult task of convincing the Special Medical Board of the Corporation about the same.

Pandya[59] in his study of chemical industrial belts in Ankleshwar and Vapi found that 45 of the units did not have a supervisor. The hospital in the area had five doctors, none of them trained to diagnose occupational problems, despite the fact that 50% of the cases brought in were ones of accident trauma and 20% of the cases showed upper respiratory tract infections. The factory inspectors were short of resources like vehicles, equipment for inspections like meters for monitoring levels of gas in the chemical units. Of the total 250 units surveyed, 150 were in need of constant monitoring since they were extremely

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[57] NIOH (1989-90) Cotton Dust Exposure in the Ginning Industry, Annual Report.

[58] PRIA (1991) Mismanaging Health and Safety at the Workplace, Society For Participatory Research in Asia, New Delhi. quoted in D'Souza, 1995, op.cit.,pp.27.

[59] Pandya, C.G (1992) Risks in Chemical Units, quoted in D'Souza, 1995, op.cit., pp.29

hazardous. 75% of the units employed contract labour, 85% of the units employed untrained contract labour, 56% of the unit conducted no medical check ups and 78% of them did not undertake any maintenance activities for the factories.

A study on workers in the steel factories in the Wazirpur Industrial Area in Delhi[60], describes that they work under the strict supervision of their employer, have infrequent breaks in their 12-hour daily routine, are subjected to high temperatures, toxic fumes, excessive noise and toil without sufficient food or water. The fear of loosing limbs or getting burnt looms large in the lives of the workers in an area where fatal and disabling accidents occur with fearful regularity. The workers do not wear any protective equipment, gloves or guards while handling corrosive acids or high-speed machines. Besides, most of them suffer from diseases like TB, oesophagitis, ulcer, asthma, chest pain and physical weakness.

The restructuring of the economy Tangible evidence of working conditions in the new regime of employment in India is hard to come by. There have been a few sporadic studies to explore conditions of work in industries located in the Export Processing Zones. The case studies by Padmini Swaminathan[61] of women workers in the Export Processing Zones of Chennai show that they are subject to strict supervision, do not get any leisure time or adequate lunch breaks, are sexually harassed at the work place by their male colleagues and superiors and do not receive any benefits other than their meagre wages. They are also deprived of the right to voice their problems and concerns. There are no unions in these areas. Workers are always subject to constant fear of lay-off, since downsizing and casualisation is the key to greater profits and increased efficiency. They are on the edge of losing control over their own lives.

Workers are being constantly subjected to a process of de-skilling on the shop floor resulting in their being employed in the jobs that are mechanical in nature. The case of Maruti Udyog is an illustration of the physical and mental costs that workers bear in such an environment. They work in eight and a half hour long shifts under close supervision.

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[60] Singh, R. (1999) HIV/AIDS and Labour Rights – A Study of Vulnerability of the Workers of the Wazirpur Industrial Area in Delhi, Centre for Education and Communication, New Delhi.

[61] Swaminathan, P. (2002) Labour- Intensive Industries but Units without 'Workers': Where will ILO's Social Dialogue Begin?, Madras Institute of Development Studies, Chennai, pp. 41-42

Workers are allowed to relieve themselves and drink water only when they get a seven-minute break. There are cases of repetitive strain injuries owing to stress, nervous disorders and physical pain due to working repeatedly in bent postures. Most of the production activity is carried out by non-permanent workers or apprentices who maybe paid as little as Rs.600 p.m.[62]

The current economic and political environment of globalisation and liberalisation in the world has far reaching implications for the issue of work related health problems in different parts of the world. Radha D'Souza suggests that the present circumstances In which many of the countries of the developing world have put their economies through the process of structural reform and have opened their markets to foreign investment, creates fertile ground for the export of polluting industries from the developed countries to the countries of the Third World owing to their weak legislative provisions for environmental protection. In her observations on the role of international agencies, D'Souza cites a UN publication, the ILO volume on Multinational Enterprises and Social Policy and the United Nations' Industrial Development Survey that have maintained a near silence or made just tangential references to the issue of occupational health in the context of export of hazards. They speak of the benefits of industrialisation, increased employment opportunities and the 'competitive advantage' that the entrepreneurs in developing countries would be able to derive from the increased costs and restrictions on production that the implementation of stricter controls in the developed countries will result in, without any reference to the issue of human costs that this would entail. Problems of polluting industries are most often than not presented as problems of the environment and the problems they pose to the health of workers both within and without the polluting unit is circumvented.[63] The policies of the World Bank and the IMF recommending structural adjustment programmes, opening of national markets, advocating free trade and competition leave the regulation of wages, work environment and safety issues to the national arena. According to Knutsen the motivation for the transfer of hazardous industries to the developing countries stems from the need to cut

[62] Workers' Solidarity (Nov 2000) Lock Out at Maruti, New Delhi

[63] D'Souza, 1995, op.cit.pp.38

pollution control costs and to retain profits from a technology long after it has been banned in parts of the developed world.

In the following case studies of two very recent developments in India will serve the purpose of highlighting the issue of total silence on the issue of worker's health in the present phase of celebration of industrial growth and increasing concern around the environmental pollution and its effects on the lives of the 'common people'.

## THE CHEMICAL INDUSTRY IN GUJARAT

India has 1500 chemical industrial units in the organised sector and 1,40,000 in the unorganised sector. 400 of the former and 10,000[64] of the latter are in the state of Gujarat. In Gujarat the output of the chemical industry accounts for 44% of the total chemicals manufactured. It provides employment to 1,30,000 people and produces goods that equal 41% [65]of the gross output of all other industries in the state. Post liberalisation the state government has made the licensing system convenient for the industry, has removed locational restrictions and provided incentives to entrepreneurs in an effort to woo NRIs to set up industrial units in the state. The government is pursuing economic policies that are encouraging the foreign investors to set up house in south Gujarat. Many American and European firms have made financial and technical investments in the state in the biotechnology and chemical industries. The Golden Corridor as the stretch between Ahmedabad and Vapi in south Gujarat is called, is the new chemical industrial belt. The area is fraught with problems of unplanned growth resulting in undue pressure on the infrastructure and civic amenities that exacerbate the problems of non-compliance environmental laws. Many units in both the sectors have sought to produce and export chemicals that are banned in other countries. The government's efforts to induce the industries to tackle the pollution problem collectively have been rather unsuccessful. The absence of a set of rational policies by the government and laws that are easy to

[64] Rajagopal, R. (1995) The Chemical Industry in Gujarat- a Rapidly Industrialising Zone in Hesselberg, J. (ed.) Industrial Pollution: The Chemical Industry in Gujarat, India Research Proposals, FIL Working Papers, No.5, University of Oslo, Norway, pp.7.

[65] Ibid, pp.7.

circumvent are doing little to change the situation for the better. Most of the production of chemicals like pesticides happens in industrial estates in Gujarat that are devoid of basic waste disposal systems like adequate sewage lines.

The manufacture of chemicals involves highly hazardous processes.[66] For eg. The organophosphore compounds affect the nervous system, and are highly toxic when in touch with the skin. Evidence shows that exposure to the chemical has resulted in changes in hormones, behaviour, cold tolerance, growth and embryonic development. During the manufacturing process or due to faulty storage and packaging these chemicals may also produce highly toxic secondary substances for e.g. Mallathion when stored incorrectly can result in the formation of isomalathion.

The Indian pesticide industry as a whole uses conventional manual or semi-automatic systems for production and packaging, thus increasing the chances of hazard and pollution. There are a considerable number of small unregistered, unlicensed firms that produce chemicals that produce low quality products in environmentally damaging conditions. The technology used is simple and the workers have little technical know-how and information about risks. The large number of these small units in the industry makes it rather difficult to estimate the actual number of production units.[67] Te economic benefits gained from the industry has come at the cost of increased risk to workers and both air and water pollution along with the problem of toxic solid wastes.

## INDUSTRIAL RELOCATION IN DELHI

Another case of the absence of the working class from the entire discourse on health and environmental pollution is the recent case of industrial relocation in Delhi. The Supreme Court, through an order in 1996 delivered the 'historic' judgement calling for the closure of hazardous industries operating in the conforming and non-conforming areas of Delhi citing the imperative of 'protection of the environment at all costs'. This judgement was

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[66]Lindstad, P. (1995) Pesticide Production in India : International Linkages, product Cycle and the Environment in Hesselberg, J. (ed.) Industrial Pollution: The Chemical Industry in Gujarat, India Research Proposals, FIL Working Papers, No.5, University of Oslo, Norway, pp.14.

[67] Ibid, pp.16

delivered in response to a petition filed in the court by Mr. MC Mehta, an environmentalist lawyer and a 'public-spirited citizen'. Mehta, brought up the issue of the incessant pollution of the river Ganga, following which the court ordered the closure or relocation of 168 polluting industries by the 30th of November 1996, 513 units in residential areas, 334 others in non conforming areas, by March 1997, 46 hot mix plants by February 1997 and 243 brick kilns by June 1997, since they were operating in violation of the provisions of the master plan. About 50, 000 workers lost their jobs following these orders. The Court then ordered for payment of one year's wages as compensation to the workers of these industries, in the event of relocation. After much struggle and intervention by the workers organisations the compensation was raised to 6 years of wages in the case of closure of industries.[68] [69]

The court ordered the closure or relocation of polluting units that were releasing effluents into the river Yamuna, from January 2000 onwards, having prepared a tentative list of the targeted industries. By 25th January it decried that all potentially polluting units would be targeted.[70]. These closures and relocations are affecting the livelihoods of 14 lakh workers in the city. But this time what is shocking is the total silence that the court maintains on the fate of the workers whose jobs and lives have been devastated by this order. The workers in effect are paying the price of the environmental pollution, caused by the industries.

Along with the move to throw the industries out, the city is also witnessing the largest ever slum demolition drive by the state after the Emergency period in Delhi. There have been a large number of planned demolitions since during 1996, along with repression of the protests by the residents. Many of the jhuggies after demolition have not been relocated, throwing the inhabitants onto the streets and divesting them of all their meagre and hard earned belongings along with the precious investments that they had

[68] Delhi Janwadi Adhikar Manch, (April, 2000 ) How Many errors Does Time Have Patience For? Industrial Closures and Slum Demolitions in Delhi.

[69] The Cleansing of Delhi, Delhi Science Forum, March 2001.

[70] Ibid.

made to build their homes and sustain their lives amidst much harassment from the police and various agencies of the state.[71]

The current process of industrial relocation further serves to impoverish an already vulnerable working class that has no means of social security. One can obtain an idea of the same from a preliminary exploration conducted by Manju Bhagat and Ranjana Dixit of the Shri Ram Centre for Industrial Relations and Human Resources[72], on a sample of 108 workers from 23 industrial areas, affected in the first closure of the 168 industries.

- A majority of the affected workers were males, between the age group 41-50 years.
- 60% of them were either from the backward castes or belonged to the SCs or STs. Only 37% of the workers belonged to the upper castes.
- Most of the workers were migrants from Uttar Pradesh, Haryana, Rajasthan and Bihar and had been working in these industries for the past several years.
- 86% of them belonged to nuclear families and were the sole breadwinners of their families.
- 50% to 60% of the workers come under the non-permanent category.
- Most of them earned between Rs.1500-2500 per month.
- Also, data from the economic survey shows that 23.65% of the own account establishments and 10.9 % of the establishments were owned by lower castes. [73]
- The number of units that applied for relocation is curiously close to the number of directory establishments, that are larger in size and have greater capital to relocate.

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[71] Delhi Janwadi Adhikar Manch, op.cit.

[72] Dixit, R and Bhagat, M (2001) Impact on Workers of Closure/Relocation of Industrial Units in Delhi, paper presented Saf The Seminar on Closure of Industries, Shri Ram Centre for Industrial Relations, New Delhi

[73] Own account establishments are those that are family enterprises. They numbered 33,556 or 26.6% of the total industry in the city, employing 68,930 workers, i.e. 2.1 workers per unit.
The establishments hired labour, employed 13,52,940 workers, i.e. 14.1 workers per unit. 35% of the establishments hired less than 6 workers and 67.5% employed less than 10 workers. Those employed more than 6 workers were classified as directory establishments and the latter were called non-directory establishments. 87.3% of the workers were employed with the directory establishments, that numbered 59, 296.

- Of the sample of 108 workers interviewed, 47 belonged to closed down units and 51% of them had not received any compensation. 49% of the workers reported to have received some compensation and 10% received full compensation equivalent to 6 years of wages. Some of them have been utilising their compensation money for meeting their day to day requirements while some of them used it to generate self-employment. 22 workers in the sample were contract workers and have not been paid any compensation, nor have they been an option to shift with their units.
- In the above-mentioned study, the researchers found that 82% of the workers reported that their income had gone down. Most of them had not received the compensation due to them according to the court orders. 68% of the workers also mentioned that their jeopardised financial status caused them to borrow money for running day-to-day household expenses.
- 30% of the respondents revealed that they were consuming poorer quality of food and 22% reported that they had curtailed their expenses on food items. 8.5% pointed out that they had reduced their quantity of milk and non-vegetarian food. 8% reported that they somehow managed to survive by eating only once a day.
- Almost a third of the workers stated that they were deprived of the ESI facility for medical care while another third that they were forced to go to government hospitals to avail free treatment despite what they considered poor or ineffective.
- Nearly a fourth of the respondents said that their children had stopped going to schools because of financial crisis. Another 5.27% reported that their children had started working.
- Majority of the workers felt helpless due to the closure. 9.1% said that the helplessness was so severe that they felt like committing suicide. 5.4% felt that their working capacities had suffered.
- About a fourth of the respondents felt that their inability to fulfil the family needs made them sad and frequently caused quarrels at home. 30% felt that people did not show them any respect and their new unemployed status has resulted in refusal of shopkeepers and moneylenders to give credit or lend money. They said that they had also stopped attending social functions due to the stigma associated with their unemployed status.

Their temporary and contractual nature of employment renders many of the workers invisible, especially with the current shift in policies towards greater contractualisation and informalisation of labour; these workers are not registered on the live registers of the companies. Thus they are entitled neither to compensations as ordered by the Supreme Court and nor do they have possibilities of continuing employment, with the same company even in the event of relocation.

The owner thus benefits doubly, in that he procures hefty sums from the sale of prime land, sets up shop elsewhere with the proceeds and does not have to pay any compensation to the 'invisible' workers

The proposed industrial estate in Bawana, is sought to be developed by a consortium of private corporations and supply of water, sewage treatment will all be privatised as well. There are no provisions for the housing and services for over 1, 38, 000 workers who are sought to be relocated here.[74]

The court has also overlooked the shortcomings and malpractice of the concerned bureaucrats and the factory owners who have failed to comply with strictures of the Master Plan. The EPA (1986) passed after the Bhopal Gas Disaster stipulates penal provisions for those causing irreparable damage to the environment. By passing this order the court has in fact attacked the right to livelihood and thus, the right to life of over 14 lakh marginalised people, as espoused in Art.21 of the Indian Constitution.

Within this backdrop of the State's provisions of regulatory legal framework and the conditions of work and life let us now examine the provisions that the State made for workers in the formal planning process for health.

## THE PLACE OF WORKERS' HEALTH IN HEALTH PLANNING BY THE STATE

The Royal Commission had taken the view that there is a need for a 'considered program of public health' to put to use scarce financial resources. It asserted that taking a narrow short-term perspective in matters of health and housing of workers would yield

[74] Roy, D (January, 2001) Organising for Safe Livelihoods, Economic and Political Weekly, Sameeksha Trust, Bombay.

dissatisfactory results. Thus the report attempted to lay down a 'policy and a program to ensure gradual and progressive advance'.[75] When the Royal Commission discussed the health of industrial workers it did not limit itself only to the factors that affect the health of the workers at the work place, but also addressed the environmental and social factors outside the workplace that impinge upon their health. The recommendations made by the Royal Commission regarding health and welfare of workers spanned many areas including the need to create institutions for industrial health research, keeping statistical records, assessing nutritional needs of workers, providing for industrial hygiene, measures against food adulteration, provision for sanitation, water supply to mention a few.

Later, the Bhore Committee or the Health Survey and Development Committee,[76] 1946, focussed on the health problems of industrial workers, which it felt needed to be dealt with immediate effect. It picked up the concept of the industrial health service from England. The committee clearly opined that the factors affecting the health of the industrial worker emanated from his workplace and his home. An industrial health service was deemed necessary to cater to the needs of the worker in the former. This health service would aim at minimising the detrimental effects of workers' occupation, promote measures to create optimum working conditions and increase the workers capacity of work and his general sense of well-being. The industrial health service, it deemed, would not be responsible for health problems generated outside the workplace. The provision of services for the workers family members was considered important since their ill-health would have adverse effects on the workers productivity. But it was felt that for administrative purposes it would be more functional if these responsibilities were devolved on the general health services. The committee envisaged the integration of the IHS and the GHS at the local level through general practitioners and in-patient facilities at selected hospitals that could service a group of industries. It felt the need to establish department of industrial health in medical institutions and to train industrial

[75] Royal Commission, op.cit. pp.243

[76] Report of the Health Survey and Development Committee, Volume II- Recommendations, Manager of Publications, Delhi, pp. 122-136, (1946)

medical personnel and specialists. It opined that the government and the employer should meet the costs of this service and the worker should be exempted from paying. It would be in the interest of the employer also since it would reduce sickness absenteeism. The committee also suggested the deployment of a central insurance fund with contributions from the government, the employers and the workers that could be used for setting up an industrial health organisation. Major proportion of the workers contribution would go back to them in the form of sickness benefits. The committee members felt that since such an organisation would take time to establish; hence for the immediate future they suggested that:

- First-aid training should be given to workers in the immediate future.
- Crèches should be organised,
- Maternity benefits be given to women workers,
- Hours of work must be brought down to 8 hours a day,
- Accident compensations to be paid,
- Governmental enquiries be made into the prevalence of occupational diseases.
- A department in industrial medicine be set up at the All India Institute of Hygiene and Public Health
- Housing provisions be made for industrial workers
- Purchasing power of workers be increased.
- Canteens be established in industrial units
- Zoning of industries should be done along with environmental amenities being provided to the industrial workers
- As part of industrial hygiene measures the conditions of the physical environment like dust, humidity, temperature etc needed to be controlled and amenities like bathing rooms, latrines, and drinking water facilities needed to be provided.
- Pre-employment medical examinations of workers along with treatment and rectification of unhealthy modes of life in recruits.
- The unorganised factories and workshops needed to be regulated and there was a need for licensing of factory units.
- Work for women and adolescents needed to be regulated

Hence the primary rationale for intervention to safeguard the health of the industrial worker emanated from concerns of productivity. The recognition of the effects of the home environment on health of the worker led the committee to make recommendations spanning all the above-mentioned areas. But the committee did not question the organisation of production.

The leaders of newly independent India embarked upon a planned effort to attain economic self-reliance, tackling poverty and building a strong welfare state. In order to achieve these goals and to raise the standard of living of the masses the investment in planning of health and education was made an integral part of the overall planning process.

The Mudaliar or the Health Survey and Planning Committee[77], 1961 instituted to assess the progress made in implementing the recommendations of the Bhore Committee, felt the need for two types of industrial research work, one that would increase methods of production and the research connected with the health, welfare and safety of the industry. The committee suggested that in all big cities there must be one or more units carrying out research with regard to industrial health. The expenditure for research should come from the industry. The industrial research units should work in close collaboration with the CSIR, ICMR and the ESIC. The former would be useful in guiding the technical aspects of research in the industries. But it did not comment on the non-implementation of the Bhore Committee's recommendations regarding an Industrial Health Service.

The Shrivastava Committee Report[78] on Medical Education, the ICSSR–ICMR [79]Committee reports maintained silence on the issue of integration of occupational health into medical education and into the organisation of the general health services. The issue of occupational health services finds a cursory mention in the National Health Policy of

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[77] GoI, Health Survey and Planning Committee ( Mudaliar Committee ) (1962): Report, New Delhi Ministry of Health.

[78] GoI, Group on Medical Education and Support Man-Power ( Shrivastava Committee ) (1975) Health Services and Medical Education: A Programme for Immediate Action, New Delhi Ministry of Health and Family Planning

[79] ICMR-ICSSR, GoI (1980) Health for All – An Alternative Strategy. Report of a Study Group Set Up Jointly by the ICMR &the ICSSR, New Delhi, ICSSR.

1982[80], which notes the inadequacy of the ESI services and suggests that there is a need to expand its coverage. The National Health Policy, 2001 also fails to make any recommendations regarding occupational health.

The poor attention paid to the area of occupational health in medical education in the area of occupational health can be ascertained from the data on post graduate degrees and diplomas awarded in the area of medical education.

TABLE NO.2.5 NO. OF PG DEGREES AND DIPLOMAS AWARDED IN SELECTED DISCIPLINES OF MEDICAL SCIENCES BY VARIOUS UNIVERSITIES FROM 1ST JANUARY 1997-DEC1997

| S NO. | SUBJECT | NO. OF DEGREES AWARDED |
|---|---|---|
| 1 | Anaesthesiology | 196 |
| 2 | Biochemistry | 35 |
| 3 | Community Medicine | 33 |
| 4 | General Medicine | 352 |
| 5 | Pathology | 149 |
| 6 | Endocrinology (DM) | 4 |
| 7 | Neurology (DM) | 26 |
| 8 | Cardiology (DM) | 32 |
| 9 | Neuro Surgery (MCh) | 15 |
| 10 | Plastic and Reconstructive Surgery (MCh) | 15 |
| 11 | Cardiovascular Thoracic Surgery (MCh) | 26 |
| 12 | Diploma in Industrial Health | 2 |

*Source: Health Information of India, (1997-98)*

In order to provide health services specifically for the industrial worker, the Employees State Insurance Services Scheme was set up under the ESI Act described earlier.

**The Employees State Insurance Services**

The ESI Act 1948 was promulgated in the name of collective responsibility of the state, employers and employees to provide social security in the form of occupational health services, comprehensive health care, compensation in the event of accidents and diseases among workers. It is run by an autonomous body called the Employees State Insurance Corporation with representatives from workers employers and the Government, under the aegis of the Ministry of Labour and Employment of the Government of India. It was conceptualised to take care of all occupational health problems related to

[80] GoI (1982) National Health Policy, Ministry of Health and Family Welfare, New Delhi.

industrialisation. Now it provides general health services to workers and has widened its scope to include workers families and retired workers. The ESI was established according to the recommendations of the Adarkar Commission called for a comprehensive integrated scheme providing medical treatment and cash benefits for sickness, and employment injury for specific perennial factories that would be administered by the insurance institution itself. The ESI provides benefits to employees in case of sickness, maternity and employment injury. The non-medical benefits provided under the scheme imply paying of cash as compensation. In the case of sickness benefit the benefit rate applicable for a maximum period of 91 days is 50% of the daily wages of the insured person. In the case of 29 long-term diseases the insured person can get sickness benefits at enhanced rates and for a longer period of up to 309 days. Other benefits such as sickness, disablement and dependent benefits are paid at the prescribed rates after a due verification process. In the case of occupational diseases, if the worker has contracted any disease within the specified period he will be deemed to have suffered an employment injury and paid compensation subject to the recommendation of the medical board.

Three types of medical care are provided for in the scheme: restricted medical care, expanded medical care and full medical care. All the insured persons are provided full medical benefits irrespective of whether the required facilities exist in the ESI hospitals or not. In case of need the scheme draws upon facilities in government or other institutions. Family members get either restricted or expanded medical care but not full medical care. Out patient care is rendered partly through the service system through a network of fulltime ESI dispensaries and the rest of the services are part-time or mobile services and employers utilisation dispensaries and partly through the panel system under which private medical practitioners provide prescribed medical services.

Qadeer and Roy and D'Souza point out the following weaknesses and shortcomings of the scheme:

- The expansion of the services from a population of 12 lakhs in 1952 with a current coverage of 74, 26, 500[81] is rather inadequate.

[81] Goi, MoL& E (1997) Indian Labour Statistics and Pocket Year Book of Labour Statistics

- The scheme has also been criticised for its limited coverage as was discussed in the section dealing with legislation. It leaves out a large section of workers whose income is beyond the current ceiling of Rs.6500 per month.
- The share of contributions of the employers and the employees has been reduced from 5% to 4% for the former and from 2.5% to 1.5% for the latter.
- The dichotomy of responsibilities between the state governments and the ESI Corporation has resulted in poor administration of services.
- Despite being a scheme that caters exclusively to the industrial workers and their families, the ESIS totally ignores occupational health. The absence of an occupation based reporting system is ample evidence of the same. The general practitioners on its panel are not aware of the extent and type of occupational health problems of industrial workers attending their clinics.
- The services provided by the ESIS are mainly curative medical care and do not include public health.
- The services were found by a review committee to be inadequate and unsatisfactory with its poorly staffed service dispensaries, poor standard of clinics and hospitals with non-availability of drugs and total lack of attention to preventive services.
- The ESIC Review Committee in 1982 observed that the claims for temporary disablement were attended to promptly but those pertaining to crucial permanent disablement were kept pending for long.

The ESI Act was intended for the provision of comprehensive health insurance to workers, but neither does it make arrangements for occupational health monitoring, vocational rehabilitation, occupational therapy or redeployment, nor does it engage medical practitioners specialising in the above-mentioned areas. Though the corporation deals with 700,000 workers and their families it has no special wing to deal with occupational diseases, therapy or rehabilitation. The benefits cease to be made available to the workers if they go on strike.

TABLE NO.2.6 PERFORMANCE OF EMPLOYEES STATE INSURANCE SCHEME TILL 1996-97

| S. NO. | DESCRIPTION | AS ON 31.3.1997 |
|---|---|---|
| **A** | **Progress** | |
| 1 | No. of Centres | 632 |
| 2 | No. of Employees (in lakhs) | 77.31 |
| 3 | Insured Persons/ Family Units (in lakhs) | 84.45 |
| 4 | No. of beneficiaries (in lakhs) | 327.66 |
| **B** | **Provisions for Hospitals, Dispensaries etc** | |
| 1 | Hospitals | 125 |
| 2 | Annexes | 43 |
| 3 | Dispensaries | 1443 |
| i) | Functioning in Corporation Building | 348 |
| ii) | Functioning in Rented Building | 1071 |
| iii) | Mobile Dispensaries | 24 |
| iv) | Employees Utilisation Dispensaries | 23 |
| 4 | Hospital Beds | |
| i) | ESI Hospitals | 18,695 |
| ii) | ESI Annexes | 867 |
| iii) | Reserved in other Hospitals | 3772 |

*Source: Health Information of India, (1997-98)*

Given the limited scope of the ESIS and the fact that a large section of the industrial workforce is part of the unorganised sector, it becomes important to turn our attention to the general health services in India since it caters to the majority of the population and would be the ultimate resource of health care for the workers in the unorganised sector.

**The General Health Services**

A wide network of basic health services was laid down in keeping with the recommendations of the Bhore Committee report. The major thrust of health planning in India post–independence was to build infrastructure to provide basic medical care, MCH services, health information and education and referral services. And to plan for specific disease control programmes, provide family planning services and to tackle nutritional deficiencies[82].

The first two five year plans attempted to build basic infrastructure and manpower although less than 5% of the total budget was invested in the development of health. But

[82] Qadeer, I.(2000) Health Care Systems in Transition III, India, Part I. The Indian Experience, Journal of Public Health Medicine, Vol.22, No.1, pp. 25-32, Great Britain.

by the 60s this vision of an integrated health service was diluted and the system was fraught with imbalances.

Narayana[83], in his paper analyses the distribution of resources between various sectors within the health care system. He makes the following observations:

• There are startling disparities in regional allocation of resources. The variations in resource allocation and health care services across various states for the urban areas is much less than when compared to rural areas. Health resources are heavily concentrated in the urban areas where only about 35% of the population lives. Only about 13% of the doctors and 17% of the beds in the public sector are located in the rural areas.

• Both the private and the public sectors in health care have tended to concentrate in the more developed areas. The disparities in the distribution of health care have taken place in spite of the fact that the 75% of the total hospital and dispensary beds are owned by the state.

• Within medical education, the emphasis is more on producing specialised doctors for curative services instead of paramedical staff and physicians trained in preventive and social medicine. Medical research is concentrated on sophisticated diseases rather than on effective interventions for communicable diseases that are more relevant in our context. The major chunk of resources nearly 55% is spent on curative healthcare and medical education, while public health receives only a third of the total health budget, with the rest being spent on family welfare. Qadeer[84] notes that the system lacks an epidemiological logic in its investment patterns. She notes that the investment in additional infrastructural facilities and has been at the cost of preventive programmes that could effectively address the health care needs of most of the population which still has a disease profile dominated by infectious diseases.

• The cost of medical care has been increasing at an exorbitant rate and care provided is becoming more irrelevant to the health needs of most of the population in the country.

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[83] Narayana, K.V. (Oct.1991) Political Economy Of State Intervention In Health Care, Economic and Political Weekly, 1991

[84] Qadeer, I. (July- September 1985) Health Services System in India: An Expression of Socio-Economic Inequalities, Social Action, Vol.35.

• The changes in the medical care industry are geared towards realisation of greater profits instead of the health care needs of the people. The interests of the private sector have in fact been accommodated and actively promoted by the governmental policies ever since the British. The pharmaceutical and instrumentation industry along with the medical professional groups have played an important role in moulding the governmental policies.[85] The emphasis on curative interventions has made medical care yet another area amenable to profit accumulation.

Besides these aspects The General Health Services lacks facilities for recording occupational causes of morbidity and mortality. The low priority accorded to occupational health has already been observed in the absence of any discourse on the area in any of the reports subsequent to the Bhore Committee.

Occupational medicine has not been integrated effectively into the curriculum for medical education at the undergraduate level. Hence the medical practitioners recruited at the PHC or even the District hospital lack the skills to diagnose diseases with occupational causes. Data also shows that the poor access the private sector more for outpatient care. This will also impinge on the efforts to create a database for occupationally caused morbidity and mortality and on the capacities to address epidemics of occupational disease resulting from certain kinds of employment. The absence of effective integration of occupational health at the preventive and curative levels of the health services serve to keep magnitude of the problem under wraps. Data from the economic census shows that 35% of all employment in rural areas occurs in the manufacturing sector. The growth in hazardous industries and the siting of more and more industries in peri-urban and rural areas will impinge on the access to health care for worker in these units owing to the poor state of the general health services there.

The World Bank's prescription for Health Sector Reform entails:

- Cutbacks on tertiary care in the public sector
- Shifting of curative care to the private sectors
- Introduction of user fees in the public hospitals

[85] Baru, R. (1998) Private Health Care- Social Characteristics and Trends, Sage Publications, New Delhi, pp.51-58

- Defining 'essential' clinical and public health
- Tackling poverty through SAP, education and women's empowerment

These measures will serve to de-link medical care from public health services. A shifting of curative services to the private sector will put it out of reach for many of the most marginalized sections in the country.

Baru's[86] analysis of NSS data shows that though the individual private practitioners are utilised more for out patient care, over 50% of the in-patient care at hospitals is given by the public sector for the poorest sections especially in the rural areas. The public sector has a larger bed strength as compared to the private or voluntary sector and is utilised the most for in-patient care by the bottom 20% and is used well by the top 20% of the population as well. The public sector being the major provider of secondary and tertiary health services,

- Cuts in the same would result in distortion of service provision.
- Introduction of private investment in the public sector will result in the escalation of costs and the elbowing out of the poor from access to these institutions as well.
- Introduction of user fees will result in non-utilisation of curative services thus exacerbation of suffering, increase in the pool of infection and further marginalisation of the poor since the poor can ill-afford to spend on health.

The policies of Structural Adjustment Programme have already undermined the intersectoral linkages for health. The cuts in subsidies and periodic hikes in prices in India have resulted in reduced food availability. The targeted PDS launched in 1997 allocates 10 kgs of foodgrains per family below the poverty line, irrespective of family size[87]. This would be detrimental to the amount of food consumed by the poor, contributing to further malnutrition. The hike in prices of essential commodities would in turn increase the burden of work and consequently that of ill health they would have to shoulder, making them more susceptible to communicable diseases.

Apart from this, privatisation of public services like water supply, sewerage and electricity would have a marked effect on the environmental and physical health of the

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[86] Baru, R. (1999) Structure and Utilisation of Health Services in India – An Inter State Analysis in Rao, M.(ed) Disinvesting in Health, Sage Publications, New Delhi, pp.116-142.

[87] Ibid.

poor, who would no longer be able to pay the 'user fees', required to be paid under the new policy regime, to avail these services. Economic restructuring that has led to unemployment and contractualisation of labour, will exacerbate the ill health that will accrue from the attack on intersectoral linkages for health.

There has been total fragmentation of policies pertaining to the organisation of developmental activities in the health and the industrial sector. Both of which have been planned almost in mutual exclusion of each other with a multiplicity of agencies coordinating work in either area with no clear responsibilities assigned on overlapping issues. All these will have detrimental effects on access to health care for the large mass of marginalized workers in the unorganised sector.

## CONCLUSION

The trajectory of industrialisation that India has followed over the past five decades has resulted in the emergence of a large unorganised private sector in manufacturing industry employing a significant proportion of the labour force. There is much documentary evidence available to show that workers in these manufacturing units work under deplorable and inhuman conditions, with disease and death accruing due to the oppressive work processes the order of the day, and receive wages, which are not sufficient to procure for them and their families even the basic minimum necessities of life like adequate food and access to safe drinking water and sanitation facilities. The regulatory framework provided by the legislation instituted for safeguarding health of workers by controlling conditions of work is itself riddled with inconsistencies. It excludes the workers in the unorganised sector at the definitional level itself. And has served to strengthen and reinforce the fragmentation of the labour force that results from the pattern of industrial development followed by the State. Even for the small section of workers who fall within the ambit of protective legislation, the process of availing the benefits provided by it is fraught with barriers at every step. The reluctance or hostility of the industrialist coupled with the apathy and insensitivity of the state organs makes the realisation of the laws pertaining to workers' health and safety a mere pipe dream.

Further the silence of the State on the issue of workers' health is exemplified by its lack of interest in enquiring about and bringing to light the extent of damage to health and life

the poor conditions of work are causing. The failure to develop systems to record statistics, create a reliable database of disease, accidents and deaths and to enquire into the working conditions of these sections of labour are illustrations of the same.

Similar disjunctions can be seen in the formal health planning process within which workers' health is accorded very low priority. There has not been much of an attempt to sufficiently integrate occupational health into medical education and service provision. Services provided by the ESI even to a limited section of workers are unsatisfactory, and what is more, even these services pay scant attention to the diseases and health problems that accrue from work. Thus the worker has only the General Health Services to fall back on. The GHS has also been criticised for its inefficacy in dealing with occupational health problems, poor coverage, inefficiency and bias against the poor.

The policies of liberalisation, privatisation and globalisation, pursued relentlessly by the State since the beginning of the previous decade have created fertile ground for further expropriation of health of workers. The cumulative effect of these policies has been an all round attack on the working class. The very design of these policies implies a progressive erosion of protective cover of the state in the form of legislative protection, social services like health and education and job security. The 'reform' of labour laws has furthered casualisation and insecurity of employment impinging on the workers' capacity to bargain for safe and sustainable employment. At the same time the cuts in public health services, education and public distribution services have undermined the interlinkages that contribute to health. The policy package of the 'reform' era coupled with the diluted protective legislation for workers and weak environmental legislation have all contributed in encouraging the import of hazardous industries in the country which will further eat into the health of the already vulnerable workers.

# CHAPTER THREE

# THE CASE OF STATE SPONSORED OCCUPATIONAL HEALTH RESEARCH

## INTRODUCTION

This chapter is a review of occupational health research conducted at the Industrial Hygiene and Physiology Section of the All India Institute Of Hygiene and Public Health (AIIHPH) and the National Institute Of Occupational Health Research (NIOH) between 1951-1998. The body of work generated by these two institutions has been chosen for examination due to their specific mandate, which includes research ad education in the area of occupational health in India, sponsored by the State.

### A Brief History of The Section of Industrial Hygiene and Physiology of the All India Institute Of Hygiene and Public Health (AIIHPH) and the National Institute Of Occupational Health Research (NIOH)

The Industrial Hygiene and Physiology Section of the All India Institute Of Hygiene and Public Health (AIIHPH) was established as per the recommendations of the Bhore Committee Report which had called for the establishment of a centre for training medical personnel in the specialised field of industrial hygiene and for the research in the area. It was established in the year 1951. The AIIHPH is under the Ministry of Health and Family Welfare of the Union Government.

This section was also associated with the Industrial Health Research Unit of the Indian Research Fund Association. The latter went to become the Indian Council of Medical Research. Prof. NPV Lundgren of the WHO was the first Head of the Department. He was sent specifically on the mission of establishing this department in India since the area of industrial hygiene had not been explored here at that time. He along with Prof. MN Rao of the same institute were instrumental for chalking out the plans for the department. Prof. MN Rao educated at the Harvard School of Public Health was one of the pioneers in the area of industrial health in India. He remained head of the

section till the yea 1970 after which he retired. He has many publications to his credit and his vision for establishing this new area was honed in the tradition of public health. He saw great value in interdisciplinary action in the area of industrial health and tried to build a corpus of literature and knowledge that would emerge from a public health understanding firmly rooted in this local context.

The Section of Industrial Hygiene and Physiology offers a post graduate diploma and doctoral programmes in Industrial Health to medical graduates and has also been associated with researches commissioned by various industries.

In 1966 the Industrial Research Health Unit of the ICMR[1] was moved to the city of Ahmedabad after which in 1974 it was redesignated as the National Institute of Occupational Health. The institute offers certificate courses and short training programmes in industrial health to medical personnel in the industry. Its mandate is to produce scientific research and carry out studies commissioned by government agencies when required. It has also set up Regional Occupational Health Centres at Bangalore and Calcutta. It is also WHO's collaborative centre for occupational health for South East Asia region and is the lead institute for chemical safety under the IPCS.

## SELECTION OF STUDIES

### SECTION OF INDUSTRIAL HYGIENE AND PHYSIOLOGY, ALL INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH (AIIHPH)

The review has focussed on the work done in the institute from the inception of the Section of Industrial Hygiene and Physiology in 1951 to the year 1970. This is because the institute did not have a compilation of the researches or even of titles of studies accomplished after 1970.

A list of studies was obtained from a compilation of titles of research work published by the faculty and students of the Section of Industrial Hygiene and Physiology of the AIIHPH during the period from 1940s to 1970. Annotations of some of the studies and articles were also available in the three reviews of Occupational Health Research in India (1955, 1964 and 1970) sponsored by the Indian Council of Medical Research

[1] nioh@icenet.net

(ICMR). Available studies were then collected from the back issues of journals like the Indian Journal of Medical Research, the Indian Medical Gazette, Indian Journal of Social Work, Indian Journal of Industrial Medicine and others. In all 120 titles were obtained out of which only about 30 studies could actually be collected. Many of the old issues of the journals were not available and some of the journals could not be obtained since they were out of print. Many of the articles were presentations made at various seminars like the Ardeshir Dalal Memorial Lecture organised by the TISCO.

**NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH (NIOH)**

The researches conducted were published in the annual reports of the institute. Between 1974 and 1998 the annual reports for the following years were available at the documentation centre of the ICMR:

1970s: 1974, 1975, 1976, 1977, 1978, 1979;

1980s: 1980, 1981, 1983-84, 1984-85, 1985-86, 1987-88, 1989-90;

1990s: 1990-91, 1991-92, 1992-93, 1993-94, 1994-95, 1996-97 and 1997-98.

Of the total 329 studies published in the above mentioned annual reports 287 pertain to various aspects of work in the industrial sector which include environmental field studies on exposures of workers to various physical and biological agents within the factory; effects of production processes and products on the environment outside the factory, psychological studies, ergonomic, experimental studies examining the carcinogenic and toxicological potential and effects of different substances like pesticides, industrial solvents, dyes and minerals like asbestos. There were a few other studies examining other aspects like occupational cancer in different parts of the country, a directory of industries in south India and the provision of occupational health services through a primary health centre in rural Gujarat. 115 studies representing 40% of the total number of studies obtained were studied in detail.

The analysis of the studies from both the institutions will focus on the trends in the choice of subjects, the methods of study, the analysis of the health problems and the character of the interventions recommended by the scholars for the amelioration of work conditions adversely affecting the health of working populations in the industries.

## LIMITATIONS OF THE REVIEW

This review is a preliminary study and could not be a comprehensive one owing to a number of reasons:

- The review is also restricted to the researches conducted on workers on the shop floor in the manufacturing sector.
- The fact that the institutions could not be studied in detail to get a complete picture of the other commissioned projects or the researches conducted as part of the doctoral programme offered at the AIIHPH.
- A lack of pedagogical analysis of the curriculum followed in the educational programmes conducted at both institutions.
- The constraints imposed by availability of material, time and resources.

Despite these limitations this review will be a useful window into the kind of knowledge generated in the field and will be of relevance in throwing light on the State's perception of workers' health in India.

This chapter has been divided into three main sections. The first is a review of the work published at the AIIHPH. It includes an examination of the three Occupational Health Reviews carried out under the aegis of the ICMR. Prof. MN Rao Head of the Section of Industrial Hygiene and Physiology for the period 1955-9167 and 1968-1970 was associated with all the three reviews.

He was a pioneer in this field and his contribution to the area of occupational health is indeed outstanding. In the subsequent parts of this section studies conducted by him have been reviewed and then the work done by other faculty members has been examined.

The examination of the research work produced at the NIOH constitutes the second section of this chapter. The studies have been classified according to the methods used and the areas chosen. The classification has been represented in a tabular fashion for the easy identification of the trends in the research conducted.

The third section consists of the analysis and conclusions drawn from the review.

## A REVIEW OF THE STUDIES CONDUCTED AT THE ALL INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH (AIIHPH) (1951-1970)

### CLASSIFICATION OF STUDIES

The studies obtained from the body of published research of the All India Institute of Hygiene and Public Health have been classified according to three distinct time periods. These time periods correspond to those of the reviews that had been conducted under the aegis of the ICMR. This classification has also been adopted because the reviews are reflective of the changes that occurred in the area of occupational health from the 1940s to the 1960s. The studies were further classified as dealing with environmental, psychological, safety, ergonomical, physiological, toxicological and other aspects of occupational health.

Some of the studies have been discussed in detail to highlight the significant aspects of the knowledge generated at that time and its relevance in explaining the pattern of occupational health research that developed in India during that time period.

### REVIEWS OF OCCUPATIONAL HEALTH RESEARCH IN INDIA, INDIAN COUNCIL OF MEDICAL RESEARCH- 1955, 1964 AND 1970

The three reviews on occupational health research conducted in the years 1955, 1964 and 1970 were the only three of their kind sponsored by the ICMR. There have been no further reviews in the area of occupational health thereafter conducted by any government agency or institution. Dr. M.N.Rao was associated with all the three reviews of occupational health research in India carried out under the aegis of the ICMR. A close examination of all the three reviews reveals an interesting pattern in the shifts that have occurred in area of occupational health research in India.

The first of these was published in 1955[2] and Dr. NPV Lundgren and Dr. MN Rao reviewed the literature and research published till then in the field of occupational health in India. The review was divided into different parts, each reviewing the studies conducted on different areas like the Existing Facilities for Industrial Health Research, Industrial Hazards, Environmental Factors and Physiological Reactions, Physiological Norms and Psychological Factors.

Under the first heading, the then existent facilities for industrial research in the country were assessed by them looking at the role of various government organisations and institutions like the ICMR, the Labour Bureau, the Factory Inspectorates, academic institutions and private industries. The section dealing with industrial hazards in the review examined the works published on occupational disease prevalence and commented on the inefficacy of acts like the Workmen's Compensation act in dealing with occupational diseases. Other hazards addressed in the researches included diseases[3] like silicosis[4], tuberculosis, pneumoconiosis, noise deafness, skin diseases and poisoning[5] due to metals like lead and chromium, gases like cyanide, carbon monoxide and industrial solvents like phenol and tetrachloroethylene. The problems of accidents and sickness absenteeism[6] in the industry were also classified as part of industrial hazards. The reports from the governmental or semi-governmental agencies with regard to accidents were seen not to be conforming to international recommendations despite it being mandatory to report serious accidents to central agencies for record, action and publication. The factory inspectorates were

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[2] Rao, M.N. & Lundgren, N.P.V. (1955) A Review of Occupational Health in India, ICMR Special Report Series No.29.

[3] Rao, M.N. (1947) Occupational Diseases and Industrial Hygiene in India: Planning for Labour, A symposium, Labour Publications Trust, Bangalore.

[4] Rao, M.N. (1945) Objective Appraisal of Silicosis- A Physiological Approach to the Problem, Boston, Harvard School of Public Health- Thesis

[5] Banerji, B. (1950) The Problem of Lead Poisoning as Seen in Indian Industries, Proceedings of Social Studies in Industrial Medicine, No.1.

[6] Lakshmanan, C.K., Joshi, S.C. & Rao, M.N. (Jan, 1949) Sickness Absenteeism, Journal of the Indian Medical Association, Vol.XVIII, No.4, pp.117-122.

understaffed and untrained in industrial hygiene and health problems. An increasing trend of accidents was quoted in some of the studies reviewed.

Considerable emphasis was placed on psychological features of workers, like human factors involved in accidents, morale[7] and attitude, motivation and effects of psychological factors on fatigue among workers. Some studies also employed psychological tests[8] for assessing accident proneness of workers or their suitability for jobs.

Physiological reactions to environmental factors like heat, noise, illumination and high altitude was another area of study. Experimental studies analysed the physiological effects of these factors in tandem with other variables like clothing, time of the day and climate in textile units, jute units, foundries and gold mines. The economic costs of alleviating the harmful effects of these environmental conditions were addressed by some of the studies. Physiological norms for physical fitness of the adult worker with respect to pulmonary functions, anthropometric measurements, energy metabolism[9] and body temperature for Indian workers were suggested by a few researchers.

The studies covered and the pattern of the reviews is suggestive of the influence of the dominant stream in occupational health as has been seen in the development and practice in the discipline in the United States in the 20th century. The concepts as they developed there have been applied to the study of health problems of the industrial worker in the Indian context. For example there are about 15 studies in the review that address the psychological aspects of workers in the industry. As was observed in the first chapter, concepts of motivation, morale and attitude and tools like psychological tests were used to assess workers and improve their productivity. Similarly the review includes articles on physiological reactions under various environmental conditions affecting the health and thus the productivity of the workers. These reactions are

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[7] Ganguli, H.C. (1954) A Study on Effect of Union Membership on Industrial Morale, Indian Journal of Psychology, Vol.29, pp.45

[8] Lundgren, N.P.V. (1953) Job Analysis and Placement of Workers, ICMR Symposium on Industrial Health, Bombay.

[9] Sengupta , A. (1953) Assessment of Metabolic Costs in Different types of Jobs in the Jute Industry, ICMR Symposium on Industrial Health, Bombay.

ascertained by way of clinical and experimental studies. These studies were collected and their information collated at a time when occupational health was a fairly new field in India.

The authors felt that in a political and economic environment when industrialisation was seen as the most vital ingredient in fostering the building of a strong, modern nation, there was a need to conserve the limited skilled manpower and to ensure its greater productivity this aspect is the key focus of the activities relating to knowledge generation in the areas of health of the working population. In the review the authors establish the primacy of sound applied research as the basis of well-planned and adequate health measures. The review displays an interest in aspects of organisation of an effective system to deal with occupational health problems along with its accent on traditional occupational health areas as is reflected in its comments on the organisation and implementation of laws like the WC Act of 1923 and the shortage of staff in the factory inspectorates.

This review was prepared at a time when Prof. Lundgren from the WHO, sent to guide the development of the discipline of industrial health in India, was the Head of the Department of the Section of Industrial and Physiological Hygiene at the AIIHPH. As the first author, his is the perspective and pattern of thought followed in the organisation of the first review. Hence the review is divided into a rather conventional pattern following the technical classification of the discipline of occupational health.

But the works of Dr. Rao during this period in time that are included in this review showcase a different perspective. Despite being educated in the American tradition of industrial health he shows a certain nuanced and erudite understanding of the way in which health problems in a developing country have to be approached. His articles emphasise on the need to build a body of knowledge that would suit the Indian conditions and would serve the purpose of organising statistics and legal frameworks in an area that was nearly unexplored in the country. His article on debating the need for compulsory maintenance of sickness absenteeism statistics[10], or the article

[10] Lakshmanan, C.K., Joshi, S.C. & Rao, M.N. (Jan, 1949) Sickness Absenteeism, Journal of the Indian Medical Association, Vol.XVIII, No.4, pp.117-122.

suggesting the need for legal recognition of jute dermatitis[11] as an occupational disease are illustration of this frame of reference.

In 1964 the Second Review of Occupational Health Research, ICMR, Special Report Series No.50 cited many of the studies conducted at the section of Industrial Hygiene and Physiology and was co-authored by BB Chatterjee from the AIIHPH in 1964[12]. By this time Dr. Rao had been the Head of the Section of Industrial Hygiene and Physiology for about 9 years. This review and its organisation are very reflective of his larger perspective, in which he made an effort to look at the problem of industrial health in a more comprehensive manner and as interrelated with the social and economic realities of an industrialising country. Hence the attempt was to look at industrialisation as associated with the problems of urbanisation. According to the review the plans for greater industrialisation and of the country in the inter-census period had resulted in a massive migration of people into cities. The concentration of industrial populations in high densities in the cities gave rise to important problems of public health that included the problem of pollution. The review looked at areas like air pollution[13] and river pollution in addition to subjects addressed earlier.

The worker's efficiency was perceived as being associated with social problems of migration, low wages etc. Though the issues of morale and attitude were dealt with, the worker as a social unit[14] was the focussed upon. Issues of health and nutrition and their relation with wages found importance in many of the studies then reviewed. These problems were not dealt with under industrial psychology, instead these sociological aspects studied along with psychosocial studies under the sub-heading, 'The Worker and his Efficiency'.

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[11] Rao, M.N. (1943) A note on Occupational Dermatitis in the Jute Industry in India, Indian Journal of Medical Research, pp.

[12] Rao, M.N. & Chatterjee, B.B. (1964) Occupational Health Research in India: A Second Review, ICMR Special Report Series No.50.

[13] Chakravarty, M.K & Rao, M.N. (1962) Atmospheric Pollution: A Study in Calcutta, Indian Journal of Medical Research, Vol.50, No.2, pp.295-317.

[14] Ganguli, HC & Chatterjee, P.R. (1959) Social Attitudes and Voting Behaviour in Small Industrial Samples, Indian Journal of Social Work, Vol.20, pp193.

In addition to these studies the review also covered the conventional areas of industrial health hazards, health services provided for the same, sickness absenteeism ergonomics, and occupational physiology. By now a few experimental studies[15] in the area of psychology[16] had begun. There were also articles that pressed the case for the role of professionals like safety engineers[17] and trained social workers[18]. A lot of work in the area of industrial hygiene[19] and health physics[20] had begun by this time. Significantly work on the chemical industry[21] had also begun.

The third and till now the last review of occupational health research was conducted in 1970[22] by NL Ramanathan, MN Gupta and BB Chatterjee along with Rao. The review this time focussed strictly on occupational diseases and medicine where it noted a lack of epidemiological surveys and aetiological diagnostic studies to ascertain the incidence rates of diseases and non-occupational diseases. It also included studies that examined the occupational health services and their administration apart from the physical factors in the working environment, occupational physiology and ergonomics that had been studied in researches included in the previous review. There were now toxicity studies being conducted on manganese.[23] The discipline of physiology[24] was

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[15] Ganguly, T (Nov 15th 1958) An Experimental Study on Workers' Morale and Productivity, Proceedings of the Second Asian Conference on Occupational Health.

[16] Ganguly, T (1958) Group Participation as an Effective Technique to Improve the Industrial Workers' Attitude and Morale- An Experiment, Indian Journal of Psychology, Vol.33, pp.25.

[17] Majumder, N (1958) Role of Engineers in the Industrial Health Service, Alumni Association Bulletin, AIIHPH, Vol.7, pp.18

[18] Narayan, R. (1958) Role of the Trained Social Worker in Labour Welfare, Social Work Review, Vol.5, pp.48

[19] Ramanathan, N.L. (1955) Planned Illumination in the Industry, Phillips Light Bulletin, Vol.11, pp.11

[20] Ramanathan, N.L. (1957) Industrial Health Physics – New Concepts in the Study of Physical Environment in the Industry, Indian Journal of Industrial Medicine, Vol.3, pp.24.

[21] Chowdhury, S. R. (1963) Occupational Hazard in the Chemical Industry, Chemical Industry, Vol. 8, pp.389.

[22] Ramanathan, N.L., Gupta, M.N., Chatterjee, B.B. & Rao, M.N. (1970) Occupational Health Research in India: A Third Review, ICMR Special Report Series No.61.

[23] Narayanaswami, V. & Chowdhury, S.R. (1966) Toxicity of Manganese and its Measurement in Biological Materials, Alumni Association Bulletin, AIIHPH, Vol.16, pp.32

TABLE NO.3.1 (A) CLASSIFICATION OF STUDIES CONDUCTED AT THE AIIHPH FROM 1951-1970

| PERIOD | ENVIRONMENTAL STUDIES OF EFFECTS OF PRODUCTION | | | | PSYCHOLOGICAL STUDIES | | | TOXICOLOGICAL STUDIES | | ERGONOMICS AND PHYSIOLOGY |
|---|---|---|---|---|---|---|---|---|---|---|
| | ON WORKERS | ON GEN ENVMT. | ON PHYSICAL ENVMT | THROUGH MEDICO SOCIAL STUDIES | TESTS | PSYCHO-SOCIAL STUD'ES | EFFICIENCY, WORK ORGANISATION, ATTITUDE AND MORALE | EXPERIMENTAL | GENERAL | |
| **1943 –54** | 7 | - | 4 | 2 | 1 | 1 | 4 | - | - | 1 |
| **1954-1963** | 5 | 2 | 6 | - | 1 | 1 | 5 | - | - | 4 |
| **1964-1970** | 2 | 3 | 5 | - | - | - | 2 | 3 | 1 | 17 |

*Source: Compiled from titles of various studies in the ICMR Occupational Health Reviews, 1955, 1964,1970.*

TABLE NO.3.1(B) CLASSIFICATION OF STUDIES CONDUCTED AT THE AIIHPH FROM 1951-1970

| PERIOD | STUDIES ON THE ORGANISATION OF THE DISCIPLINE | STUDIES RECOMMENDING STATE INTERVENTION THROUGH LEGISLATION | STUDIES ON DISEASES | OTHER STUDIES |
|---|---|---|---|---|
| **1943-54** | 5 | 4 | 1 | 2 |
| **1954-1963** | 9 | - | - | 3 |
| **1964-1970** | 4 | - | 1 | 5 |

*Source: Compiled from titles of various studies in the ICMR Occupational Health Reviews, 1955, 1964,1970.*

given increasing importance. In the review the authors expressed the need to shift from observational and survey studies to experimental and clinical studies[1]. And significantly enough the sociological studies that had found place in the review of 1964 are fewer in number and there were increasing number of studies in the areas of industrial hygiene, ergonomics and physiology.

## PUBLICATIONS OF THE SECTION OF INDUSTRIAL HYGIENE AND PHYSIOLOGY, AIIHPH

The following section is an analysis of the studies done at the AIIHPH during the periods that were represented by the three reviews. The tables below give the trends in studies in the three periods.

From the Tables 3.1 and 3.2 the following can be concluded:

- During the period that corresponds with the first review there are many studies examining the effects of the production process on the workers[2] and on the physical environment at the workplace[3]. Two of the total environmental field studies were medico social[4] studies both of which were conducted by Prof. MN Rao. Travelling from the period covered by the first review to the third review the medico social studies are conspicuous by their absence.

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[1] Ramanathan, N.L., Gupta, M.N., Chatterje, B.B. & Rao, M.N. (1970) Occupational Health Research in India: A Third Review, ICMR Special Report Series No.61, pp.4

[2] Ghosh, P.K., Chakraborty, M.K. & Rao, M.N. (March, 1952) A Study of the Occupational Lead Hazard in two Electrical Accumulator Industries, Indian Medical Gazette, pp. 114-117.

[3] Subramanyan, K. & Majumdar, N. (October, 1951) Environmental Conditions within Jute Mills, Indian Journal Medical Research, Vol.39, No.4, pp.595-623 and other such studies on flour mills, foundries etc. Refer to Appendix II, pp.iv.

[4] Rao, M.N. & Ganguli, H.C. (1950-51) Women Labour in the Jute Industry of Bengal – A Medico-Social Study, Indian Journal of Social Work, Vol.11, pp.181-191; Rao, M.N.& Ganguli, H.C. (1951) V.D. in the Industrial Worker- A Medico Social Study, Indian Journal of Social Work, Vol.11, pp.381-387.

- Over the subsequent periods the studies involving the examination of the physical environment at the work place show a remarkable increase[5], as compared to those examining effects on workers. Also the studies on environmental concerns of industrialisation on the environment outside the factory, eg. Studies on air pollution made an appearance in beginning of the period represented by the second review.
- During the first period psychological studies were very important and most of them explored workers' morale and attitude and their relationship with factors like union membership, items in the wage structure and so on. Only one study examined the issue of job analysis and selection of worker and this was interestingly conducted by NPV Lundgren, deputed from the WHO to guide the setting up of the department for industrial hygiene at the AIIHPH.
- The accent during the first two reviews was on the creation of a systematic body of knowledge that would serve the purpose of effective intervention at various levels for safeguarding and promoting the health of industrial workers. Hence there are three studies examining the need and viability of legislation[6] in various areas of workers health, all of which were marked by the involvement of Prof.Rao. Similarly specific features of diseases like silicosis and jute dermatitis[7] were studied in order to collect data and create a profile of occupational diseases in the Indian industry. Such studies are absent in the Second and the Third Review periods.

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[5] Ramanathan, N.L (1962) Industrial Hygiene Survey in a Light Engineering Works, Indian Journal of Industrial Medicine, Vol.8, pp.18-32

[6] Lakshmanan, C.K., Joshi, S.C. & Rao, M.N. (Jan, 1949) Sickness Absenteeism, Journal of the Indian Medical Association, Vol.XVIII, No.4, pp.117-122.; Rao, M.N.& Ganguli, H.C. (April, 1952) Industrial Noise as a Health Problem, Journal of the Indian Medical Association, Vol.XXI, No.7, pp.320-325.

[7] Rao, M.N. (1943) A Note on Occupational Dermatitis in the Jute Industry in India, Indian Journal of Medical Research,; Rao, M.N. & Banerji, B. (June, 1952) Does Occupational Dermatitis exist in Indian Industries? Indian Medical Gazette, pp.265-268.

- There are also a number of studies that attempt to establish occupational health as an important field linked to issues of labour welfare and industrialisation[8]. These studies move in an interesting pattern. In the two latter review periods the accents of such articles and studies is the promotion of specific specialities like industrial health physics[9] and professions like those of the engineer[10] and the industrial doctor. The growing complexities in technology also give rise to studies addressing new areas like atomic energy[11].
- The toxicological studies that did not mark the scene during the First and the Second reviews make an appearance during the third review. These include general articles on the chemical industry and experimental studies on manganese poisoning[12]. The recognition of the problem of industrial waste disposal[13] is also illustrated in two studies carried out during the latter two reviews.
- The new awareness regarding the problems of air pollution[14] associated with industrialisation prompted studies in the area during the second review period.

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[8]Rao, M.N. (1948) Industrial Hygiene and Labour Welfare, Indian Conference of Social Work; Rao, M.N. (1947) Occupational Diseases and Industrial Hygiene in India, Planning for Labour- A Symposium, Labour Publications Trust, Bangalore, 377.

[9] Ramanathan, N.L. (1957) Industrial Health Physics – New Concepts in the Study of Physical Environment in the Industry, Indian Journal of Industrial Medicine, Vol.3, pp.24.

[10] Majumder, N (1958) Role of Engineers in the Industrial Health Service, Alumni Association Bulletin, AIIHPH, Vol.7, pp.18

[11] Ramanathan, N.L (1956) Impiication of the Use of Atomic Energy on Occupational and Public Health, Alumni Association Bulletin, AIIHPH, Vol.3, pp.34

[12] Narayanaswami, V. & Chowdhury, S.R. (1966) Toxicity of Manganese and its Measurement in Biological Materials, Alumni Association Bulletin, AIIHPH, Vol.16, pp.32; Chowdhury, S.R.& Chatterjee, B.B. (1965) Preliminary Observations on Nicotinic Acid Metabolism in Lead Poisoning, Alumni Association Bulletin, AIIHPH, Vol.15, No.29, pp.20-24

[13] Chakravarty, R.N. (1964) Potash Recovery- A Method of Disposal of Distillery Waste and Saving Foreign Exchange, Chemical Age of India, Vol.15, No.1

[14] Chakravarty, M.K & Rao, M.N. (1962) Atmospheric Pollution: A Study in Calcutta, Indian Journal of Medical Research, Vol.50, No.2, pp.295-317.

The number of studies examining only the physical environment in the factories has increased[15].

- There is a remarkable increase in the number of physiological and ergonomic studies that attempt to create anthropometric and physiological standards for the Indian workers[16]. Ergonomic aspects of work are also beginning to be explored at this point in time after the 1960s.
- Both the subsequent reviews show a trend of moving towards greater usage of experimental and clinical methods[17] in ascertaining psychological and physiological responses of the human body and select workers accordingly.
- The studies examining accidents remain more or less the same in nature in that they continue to examine the role of human factors[18] or personality characteristics of workers involved in accidents.
- As for the other studies they reveal an increasing interest in the conditions of morbidity of workers in the small sector[19] during the second and third review periods, but these too are studies that have the involvement of Prof. MN Rao. .

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[15] Chakraborty, M.K., Mukherji, R.N., Bose, A.K. and Gopalakrishnan, N (1964) An Industrial Hygiene Survey in a Lead Smelting Factory, Indian Journal of Industrial Medicine, Vol.10, pp.145-158

[16] Saha,P.N. , Sita Devi, A. and Rao, M.N. (1963) Seasonal Variation in Basal Metabolic Rate in Indians, Indian Journal of Medical Research, Vol.51pp.153-163; Ramanathan, N.L. and Datta, S.R. (1968) Energy Cost and mechanical Efficiency of Climbing Stairs with Loads, Current Science, Vol.37, No.13, pp.366-367.

[17] Ganguly, T (1958) Group Participation as an Effective Technique to Improve the Industrial Workers' Attitude and Morale- An Experiment, Indian Journal of Psychology, Vol.33, pp.25.; Ganguly, T (Nov 15th 1958) An Experimental Study on Workers' Morale and Productivity, Proceedings of the Second Asian Conference on Occupational ; Chowdhury, S.R. (1963) Pre-Employment Serum Enzyme Determination for Evaluation of Fitness of Workers, Indian Journal of Industrial Medicine, Vol.9, pp.145-155

[18] Banerji, D& Ghosh, S. (1969) An Analysis of three Psychological Characteristics of Automobile Industrial Workers involved in Accidents, Indian Journal of Occupational Health, Vol.30, pp.643; Ghosh, P.K. (1954) Human Factors in Accidents, Proceedings of Society for Studies in Industrial Medicine, No.6, pp.168

[19] Mitra, S.K. & Rao, M.N. (1970) A Critical Analysis of 200 Accidents in Small Sized industries in Calcutta, Indian Journal of Industrial Medicine, Vol16, pp.75

A more detailed examination of Prof. M.N. Rao's works would be instructive in understanding his perspective, which guided the organisation of research at AIIHPH from the early 1950s to 1970. Rao was the author of many works and his writings at this nascent stage of the discipline are very insightful of the issues he considered important for the development of a sound field of study and practice that would offer solutions to the problems of industrial workers in those times.

Studies Conducted by Prof. MN Rao

The book titled 'The History of Public Health in India'[20] that Rao co-authored with KK Radhalaxmi is reflective of his perspective of public health. He sees public health practices as rooted in the social practices and the history of a society. His assertion was that modern principles of health could be assimilated only if they are attuned to the beliefs and practices of society. He defined public health as a social science closely related with other social sciences and dependent on the economic practices of a community. He located Indian public health practices in the ancient treatises and religious texts. His reconstruction of public health history in India includes a review of issues as wide-ranging social security as was applicable to Indian society, ancient labour codes, health and medical education, medical services, development of nursing as a profession, town planning, sex-education, rights of marginalized groups such as women, harijans, lepers and control of prostitution and vital statistics before the advent of modern western medicine in this country. All of this according to him merited attention as part of public health.

In the context workers health as part of public health he mainly examined labour legislation as part of its role to protect the rights, interests and health of working populations and criticised acts like the ESI for being conceived in a hurry and being paternalistic in spirit. Recognising that in the complexities of modern societies labour has been subjected to much privation and neglect.

Dr. Rao's work in the area of occupational health commenced much before the formal opening of this Section at the AIIHPH. He was the author of many works in the field of

[20] Rao, M.N. & Radhalaxmi, K.K. (1960) History of Public Health In India, Navana Printing Works, Calcutta.

occupational health. Many of his earliest writings spanned a wide range of issues. They are an affirmation of his keen vision of the need of developing a body of knowledge that emerged from and served the purpose of providing solutions to the health problems of industrial workers in a newly independent developing country like India.

He examined policy issues and championed the cause of State intervention through expansion of legal definitions and promulgation of legislations in the field of occupational health. His earliest articles on occupational dermatitis and sickness absenteeism records are an affirmation of this commitment. This is demonstrated in his assessment of industrial noise as well albeit his recognition of limits to the efficaciousness of State intervention in a capitalist economy.

In 1943 he published one of his first studies on occupational dermatitis[21] among the workers in the jute industry in India. He concluded that mineral oil, a component of the batching oil used to treat the jute, causes occupational dermatitis seen among the workers. He opined that the poor economic status of the workers along with their unhygienic habits was contributing factors to the causation of the problem. Finally he made a case for recognising jute dermatitis as an occupational disease, since its causation conforms to the definition of the committee on industrial dermatosis and syphilology of the American Medical Association (AMA). His other study on occupational dermatitis in Indian industries[22] asserted that dermatitis did exist in various manufacturing sectors of the Indian industry but only dermatitis caused due to chrome ulceration or its sequelae was compensable in India. Rao urged that the scope of the list of occupational diseases mentioned in the Workmen's Compensation Act be enlarged and that the industrial physician be made more aware of these diseases.

MN Rao was also part of the Sub Committee on Industrial Health of the Industrial Health Advisory Committee of the Indian Research Fund Association. The sub committee was instituted to examine the feasibility of the passage of a legislation to

[21] Rao, M.N. (1943) A note on Occupational Dermatitis in the Jute Industry in India, Indian Journal of Medical Research, pp.

[22] Rao, M.N. & Banerji, B. (June, 1952) Does Occupational Dermatitis exist in Indian Industries? Indian Medical Gazette, pp.265-268.

enforce the maintenance of adequate sickness absenteeism records in the industry[23]. Sickness absenteeism was defined as the time lost in industry due to illness of the workers. Rao emphasised on the significance of recording absence due to sickness due to its usefulness to the employer, the individual and the community. The analysis of these records was deemed effective and beneficial to the industry in identifying the kinds of problems that cause most loss of time and resources. This was important to create a database on these work related aspects like details of the illness, the kind of medical facility accessed and distribution of illnesses by sex and age.

While recognising the resource constraints faced by small units, (both financial and in matters of expertise), the accent of the recommendation was on maintaining records mainly for permanent workers in large establishments so that the records would be complete and would benefit majority of the workers. This understanding is much in tune with the policies that have been pursued by the State in the context of labour, post-independence. In the earlier chapter we have seen how such policies addressing only a select section of the workforce has intensified the cleavages between the formal and the informal sectors in labour, further eroding the rights and well-being of the workers in the small and the informal sector. This is despite the knowledge that the conditions of work in small establishments are worse than in the larger ones and the small sector served the purpose of providing employment and subsidising production costs for many large industries. In the recommendations Rao suggested that in the Indian context it would be better to educate employers to maintain records rather than compelling them. The country at this point also awaited the passage of social insurance for cover of industrial workers (later the ESI), hence the committee felt that another legislation would be immature at that stage and the government should in the meantime encourage the maintenance of sickness absenteeism records in the large scale establishments.

The article on Industrial Noise[24] reviews available studies and reports their findings. After reviewing various studies done in India and all over the world the authors

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[23] Lakshmanan, C.K., Joshi, S.C. & Rao, M.N. (Jan, 1949) Sickness Absenteeism, Journal of the Indian Medical Association, Vol.XVIII, No.4, pp.117-122.

[24] Rao, M.N.& Ganguli, H.C. (April, 1952) Industrial Noise as a Health Problem, Journal of the Indian Medical Association, Vol.XXI, No.7, pp.320-325.

concluded that high factory noise of the order of 100 decibels was not a serious handicap to the working efficiency of workers in any industry. They identified cement factories, flourmills, India rubber goods, telephone, telegraph and armament industries as noisy industries in India

Noise can cause hearing impairment, physiological reactions akin to those produced by emotions of fear, causes mental fatigue and irritation.

Rao and Ganguli also felt that the women workers or those who are psychologically maladjusted or suffering from some functional disorder should be given a less noisy form of employment. Though this understanding reveals a sensitivity towards women and disturbed individuals, on the flip side, this recommendation could very well be used to keep certain sections like the above mentioned out of the workforce and the use of pre-employment medical examinations could very well serve the purpose of doing so. The author also advocates the use of ergonomic solutions to decrease the ill-effects of noise on the workers through interventions in the area of work like equipment and protective measures to protect them from the ill effects of loud noise, proper maintenance of machinery, and substitution of noisy processes for less noisy ones.

The authors also conceded that within a capitalist system the best safeguard is to use the notion of enlightened self-interest of the industrialist by creating a consciousness about the losses he would incur owing to workers impairment due to noise. Second to that the State should officially declare noisy industries as dangerous industries, along with declaration of loss of hearing as an occupational disease and allowing compensations for that loss simultaneously laying down the maximum permissible levels of noise for all newly constructed factory buildings.

Glimpses of Rao's nuanced understanding of health can be seen in the medico-social studies on women's labour and venereal disease among industrial workers that he undertook in the 1950s after the establishment of the Department of Industrial Hygiene and Physiology at AIIHPH. His work is indicative of a perspective that gave credence to workers' experiences and sought out the social and economic factors that created disabling conditions in order to intervene through legislative or administrative measures at those levels outside the work place.

His study with colleague Ganguli, on women labour in jute industry[25] takes cognisance of the many social roles of women workers who were a fast growing part of the labour force. The authors felt that their social, physical and physiological differences warranted special attention to the health problems that they could face in the industry. The study found that all the workers were married and they joined work in the jute industry in circumstances of economic duress. Living in nuclear families they had to perform the household chores over and above their work in the factory. The authors advocated that this dual role undertaken by women be kept in mind when legislating on hours of work in the factory in order to avoid fatigue that many of the interviewed workers complained of. In the absence of sufficient data on the effects of factory work on the reproductive patterns of women workers this study attempted to make a comparison of reproductive health of control and experimental groups. It reported a significant increase in vital losses on account of industrial employment among the women engaged in the jute work, which included miscarriages, stillbirths and neonatal deaths. The authors also positively noted that though the women were illiterate they were sufficiently accurate and mindful as regards the results of their conception.

In the second study that Rao and Ganguli conducted during this period they examined the prevalence of venereal diseases[26] in the industrial population of Calcutta. Their definition of the industrial worker included the permanent factory worker along with the other workers like the unscheduled worker, the coolie and the transport-man. Most of them fell in the 21-30 years age group and were married. The data revealed that more than 90% of those who contracted venereal disease were those who were either bachelors or due to circumstances forced to lead a single life. Many of them were living with their wives at the time of exposure but compelled to live in the same room with his wife and other family members creating conditions that were unfavourable to normal marital relations. Rao's assertion that this pointed to the need for sufficient industrial housing to control venereal disease in industrial workers, is a clear instance of his comprehensive conception of worker's health as being shaped by events and

[25] Rao, M.N. & Ganguli, H.C. (1950-51) Women Labour in the Jute Industry of Bengal – A Medico-Social Study, Indian Journal of Social Work, Vol.11, pp.181-191.

[26] Rao, M.N.& Ganguli, H.C. (1951) V.D. in the Industrial Worker- A Medico Social Study, Indian Journal of Social Work, Vol.11, pp.381-387.

opportunities beyond the workplace and the role the state could play in mitigating those disease producing circumstances.

Nearly four fifths of the workers consulted some sort of medical men or the other as soon as the first symptoms of disease appeared, very few considered cost a criteria for choice of care. The lack of accurate data regarding the incidence of venereal disease in India was a handicap in assessing the magnitude of the problem, but an estimate of 10% of the population was made by some of the studies. Rao and Ganguli believed that curative and preventive strategies were necessary for controlling the problem. The curative method included the treating of the patient and the source. The preventive method would include the improvement of living standards, provision of adequate housing and educating the working population as a group. For ensuring effective treatment of the infected, the workers needed to be assured that they would not discriminated against or victimised in any fashion and this required the cooperation of the employer. His recommendations are also demonstrative of his sensitivity to the social meanings of the disease, which have to be addressed at varying levels in order to deal with the problem holistically.

Rao's focus on various aspects of workers health also led him to study issues other than those that were regarded traditionally as 'health' or 'medical' issues. Thus he also made suggestions regarding the organisation of industrial canteens in India[27]. He recommended the setting up of management-subsidised canteens in the factories. These would serve the purpose of providing a nutritious meal to the workers and also of improving employee-employer relations.

With a perspective to establish firmly the discipline of industrial health as an important part of basic medical training he wrote on the need for integrating industrial medicine and hygiene into the teaching of modern medicine at the undergraduate level[28].

With an interdisciplinary perspective he also commented on the public health significance of various aspects of industrialisation. Here he felt that one could not

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[27] Rao, M.N. (1952) Organisation of Industrial Canteens, Indian Journal of Social Work, pp.120-128

[28] Rao, M.N. (1966) Industrial Health in Medical Education, Indian Journal of Medical Education. Vol.5, pp.313-317

underestimate the problems that industrialisation[29] and its associated effect of urbanisation had generated, like those of a lopsided sex ratio, maladjustment syndromes, lowered health status of women, poor nutrition and rapid population growth. Similarly he stressed on the need to build synergistic approaches of occupational health with other fields like labour welfare[30].

By the 1960s he was also involved in studying other environmental effects of industrialisation like air pollution. Rao and Chakraborty then carried out a three-year study to examine this problem in the city of Calcutta[31]. Monthly estimations of the contaminants such as soot, sulphur dioxide, oxides of nitrogen, respirable dusts and other were made. The paper reviewed the possible effects of air pollution as a public health problem. The problem entailed economic losses, death and accidents in cases of acute cases of pollution and possible effects of chronic exposure.

He also studied the occupational health hazards posed by lead in two electrical accumulator industries[32] Ghosh, Rao and Chakraborty assessed lead absorption by testing blood, urine and environmental air of the exposed workers. A comparison was made between a modern factory with adequate equipment for plant sanitation and another, which was more like a cottage industry doing the job in a primitive form. There was not a single case of lead absorption in the modern factory with adequate preventive measures whereas the second factory showed 40% of the high absorption cases. This study clearly showed the need to develop innovative measures in order to address the problems that are seen to be rampant in small factories that are part of the unorganised sector. But the authors did not comment upon this.

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[29] Rao, M.N. (1966) Public Health Significance of Some Important aspects of Industrialisation in India, Journal of Indian Medical Association, Vol.46, pp.78-82

[30] Rao, M.N. (1948) Industrial Hygiene and Labour Welfare, Indian Conference of Social Work

[31] Chakravarty, M.K & Rao, M.N. (1962) Atmospheric Pollution: A Study in Calcutta, Indian Journal of Medical Research, Vol.50, No.2, pp.295-317.

[32] Ghosh, P.K., Chakraborty, M.K. & Rao, M.N. (March, 1952) A Study of the Occupational Lead Hazard in two Electrical Accumulator Industries, Indian Medical Gazette, pp. 114-117.

Studies Conducted by Faculty Members other than MN Rao

The earliest efforts to address the issue of research in the area of workers health through a formal institutional set-up were through the activities of the Industrial Health Research Unit of the Indian Research Fund Association, and later through the newly established Section of Industrial Hygiene and Physiology at the All India Institute of Hygiene and Public Health. The primary emphasis of the research work done by the Section of Industrial Hygiene and Physiology, AIIHPH was the health of the industrial worker due to the centrality of industrialisation to the development of the country. Thus the notion of occupational health was limited to industrial health at the institution.

The approach to workers health as occupational health- industrial hygiene, ergonomics, industrial psychology and occupational medicine was borrowed from the already existent body of knowledge in the west, especially countries like the United States of America and the United Kingdom. The development of workers health into these many fragmented disciplines has already been discussed in the second chapter tracing the context in which birth and developments of these disciplines. The more sophisticated development of these fields of knowledge in these countries and their powerful influence as leaders of modern development fostered a dependence on their technical expertise and approaches to workers health. Experts like Prof. NPV Lundgren were deputed by the WHO to foster the development and guide the setting up of the research and educational department in of the area of workers health, reduced now to Industrial Hygiene and Physiology. The influence of the specialised disciplines mentioned above is very clearly visible in the pattern of research generated in the area of health of industrial workers in India as well with American standards and their definitions of occupational disease being used as reference points in order to assess and further develop interventions in India.

There were studies by other faculty members at the department and at other departments of the AIIHPH. Most of these studies were in this dominant tradition of occupational health, involving experimental studies or studies observing physical agents in the working environment or examining the psychological attributes like

attitude, morale etc of industrial workers. All the studies are essentially aiming to study and create conditions where productivity of the worker would be maximised. This is done with a clinical separation of social, political and economic factors that operate recursively in society to produce the whole that the work situation appears to be.

The studies conducted during the initial years at the AIIHPH at least acknowledge the important role that these factors play in affecting the workers ability to perform. And they do consider the study of availability of civic amenities an important part of the study of the environment. The study by Subramanyan and Majumdar, of the sanitary engineering section is one such study. Their study in 1952[33] examined the environmental conditions in jute mills. The physical environment within jute mills was studied since the authors considered it to have an appreciable influence on the efficiency, output and health of the workers. But the researchers considered it to be limited by the skill, intelligence, nutritional state and acquired immunity against particular diseases. They recognised that the environment outside the factory was likely to influence the health, efficiency and mental attitude of the workers. But the home environment was seen as part of the general social problems in society, which the authors felt was out of their scope of intervention. The problems with the environment in the factory could be sufficiently addressed if driven by the self-interest of the industrialists. They would not have a stake in the problems that accrued from the home environment.

Data was collected from the various departments of the mill on the levels of temperature, the humidity, the illumination, dust concentrations and their effects on absenteeism, accidents and production. Amenities within and outside the jute mill were also taken into consideration. In order to alleviate the problems posed by the uncomfortable levels of temperature and dust concentrations within the mill, the researchers suggested mechanical ventilation to bring comfort to the workers and resultantly to help in increasing the rate of production. As for the rate of accidents, the authors conceded that there were several extraneous influences that could not be eliminated to find out how far the working environment alone was responsible for

[33] Subramanyan, K. & Majumdar, N. (October, 1951) Environmental Conditions within Jute Mills, Indian Journal Medical Research, Vol.39, No.4, pp.595-623.

accidents. According to them the skill of the worker, his accident proneness and mental condition would also have an effect on the rates of accidents along with the nature of the operation, the efficiency of safety measures, the working environment and the state of mental fatigue. The highest accident rates were recorded in departments with lower floor space and in summer when the air temperatures were higher and so was the air stagnation. Though production was seen to drop with an increase in temperatures beyond 85F the authors could not see any direct correlation between production and conditions of temperature, humidity, lighting and air velocity. Though many of the machines were caged safety precautions were inadequate.

Though amenities like piped water, latrines, urinals and a club were provided within the mill compounds, the sanitation facilities and living conditions of the workers were far from satisfactory. As a continuation of this series of studies both the researchers also studied the environmental conditions in two fairly large flourmills[34]. Workers there needed special protection. The hazards caused due to dust had been greatly reduced in other departments due to the adoption of local exhaust ventilation. The workers lived in the local bastis and were not provided any accommodation by the mill employers. There had been no accidents in the first mill whereas the second one had reported only 6 accidents in all.

Though the authors focus primarily on the physical environment they give credence to the influence that the social environment at home and the other amenities at the workplace have on workers performance and health. But they do not see the conditions at the workplace also contribute to create the disabling conditions at home and that the lack physical amenities is not a mere isolated neutral event but is strongly entrenched in the societal circumstances that shape the possibilities of work availability and opportunities therein.

In studies that do examine the poor conditions of work at these units many authors see education of workers as the panacea to all the problems even after recognising the conditions of want and lack of bargaining capacity of the workers. Mitra and Rao of

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[34] Subramanyan, K. & Majumdar, N. (January, 1953) Environmental Conditions within Flourmills, Indian Journal Medical Research, Vol.39, No.4, pp.123-140.

the AIIHPH's Urban Health Centre at Chetla[35] examined the physical working conditions of small industrial establishments. Of 104 units surveyed only 10% had concrete roofs, 33% had kuttcha floors, 34% had own water supply system, only 15% had drainage facilities, 29% had washing facilities and 35% had toilet facilities. Most of them had uncomfortable environmental conditions due to high heat and humidity, poor ventilation and prevalence of dust. After observing all this the researchers opined that the conditions in these establishments could improve with subsidies and education. The studies examining the physical environment at the workplace in the subsequent review periods do not even pay lip service to the role of social and political factors in defining the nature of work and determining the conditions that contribute to the worker's choice to engage in low-paying, often strenuous and dangerous work.. They merely observe the existing conditions and measure the temperature or concentration of dust in the environment and examine the effect of the same on the bodies of the workers by measuring physiological responses. Saha et al[36] examined physiological strain due to thermal stress in two foundries in Calcutta. The researchers observed negligible dehydration during winter but it was found to be significantly high in the hot-dry season. Significant circulatory fatigue was also observed in the hot-dry and hot-humid seasons.

An industrial hygiene survey at a lead smelting factory[37] revealed a large quantity of lead dust about 2000lbs was released daily into the atmosphere along with huge quantities of sulphur dioxide. An examination of the in-plant environmental conditions showed high concentrations of lead and sulphur dioxide along with chronic lead poisoning among some workers which was ascertained by analysing urinary excretion of lead.

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[35] Mitra, S.K. & Rao, A.V. (1966) Physical Working Conditions at Small Industrial Establishments at Chetla, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.16, No.30, pp.3-11.

[36] Saha, P.N., Sengupta, A. & Rao, M.N. (1962) Thermal Stress and Physiological Strain in Foundry Operations, Indian Journal of Medical Research, Vol.50, pp.282.

[37] Chakraborty, M.K., Mukherji, R.N., Bose, A.K. & Gopalakrishnan, N.(1964) An Industrial Hygiene Survey in a Lead Smelting Factory, Indian Journal of Industrial Medicine, Vol.10, pp.145-158.

Studies conducted in the area of industrial psychology have been part of the first review of occupational health research. The review recognises that 'the industrial worker as a social unit outside his workplace warrants more study to evaluate his total health.' Hence attention has been paid to aspects like voting behaviour, nutrition and availability of wages. Ganguli and Chatterjee tested the relation between social attitudes voting behaviour between Bengali and Hindi speaking workers[38]. Within both these groups also the professionals seemed to be less radical than the working class. The Bengalis voted for either the Communist Party of India (CPI) or the Congress. Those who voted for the CPI were seen to be 'tougher minded' towards social issues. This was a more or less homogenous pattern for this group of people. The proportion of Congress voters among the Hindi speaking workers was the highest, and they were more conservative than those who voted for the CPI.

The influence of the dominant stream in industrial psychology is more than visible in the choice of subjects of study at the AIIHPH. The discipline the way it is conceptualised and utilised reflects a fundamental bias in favour of the employer. The studies conducted at the AIIHPH have adopted the same paradigm rather unquestioningly and without even commenting on some of the conclusions that are drawn from their works. For e.g. Ganguli studied effects of union membership on morale[39] of industrial workers and he found that non-union members had a mean morale score significantly higher than unionised workers. T Ganguly[40] also reported an inverse relationship between educational qualifications of workers and morale. These findings have grave implications for the issues of education for all and the power of collective bargaining of workers to demand their rights at the workplace.

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[33] Ganguli, HC & Chatterjee, P.R. (1959) Social Attitudes and Voting Behaviour in Small Industrial Samples, Indian Journal of Social Work, Vol.20, pp193.

[39]Ganguli, H.C. (1954) A study on Effect of Union Membership on Industrial Morale, Indian Journal of Psychology, Vol.29, pp.45

[40] Ganguly, T. (1954) Study of Industrial Tension through an Attitude Survey in a Large Steel Industry, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.1, pp.82.

In a later study on women workers'[41] it was seen that their attitude towards work was significantly affected by their relation with the supervisors. To measure worker attitudes towards the employment relationship attempts were made to measure the influence of factors like age, education, length of service, weekly production, membership in the union, and monthly income on their attitudes[42]. But the author admitted that such studies of factors affecting attitudes of workers did not provide complete explanations of change in workers attitudes. Another study by Ganguli[43] adduced evidence to show that conditions of adequate communication led to an improvement in performance and relations between employers and employees. The reasrecher also resorted to labelling of the workers responses to frustration and alienation experiences at work as 'problems' for achieving the goal of ever-greater productivity. He studied human relations[44] in a government owned engineering factory. The study examined various 'maladjusted' workers. Manifesting 'problems' of aggression like absenteeism, strikes, or the problems in the apathetic workers who acquiesce to minimum demands of industry and are rather uncomplaining. The study concluded that 43% of the workers preferred autocratic leadership, 1.1% prefers bureaucratic leadership and 44% of them prefer democratic leadership.

Very few studies in the realm of accidents and safety stress on the role of interventions like the organisation of effective safety committees in bringing down the incidence of accidents. Pant's study in a soap factory in Bombay[45] testified the efficacy of a well-organised safety committee in the industry in reducing accidents. The accident rate in the vanaspati soap factory came down from 171.3 per thousand employees per month in 1951 to 40.3 per thousand employees per month in 1959 due the active intervention of the safety committee.

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[41] Ganguly, T. (1955) Attitude Survey of Women Workers in a Calcutta Factory, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.2, pp.37.

[42] Ganguly, T. (1957) A Discussion of Some Variables Affecting Attitudes of Industrial Workers,

[43] Ganguli, H.C. (1961) On Communication in Industries, Indian Labour Journal, Vol.2, pp.11

[44] Ganguli, H.C. (1961) The Supervisor: His Functions and their Effectiveness, Indian Journal of Social Work, Vol.21, pp.451

[45] Pant, NM (1959) Safety Organisation in the Vanaspati Soap factory in Bombay, Indian Journal of Industrial Medicine, Vol.8, No. 8

The others continue to resort to a nit-picking approach where individual's personality traits are blamed for the accidents and not the problems with the machine, or the lack of training or the organisation of production and the speed of work that is controlled by the management. Mukhopadhyay and Sircar's[46] study of accident trends in an engineering factory concluded that faulty operations and unsafe acts were chief causes of industrial accidents. The analysis of accidents among contract workers according to them yielded data showing that the human factor was responsible for the majority of the accidents and unsafe acts were the 'single chief cause' of accidents.

Ghosh[47] stressed on the important role of personal factors that played a role in persons who had multiple accidents in a year. Sickness absenteeism was examined among workers in an organised sector factory in Calcutta[48]. There were seasonal variations the incidence sickness and accidents. The accidents were highest in the period from September to October and lowest in January. The reported occupational accidents were twice as frequent as injuries outside the workplace. Per 1000 planned man-days 25-30 were lost due to sickness.

The solutions to these safety problems was sought in preplacement examinations of workers and in educating them. Majumdar and Basak[49] studied accidents in different industries of West Bengal and considered their causes, effects and preventive aspects. The data was collected from the ESI Corporation of the state. The accidents were observed to have decreased with advancing age and could have been prevented by educating the workers, pre-placement examinations and by providing adequate guards for machinery. Ramanathan[50] suggested the development of a programme for the development of special Industrial safety equipment in India.

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[46] Mukhopadhyay, R.N. & Sircar, A.B. (1968) A Case Study of Accident Trends in an Engineering Factory, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.18, No.36, pp.3-6

[47] Ghosh, P.K. (1954) Human Factors in Accidents, Proceedings of Social Studies in Industrial Medicine, No.6, pp.168

[48] Bas, S.K., Banerji, B., Dutta, R.C. &Rao, M.N. (1961) Seasonal variation of Health in a Calcutta Factory, Indian Journal of Industrial Medicine, Vol.8, No.50

[49] Basak, B.C. & Majumdar, N. (1966) Accidents in Industry, Indian Journal of Industrial Medicine, Vol.11, pp.1-8.

[50] Rmanathan, N.L. (1963) Industrial Hygiene and Safety, Swasth Hind, Vol.7, pp.1-4

Over the second and third review periods the unusual increase in the ergonomic and physiological studies as compared to studies in other areas is an evidence of the further narrowing down of perspectives and parameters of health to the micro level indicators in the human body. But many of these efforts were also useful in trying to assess energy costs for workers in the unorganised sector like load carriers, which would serve the purpose of laying standards for load carriage in our context of health status, climate and nutrition. The pedalling ergometer[51] constructed at the Section of Physiological and Industrial Hygiene, with financial assistance from the ICMR, to study the physiological responses of human beings during exercise could be of use for such exercises. Preliminary studies conducted using the ergometer showed that the oxygen consumption of different volunteers at different loads was indicative of the proportionality of the workload and the metabolic costs.

THE PERSPECTIVES OF RESEARCH AT THE AIIHPH

The earliest writings of Dr,M.N. Rao, the first Head of the Department of the Section of Industrial Hygiene and Physiology at the All India Institute of Hygiene and Public Health, in the late 1940s and the 1950s reflect efforts to build an indigenous body of knowledge. This mirrored the spirit that prevailed in the newly independent India with the leaders at the helm, envisaging the making of a modern, independent, industrially developed nation. Embarking on the effort depending on the available resources and within constraints both economic and technological, but with a will to build a strong foundation in every conceivable sphere seminal to modern development.

Hence his first article pertaining to occupational dermatitis[52] identifies the disease as existent in jute industries in the Indian context and advocates the recognition of the same by way of enlarging the scope of the WC Act to include the same. This **effort to create a database on as wide a range of issues** as possible regarding the case of the

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[51] Ramanathan, N.L., Chakravarty, M.S. & Mukherjee, R.N. (January, 1958) A Pedalling Ergometer with a Dynamo Brake, Indian Journal of Medical Research, Vol.46, No.1, pp.129-135.

[52] Rao, M.N. (1943) A note on Occupational Dermatitis in the Jute Industry in India, Indian Journal of Medical Research, pp.; Rao, M.N. & Banerji, B. (June, 1952) Does Occupational Dermatitis exist in Indian Industries? Indian Medical Gazette, pp.265-268.

Indian industrial workers is also well evinced in his attempt to study various sectors of the workforce like women workers[53], incidence of venereal diseases[54] among industrial workers, or the problem of industrial noise[55] and its effects on health.

Well-recognising the constraints of resources and the capitalist path of development chosen by the State he advocates for maximum possible coverage and benefits to as many workers as possible.

The author has a Chadwickian position in that he takes the capitalist path for given and advocates measures to make the workers situation as good as it can get within its prescribed boundaries. He candidly maintains, that the amelioration of workers ill-health and interventions for the same can be possible only within the boundaries of the capitalist's self interest, like in the case of the article which discusses the feasibility of legislation for making sickness absenteeism records[56] mandatory in industries. Within this frame of reference the State would have to enact legislation in order to control the damage that individual capitalists could cause to the workers in the pursuit of self-interest. But it becomes most important to impress upon the employer the monetary losses that he could incur in case of sickness of the workers.

Despite this very instrumental notion of the worker the approach towards understanding workers health is closer to a social epidemiological perspective, where there is a recognition of the need to examine the social and economic factors that are important co-ordinates of ill-health and disease in the workplace. In Rao's articles he examines not merely personal factors like age, sex or individual behaviour, or only factors in the physical environment of the workplace. Instead he looks at the lives of workers in totality, he examines social and economic coordinates that condition and shape human behaviour like, living conditions, definition of gender roles in society and

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[53] Rao, M.N. & Ganguli, H.C. (1950-51) Women Labour in the Jute Industry of Bengal – A Medico-Social Study, Indian Journal of Social Work, Vol.11, pp.181-191.

[54] Rao, M.N.& Ganguli, H.C. (1951) V.D. in the Industrial Worker- A Medico Social Study, Indian Journal of Social Work, Vol.11, pp.381-387.

[55] Rao, M.N.& Ganguli, H.C. (April, 1952) Industrial Noise as a Health Problem, Journal of the Indian Medical Association, Vol.XXI, No.7, pp.320-325.

[56] Lakshmanan, C.K., Joshi, S.C. & Rao, M.N. (Jan, 1949) Sickness Absenteeism, Journal of the Indian Medical Association, Vol.XVIII, No.4, pp.117-122.

how they impinge upon the other burdens that the workers may face outside the factory. Thus he is able to make exceptionally progressive recommendations that would serve to make a structural difference in their life circumstances. He recommends taking into consideration the double burden of work that women workers bear when legislating for their hours of work in the factory. In case of venereal disease he locates the causation of the illness not merely in the microorganisms that infect the body or in the ignorance of the workers but he urges that the amelioration of the problem would lie in measures to address the problem of housing for industrial workers.

Simultaneously concerns of worker efficiency were constantly voiced in works of his other colleagues and contemporaries like Subramanyan and Majumdar[57], Sabnis et al[58] who examined environmental conditions in flour and jute mills. They accredited the fact that social influences also affect the workers performance other than mere physical environmental conditions. They essentially focussed on the environmental hazards within the factory in order to ensure better working conditions. They ignore the social power relations that determine the environment of exposures to certain physical conditions of work, which also determine how a worker fits into that particular work environment and by ignoring these fundamental roots that create disabling and environments for workers one may only be able to recommend measures that though important may be extremely limited in scope. Limiting focus of intervention to the physical agents in the working environment which maybe the immediate cause of ill health in isolation of the social conditions that situate the worker in those work circumstances obscures the real causes behind the ill health and the reasons why the worker cannot do much to ameliorate them.

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[57] Subramanyan, K. & Majumdar, N. (October, 1951) Environmental Conditions within Jute Mills, Indian Journal Medical Research, Vol.39, No.4, pp.595-623.; Subramanyan, K. & Majumdar, N. (January, 1953) Environmental Conditions within Flourmills, Indian Journal Medical Research, Vol.39, No.4, pp.123-140.

[58] Sabnis, C.V., Banerjee, S.K & Banerjea, A. (1956) Survey of Environmental Conditions in Foundries in Relation to the Health of the Workers, Alumni Association Bulletin, AIIHPH, Vol.2, No.28

This is not to say that analyses of the working environment and the physical hazards are not required. But it is important to recognise that such an emphasis on just 'scientific' study of physical environmental conditions would never be able to create a holistic picture of the effect of work on workers' health.

Concerns of worker productivity and effects of morale and attitude are voiced in the psychological studies that have been undertaken by the faculty like Ganguli, HC[59] and Ganguli, T[60] in the institute. The studies conclude that morale of workers negatively correlating with levels of education and union membership. These studies indicate a very clear bias in favour of the employer. There have been numerous works that mention the alienation the worker feels in the system of capitalist production, starting from Marx and Engels to Navarro in the current context. There is no analysis of the nature of the work process, the raw materials used, the control that workers may be able to exercise over the work they perform, the wages they receive and the organisation of production. In a capitalist society employer controls all these. Failing to recognise this can very well lead study to conclude that the workers lack of interest stems from his attitude that can be reconstructed and changed by educating him.
The discipline of industrial psychology is employed to deal with the symptoms of frustration, aggression, disinterest, which may be labelled as problems of attitude and behaviour. The discipline deals with these reactions as 'problems' in the sphere of production and thus these have to be dealt with strategies like more effective communication or education of workers. The discipline would not address the fundamental problems of worker's vulnerability, lack of control over work process, lack of avenues to be creative and lack of participatory opportunities in the decisions pertaining to work. These behavioural explanations for structural and collective

[59] Ganguli, HC & Chatterjee, P.R. (1959) Social Attitudes and Voting Behaviour in Small Industrial Samples, Indian Journal of Social Work, Vol.20, pp193.; Ganguli, H.C. (1954) A study on Effect of Union Membership on Industrial Morale, Indian Journal of Psychology, Vol.29, pp.45

[60] Ganguly, T. (1954) Study of Industrial Tension through an Attitude Survey in a Large Steel Industry, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.1, pp.82.; Ganguly, T. (1955) Attitude Survey of Women Workers in a Calcutta Factory. Alumni Association Bulletin, AIIHPH, Calcutta, Vol.2, pp.37.; Ganguly, T. (1957) A Discussion of Some Variables Affecting Attitudes of Industrial Workers,

problems of the society tend to protect the larger powerful interests from the burden of collective action. And encourage attempts that dwell only on changing the 'so-called faulty behaviours' and 'maladjustment' of individual workers.

Yet, these studies conducted in the 1950s and early 1960s recognise the worker as a social unit. The choice of subjects of study like political affiliations and their effect on workers attitude is the recognition of the existent societal realities outside the factory and home that shape social attitudes and behaviour. The studies like those focussing on the attitude of women workers[61] clearly recognise the importance of authority and the nature of supervision in shaping workers responses to work.

Some of the articles dealing with accidents in the industry emphasise the importance of safety committees in controlling them. The thrust of some of the articles is on the immediate cause of the accident, which in most cases can be interpreted as the worker's fault or his indulgence in 'unsafe acts'[62]. Thus they recommend pre-placement examinations and education of workers to prevent accidents, without sufficiently dwelling on disabling environments, which may lead to unsafe acts; like the lack of workers powers to pressurise for safety equipment or protective gear, or the very low wages and lack of security of employment which lead to the union's demands being limited to increased wages, or the pace at which work would be carried out which is determined by the management, status of the worker whether he is a permanent or temporary worker, does he work on a salary or on piece rates.

Hence in the case of the studies conducted at the All India Institute of Hygiene and Public Health, though the influence of the American pattern of occupational health practice is very clear from its inception, there was a conscious effort, especially in the writings of Dr. MN Rao, to build a body of knowledge applicable to and reflecting the concerns for the industrial worker firmly grounded in the realities of India. The effort

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[61] Ganguly, T. (1955) Attitude Survey of Women Workers in a Calcutta Factory, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.2, pp.37.

[62] Mukhopadhyay, R.N. & Sircar, A.B. (1968) A Case Study of Accident Trends in an Engineering Factory, Alumni Association Bulletin, AIIHPH, Calcutta, Vol.18, No.36, pp.3-6

was to borrow from and build on the existing knowledge that the more industrialised nations had developed to cater to the needs of their industries.

The studies carried out by MN Rao did not merely address the 'imbalances' that were created in the body but they tried to locate the causes and contributing factors in the social and economic circumstances outside the body and beyond mere individual control.

At the same time the notion of the industrial worker as a 'factor of production' was also very clearly suggested in many of the writings especially the psychological studies. Their primary concern seemed to be the efficiency, productivity and attitude of workers. The intent was to manage and deal with the reactions of the workers to the discomfort produced by the work or the work environment. Thus interventions were made in the form of better communication strategies, health education and studies on workers and labelling their personalities to identify characteristics that seemed more responsible for the so-called maladjustments among the workers. Yet the choice of the areas of research even in industrial psychology reflect an understanding wherein the worker as a social being is recognised and the variety of social, political and economic influences he or she lives in are given credence to. The studies, even the ones dealing with the physical environment recognise these larger influences but admit their limitations in being able to address them.

## REVIEW OF RESEARCH CONDUCTED AT THE NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH (1974-1998)

A total of 329 studies were obtained from the annual reports published by the NIOH since 1974 up to the year 1998. The annual reports that could be accessed from the library of the Indian Council of Medical Research are for the following years:

1970s: 1974, 1975, 1976, 1977, 1978, 1979;
1980s: 1980, 1981, 1983-84, 1984-85, 1985-86, 1987-88, 1989-90;
1990s: 1990-91, 1991-92, 1992-93, 1993-94, 1994-95, 1996-97 and 1997-98.

Of the total 329 studies published in the above mentioned annual reports, 287 pertain to various aspects of work in the industrial sector which include environmental exposures of workers to various physical and biological agents within the factory; effects of production processes on the environment, humans and livestock outside the workplace; experimental toxicological studies, psychological effects of the environment and their effects on work-efficiency and studies dealing with other related aspects of worker's health and performance at the workplace.

In this section 87 i.e. over 30% of the 287 studies have been studied in detail. The criterion adopted for selection of these studies has been their representativeness of the body of work generated by the institute.

TABLE NO.3.2 NUMBER OF ORGANISED AND UNORGANISED SECTOR UNITS COVERED IN THE STUDIES CONDUCTED IN THE 1970S, 1980S AND THE1990S.

| TYPE OF UNITS STUDIED | ORGANISED SECTOR | | UNORGANISED SECTOR | |
|---|---|---|---|---|
| | *No. of Units* | *Units covered* | *No. of Units* | *Units covered* |
| **1970s** | 10 | Asbestos, Cotton, Lead Smelting & Battery Manufacturing Units, ONGC. | 10 | Garages, Rice Mills, Ceramics, Steel Foundries & Coir. |
| **1980s** | 24 | Asbestos, Cotton, Pesticides, Condom, Solvent and Battery Manufacturing Units | 23 | Glass, Slate-pencil, Sand Grinding, Agate, Beedi Manufacturing |
| **1990s** | 17 | Asbestos, Cotton, Pesticides Manufacturing Units, HMT | 7 | Agate, Salt Workers, Welders |

*Source: Annual Reports, NIOH, Various Years*

First of all I shall analyse the trends that can be discerned in the pattern of studies generated in the three successive decades. This decadal classification has been sought for the purpose of convenience and for the fact that the pattern of the studies show some specific trends that vary from decade to decade.

- Table No.3.2 shows macro trends in the choice of industry for research work conducted at the NIOH in the three decades. From this it can be discerned that

in the 1970s and the 1980s the number of studies in the unorganised sector stood at par with that in the organised sector.

- By the 1990s, however, there is a marked difference between the number of studies in the organised sector as compared with the unorganised sector. The studies in the former exceed the latter by a factor of ten.

The table on below gives a more nuanced picture of the kind of increase that has taken place in the studies in the organised sector.

TABLE NO.3.3 SELECTED AREAS OF RESEARCH THAT THE STUDIES CONDUCTED AT NIOH HAVE COVERED IN THE THREE DECADES

| AREA OF STUDY | Type of Study | 1970s | 1980s | 1990s |
|---|---|---|---|---|
| **ASBESTOS** | Environmental | 2 | 3 | 3* |
| | Experimental | 4 | - | - |
| **Cotton** | Environmental | 3 | 8 | 8* |
| | Experimental | - | - | - |
| **Pesticides** | Environmental | 8 | 5 | 11 |
| | Experimental | 5 | 8 | 5 |
| **Other Chemicals (Dyes, Solvents)** | Environmental | - | 6 | 7 |
| | Experimental | - | 10 | 14 |
| **Agate** | Environmental | - | 1 | 3* |
| | Experimental | - | - | - |
| **Manganese** | Environmental | 1 | - | - |
| | Experimental | 6 | 6 | 4 |
| **Lead** | Environmental | 5 | 2 | 3 |
| | Experimental | 1 | 5 | 2 |
| **Glass, Ceramics & Potteries** | Environmental | 2 | 6 | - |
| | Experimental | - | - | - |
| **Industrial Effluents** | Environmental | - | 1 | 5 |
| | Experimental | - | - | 1 |
| **Jute** | Environmental | - | 2 | - |
| | Experimental | - | - | - |
| **Beedi** | Environmental | - | 3 | - |
| | Experimental | - | - | - |

*Source: Annual Reports, NIOH, Various Years*

*Include intervention studies conducted only in the 1990s.

TABLE NO.3.4 (A) CLASSIFICATION OF STUDIES CONDUCTED AT THE NIOH IN THE 1970S, 1980S AND THE 1990S

| DECADE | EXAMINING EFFECTS OF WORK ENVIRONMENT ON WORKERS | | | EXAMINING EFFECTS OF MANUFACTURING ACTIVITIES ON THE ENVIRONMENT OUTSIDE WORKPLACE | | | |
|---|---|---|---|---|---|---|---|
| | Environmental & Clinical Studies | Immuno-logical Studies | Physical Environment | Atmosphere | Humans | *Live-stock* | Food |
| 1970's | 20 | - | - | 3 | 8 | 1 | - |
| 1980's | 43 | 2 | 7 | 7 | 5 | 2 | - |
| 1990's | 23* | 4 | 5 | 4 | 6 | - | 4 |

*Source Various NIOH Annual Reports :*

*Out of the 23 studies entailing Environmental and Clinical examinations 6 of them are titled intervention studies, a trend that was seen specifically in the 1990s

TABLE NO.3.4 (B) CLASSIFICATION OF STUDIES CONDUCTED AT THE NIOH IN THE 1970S, 1980S AND THE 1990S

| EXPERIMENTAL STUDIES | | | PSYCHO-LOGICAL | ERGONOMIC PHYSIO-LOGICAL | OTHER |
|---|---|---|---|---|---|
| Carcino-Genicity Studies | Toxicity | Others | | | |
| 5 | 11 | 1 | 6 | 4 | 2 |
| 2 | 24 | 4 | 6 | 13 | 4 |
| 1 | 42 | - | 6 | 7 | 6 |

*Source Various NIOH Annual Reports*

- The table 3.3 above shows that the 1990s show an increase in the number of environmental studies in the asbestos, pesticide and cotton industries and the studies on industrial effluents. According to the table they include 6 intervention studies.
- Further table 3.4 shows that the increase in environmental studies within the factories consists of an increasing proportion of immunological studies in the 1990s. There is an increase in the number of studies examining the physical environment as well. These studies on cotton examine the presence of gram-negative bacteria and endotoxins in the atmosphere and also analyse the kinds of fibres present in the atmosphere. This is true especially for the 1980s.
- The studies in the 1990s also show for the first time 6 intervention studies. These interventions have been carried out both in the organised as well as the unorganised sector in the cotton, asbestos and agate units.
- Table 3.3 also shows an increase in the experimental studies over the years. Especially the toxicity studies that have multiplied four times over, i.e. from 11 in 1970s to 42 in the 90s. This increase in the experimental studies began to show in the 1980s, when the number of studies nearly doubled.
- The experimental studies in the 1970s addressed the areas of asbestos, pesticides, lead and manganese toxicity and carcinogenicity. In the 1980s the studies looked at the toxic potentials of pesticides, other chemicals like dyes and industrial solvents, lead and manganese. The number of carcinogenicity studies fell during this period and came down to 2. In the following decade of the 1990s the experimental studies looked at the areas delineated above in addition to studies on industrial effluents.
- The psychological studies have stood at a constant number through the three decades but have fallen progressively in proportion to the other studies.
- There were a large number of ergonomic and physiological studies in the 1980s.
- In the 1990s the studies in other areas have increased marginally which is due to the 4 studies on done on occupational cancer and an interesting new study on occupational health service delivery from the PHCs in rural areas.

In the following sections I have described some of the studies that have been conducted at the institute and that are representative of most of the work done at the institute and the trends in research. The rest of the studies have been entered in Appendix III. This is due to the repetitions that occur in study design and findings.

ENVIRONMENTAL FIELD STUDIES

The broad pattern of studies is discernible from the section above and tells us of the importance place of environmental field studies and experimental studies in the body of work generated by the NIOH. This section shall discuss in detail some of the studies that are most representative from the point of view of the aspects of workers health studied and the methods and tools employed for the purpose.

The studies on the unorganised and the small sector in the 1970s included studies on ceramic units and foundries. The main aspects studied in the body of environmental research entailing field studies in the 1970s are heat stress, exposure to dust and chemicals and the resultant physiological responses of the exposed workers. The effects on the workers health were assessed through clinical, biochemical and radiological examinations using methods like x-rays for ascertaining a case of silicosis; sweat analysis for discomforts and physiological costs of work.

The rationale for examining physiological responses in the workers was to ascertain energy costs and the resultant efficiency of the worker. For example, sweat analysis was carried out of the workers employed in **foundries**[1], subjected to high heat stress. The purpose was to see the effects of dehydration on the productivity of the workers engaged, since dehydration above 2% of the body weight was said to have detrimental effects on the working capacity. The study claimed that the workers didn't consume sufficient water when at work. But the researchers themselves had noted earlier in the study that the sanitation and other amenities were rather unsatisfactory in these foundries that were not registered under the Factories Act.

[1] Health Hazards in Small-Scale Industries, Non-Ferrous and Stainless Steel Foundries (1974&1975)

In the **ceramic**[2] units, as in the case of foundries, the workers were subject to conditions of severe heat stress. The recovery pattern of pulse rates and low rise of oral temperatures were used to conclude that though the workers were subjected to considerable heat they were under minimal physiological strain.

The workers exposed to silica dust for longer durations showed increased incidence of dyspnoea, tuberculosis and emphysema, the researchers note that the levels of dust were above permissible limits and the workers were not given protective gear or equipment. The foundries and ceramic units were part of the unorganised sector, the studies do not comment on the hours or the conditions of work, though. The same is applicable to the glass industry as well.

Similar methods were employed to study the effect of environmental conditions at work on the health of the workers in the studies on the ceramic units[3], glass industry [4] and the wool units[5]. The same methods have been used in the 1990s to study the effects of exposure to cotton dusts[6].

But there have been stray efforts to study the conditions of work and the socio-economic circumstances of certain groups of workers. The study observing the **coir workers** [7] is different from the rest of the explorations that have been made in the 1970s. The study has attempted to make correlations between economic status of workers and their morbidity pattern, which shows diseases of malnutrition and poverty. The people engaged in coir work are economically more vulnerable and are thus forced

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[2] Health Hazards in Small-Scale Industries, Ceramic and Pottery Health Hazards Industries (1976, 1977&1978)

[3] Health Hazards in Small Scale Industries: Ceramic and Pottery Industries (Further Studies) (1980)

[4] Health Hazards in Glass Bangle Industry (1985-86); Health Hazards in the Glass Industry: Hygiene Survey in a Medium Glass Unit (1987-88)

[5] Preliminary Study of the Health Hazards in the Woollen Carpet Industry (1980); Health Hazards in the Wool Industry (1983-84)[5]

[6] Cotton Dust Exposure in the Ginning Industry (1990-91); Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1991-92); Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1993-94); Cotton Dust Exposure in Textile Mill Processing Coarse and Fine Cotton and Intervention Studies (1994-95; 1995-96)

[7] Occupational Hazards in Coir Work (Pilot Study) (1979)

to be employed in this low paid work that aggravates their other illnesses. It concluded that coir workers have a higher rate of morbidity than the rest of the population even though the causes of morbidity among them are same as those in the general population. Skin diseases, respiratory diseases and elephantiasis are the main causes of sickness and those in the process of spinning and weaving show majority of the illnesses.

The NIOH and its Regional Occupational Health Centre (ROHC) in Calcutta conducted studies on **jute mill workers**[8] and the effect of working conditions on their health. Though the dust levels were less than recommended TLV, the workers complained of breathlessness, wheezing or whistling in the chest. Some workers noticed an exacerbation in cough and phlegm when after joining their duties. Other common complaints included piles, hernia, bleeding from the nose, hernia and hydrocele.

The studies conducted by the ROHC, Calcutta[9] revealed other problems like vertigo, disturbed sleep, night blindness, bleeding of gums and reduction of near vision. This study was more insightful since it also explored the psychosocial effects of work and ill health emanating from it. The workers lived in single room quarters devoid of a separate kitchen, electricity or water connection. Usually 5-7 persons lived in one room. The per capita income of the workers per month was as low as Rs.400. 81% of the exposed workers lived in kutcha or semi-pucca houses. Most of the exposed workers were from Bihar, 37% of them were living in joint families and 33% were living alone. Whereas, of the control group, 83.2% were from Bengal, only 22% of them were from joint families and 70.6% were staying with their families. When compared for parameters like status of vaccination, only 16.3% of the exposed and 67.5% of the control group had been vaccinated against small pox. Most of the exposed workers saw alcohol as a refreshing, helpful and stimulating drink, while 77% of the control group treated alcohol as harmful. 75% of the exposed workers consumed alcohol regularly. 81.3% of the exposed workers were either smoking or chewing tobacco as against 8.9% in the control group. About 60% of the workers were in favour

[8] A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1983-84)
[9] A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1985-86)

of visiting prostitutes because of the absence of their wives, for pleasure and for recreation. In case of the control group these figures were negligible. 88.2% of the control group and 8.7% of the exposed subjects thought that there was a possibility of promotion in their jobs. Most of the exposed workers felt that jute millwork was heavy and employers and supervisors behaved badly with them. 83.2% of the exposed and 48.65% of the control group felt that the children's education and guidance, illness, daughter's marriage caused them anxiety.

Despite these earlier insights into the social and economic conditions of the workers affecting their health, later studies in 1987-88[10], examining other jute mills in Calcutta, focussed only on physical environmental conditions of the mills. They focussed their attention mainly on factors such as thermal environment, illumination and dust at the workplace. The studies showed that the process of jute manufacture entailed exposure to high levels of dust and noise. The exposed workers showed the prevalence of obstructive and restrictive type of respiratory impairments among high and low dust exposed workers respectively. The workers also manifested signs of nutritional deficiencies like anaemia, cheilosis, glossitis etc. To assess the effects of work on health they relied only on blood tests and pulmonary function tests.

Some of the studies in the unorganised sector, especially the ones in the 1980s, had been taken up on account of the orders of the judiciary or due to the issue being raised by the media.

Studies in the **quartz industry** of Gujarat[11] revealed that the total and respirable dust concentration were 81-660 and 12-243 times the recommended TLVS. The exposed workers showed the prevalence of silicosis of about 7% even though they had been working for less than a year. The quartz industry being in the unorganised sector the workers were engaged on a daily basis and the labour turnover in the industry was very high. This could be associated with the occupational hazard in the industry. The study also commented that workers suffering from silicosis got eliminated from the work by 'natural process', since the disease was incapacitating and the work required the

[10] Assessment of Health Status of Jute Mill Workers (1987-88)

[11] Health Hazards in Quartz Crushing Industry and Evaluation of Dust Control Measures (1985-86)

workers to be physically fit, since it involved a lot of hard labour. A follow up of the ex-workers revealed that a large number of the workers had died (about 90), and most of them were aged between 30-35 years of age. Though dust control measures were initiated in the quartz crushing units the dust concentrations exceeded the TLVs. The study comments ambiguously that 'a fair degree of automation has reduced the required manpower.' It suggests that pre-employment and periodical medical examinations should be conducted for the workers. It also suggests that the workers should be warned of the possible consequences of the occupation and the means of preventing them.

After newspaper reports of a number of deaths among **sand grinding**[12] workers in Vadhvan and Surajdeval in Gujarat, the NIOH conducted a medical survey at the request of the Chief Inspector of Factories. The survey was conducted using the records at the Hospital of Chest and Respiratory Diseases at Vadhvan since all units had closed down. Only 4 cases have been recorded as silicosis. These cases were contacted and in all 36 workers were traced. 27.7% of the workers were silicotic, their average age was 28.2 years and their mean duration of work in the sand grinding industry was 6.3 years.

Some studies have sometimes uncritically used studies published in countries like the USA and Canada and most of unquestioningly subscribe to the TLVs and other such standards. The two field studies on **asbestos** included clinical and pulmonary examination[13] of workers and medical cum environmental surveillance of workers in an asbestos factory[14]. This study clearly showed workers suffering from symptoms like chronic cough with expectoration and dyspnoea. The vital capacities of workers in the stripping and pipe finishing departments were considerably reduced as compared to the control subjects irrespective of smoking habits. Younger workers were much more affected than older ones. According to the results of the study the researchers found no

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13 Clinical and Pulmonary Tests of Workers in an Asbestos Cement Factory (1976)

14 Environmental cum Medical Surveillance in an Asbestos Cement Factory (1979)

correlation between length of exposure and pulmonary function. They quote a host of studies published in the US and in Canada[15] regarding workers in chrysotile asbestos plants showing little retardation in pulmonary and working ability. At the same time the study also observed that in the sheet moulding and stripping departments where the exposure to asbestos dust is the maximum there were no workers whose experience exceeded 10 years. The study concluded that the low rates of morbidity could be attributed to the 'high labour turnover due to the hazardous environments in these departments'. This study is an example of the faulty conclusions that a scientist or medical person may arrive at, going by only 'objective' observable evidence. The scientist even sometimes fails to acknowledge the circumstances of want and vulnerability that the social position of the worker subjects him to, or has sometimes played the role of manipulating information to serve the interests of the management, as is demonstrated in the earlier examples quoted. The researchers do not examine the facilities made available to the affected workers, their employment status or the employment structure of the factory. In the context of the contradictory evidences the authors recommend regular periodical Vital Capacity measurements for a prevention programme of the workers in the asbestos factory, again relegating what is essentially a problem of social power relations to the control of the physician who then certifies the individual worker as suffering from a disease or not.

The second study in a different asbestos factory clearly notes that the symptoms like crepitation were more in the workers exposed for a longer duration. The exposed workers complained of back pain and deafness along with the symptoms mentioned in the earlier study. The researchers also investigated smoking habits of the workers and observed an increase in radiological changes and crepitations with an increase in the

[15] Fournier et al (1975) reported in their study of Quebec Chrysotile (one of the largest producers of Chrysotile Asbestos) asbestos workers that 44.3% of the workers had a normal pulmonary function and a further 26.3% had some functional changes. Jarca et al (1976) reported that asbestos cement factory workers do not have any marked effects on the pulmonary function tests and working ability. Balaam ands McCullagh (1975) also established asbestos cement workers as a group showed a lower Vital Capacity and FEV% as compared to non-asbestos workers but the difference was not significant.

duration of smoking habits[16], but they concluded that the reduction in vital capacity among exposed workers was not related to smoking habits. The environmental survey in the factory also took note of the dust and fibre concentrations that exceed the TLV levels suggested by the ACGIH.

The studies also show a tendency of evaluating and ascertaining hazards against the much-debated Threshold Limit Values, without questioning the values or the context in which these Values have emerged and their suitability to the context in which the workers belong to a developing country like India with poorer health and nutritional status have to work.

In the earlier chapter describing the history of the development of the area of occupational health in the United States one has already seen that these standards are not arrived at in a process that merely entailed scientific experiments but very much in a process where value judgements and clash of interests of contending groups played a crucial role in their promulgation. Often the process was subverted and controlled in the ultimate instance by the power and the interests of the capitalist class.

Many of the studies are repetitive and do not serve much purpose since they reiterate what has already been oft repeated. These studies, instead of looking at macro issues of concern continue to look at more micro changes in the human body like changes in tissues of various organs or cytological changes. In the 1980s the studies on asbestos workers were continued. An environmental cum medical surveillance of workers in an asbestos textile industry was carried out by NIOH[17]. The total and respirable fibre concentrations were found to be higher than the recommended TLVs. 46% of the workers had some or the other chronic respiratory complaint. 16% of them were seen to be anaemic, 6.2% suffered from cheilosis, and 4.65% from 4 glossitis. All of them showed a reduction in vital capacity. They also had crepitations and showed restrictive pulmonary impairments along with a fall in vital capacities as compared to the

[16] The researchers also quote a study by Aurebach (1963), which observes that smoking along with asbestos exposure has a synergistic effect leading to asbestotic fibrosis, bronchitis and smoking related fibrosis.

[17] Environmental cum Medical Surveillance in an Asbestos Cement Factory (1980)

controls[18]. Smoking aggravated parenchymal and pleural changes in the lungs. The prevalence of asbestosis was 8.9% among the workers. The unit was advised to carry out periodical and pre-employment medical examinations and maintain complete medical and environmental records.

Besides being repetitive these studies offer suggestions for intervention that are clinical in nature and rather discriminatory against the workers. Instead of correcting dangerous production processes or substituting hazardous substances for safer alternatives the prescriptions like pre-employment medical examinations can become an excuse for depriving 'unfit' and thus more needy workers from the scarce employment opportunities available. Another intervention study observed workers in 4 asbestos cement factories [19] and revealed that the levels of fibres were much below the recommended TLVs. The workers studied had a mean age of 46 years and their average exposure was 26 years. 24.1% of the exposed workers had respiratory complaints like dyspnoea, cough, expectoration and pain in the chest as compared to 5.9% of the control. Some of them manifested crepitations and harsh breathing. Crepitations were found to be present in 17%-19% of the exposed population and 3%-9% of the control population. Assessment according to the criteria suggested by the ILO 8.9% of the workers seemed to suffer from asbestosis. The study revealed that asbestos exposure alone led to restrictive type of pulmonary impairment, but when coupled with smoking it culminates in obstructive type of impairment as well, probably due to thickening of the bronchial wall and other parenchymal or pleural changes that smoking induced.

As part of the environmental intervention methods the fibre feeding had been automated, housekeeping and cleanliness were improved, especially in the storage area, and protective equipment was recommended for the rest of the asbestos cement production process that was wet and manual. As part of medical intervention the factory was asked to carry out periodical medical examinations including Pulmonary Function Tests and chest x-rays. It was suggested that the pre-employment tests be

[18] Environmental cum Medical Survey in an Asbestos Cement Factory (1981)

[19] Intervention Study in an Asbestos Cement Factory (1987-88)

made compulsory for new recruitments and the medical record keeping be improved. For this the factory management purchased the latest and the most sophisticated model of a new vitalograph and the institute took upon itself the responsibility for training them to use it. The hazards of smoking and its aggravating effects on asbestosis were explained to the workers who were also provided with protective devices like respiratory masks, gloves, boots etc.

The interventions suggested often place the onus of ill-health and responsibility of the same in the hands of the workers only. The exploration into Low-back pain among workers of the Oil and Natural Gas Commission (ONGC)[20] is an important study since it is one commissioned by a Public Sector Unit. The study entailing the examination of complaints in workers of the ONGC, employed at the drill site, points to the nature and years of work and the long distance travelling as causes of the problem. The workers had to travel nearly 100-160 kms. daily, in a poorly maintained vehicle on bad roads. This aggravated the problem that was more pronounced among heavy workers who had been working for 8-12 years. The investigators recommended pre-employment and pre-placement medical examinations as a means of prevention in order to identify and eliminate individuals with a history of back pain, abnormal spinal geometry and inadequate physical fitness. Further recommendations were that the workers should be taught the correct technique of weight lifting and that they should travel in properly maintained vehicles. Thus the remedy for ill-health is sought in behaviour changes and education of the worker. And once again the solutions are sought in pre-employment medical examinations of workers to eliminate those who seem to be more susceptible to back problems. The structural issue of the responsibility of the establishment to provide housing in the vicinity of the workplace is neatly circumvented.

Towards the 1990s the NIOH also conducted studies to observe the changes in the immunological profiles[21] of the 3 workers suffering from asbestosis as compared to those of 36 workers exposed to asbestos and 28 control subjects. The anti-nuclear

[20] Low Back Pain Among Workers of the Oil and Natural Gas Commission (1977)

[21] Immunological Profile of Workers Having Asbestosis (1990-91)

factor was higher in asbestos exposed workers and those suffering from asbestosis. The mean immunoglobulin levels of the exposed and suffering workers were also significantly higher than those of the controls. The female workers appeared to be more reactive as compared to the male workers. The study concluded that immunoglobulins played an important role in the pathogenesis of asbestosis and other diseases related to asbestos exposure. A study carried out to monitor the health status of workers in an **organophosphate insecticides** unit in the organised sector[22] discovered neurological morbidity in 21% of the workers, 20.6% of the workers manifested morbidities related to the eyes, 34.5% had skin irritation and 64.84% complained of joint pains. The immunoglobulin levels were significantly low in those who had joint pains and they also showed joint space reduction in the medial compartment of the knee. The study suggested the need for periodic health monitoring and promoting use of safety measures and protective devices.

EXPERIMENTAL STUDIES

The studies conducted to understand the effects of exposure to DDT and BHC[23] involved laboratory experiments on animals like Swiss mice through various routes, at various concentrations, on different organs of the body.

Carcinogenicity of DDT and BHC was studied in rats by exposing them to the pesticides through various means like oral intubation, skin painting and sub-cutaneous injections. The incidence of tumours was compared with the control group and then statistically evaluated. Some of the studies were used to ascertain indicators for early detection of impairment due to exposures and the prognosis of the disease. The animals manifested tumours of the lung, spleen, kidney, stomach, cervix and the liver, which were least in those that had been exposed to DDT via the dermal route. Such studies were utilised for early detection[24] of health impairment due to the chemical exposure by measuring urinally excreted compounds like copoporphyrin and certain other amino acids that are products of BHC metabolism in exposed persons and for learning the

[22] Health Monitoring of Workers Manufacturing and Formulating Organophosphate Insecticides (1991-92)

[23] Early detection of Health Impairment due to BHC (Hexachlorocyclohexane) exposure (1976)

[24] Ibid.

pattern of progression of hepatocarcinogenesis [25] by finding out biological markers, at different stages of development of the cancer, which could be used in those occupationally exposed to these pesticides. This could also help in identifying the stages where the changes in the liver tissues could be reversible[26]. The study accedes that though intrinsic factors like age, hormonal status and species affect the progression of the tumour the extrinsic factors like nutrition also play a role in carcinogenesis.

Similar tests carried out on the carcinogenicity of asbestos fibres and on the toxic effects of manganese[27] demonstrated the varying toxicity of manganese when associated with other chemicals. The studies showed the protective effect of Lithium perchlorate in case of manganese toxicity and the increased glycine levels in the brain due to the effect of manganese. The differential effects of toxicity were also demonstrated in male and female rats, with the latter becoming more vulnerable with ovaractomy. The researchers concluded that an assessment of gonadal functions would be helpful in early detection of manganese toxicity.

In the 90s there have been a number of toxicity studies but they have mostly focussed on three areas - effects of toxicity resulting from exposure to lead[28], formaldehyde[29] and carbon disulphide[30], in animals like rats.

The rise in serum levels of perchloric acid and soluble sialic acid were seen to be useful as biological markers of lead toxicity. Different doses of Formaldehyde showed a significant inhibition in membrane bound enzymes of seminiferous tubules in rats and also altered the metabolic pathways of testosterone. Varying doses of Formaldehyde in a following study[31] were seen to exhibit low sperm counts and cause

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[25] Biochemical, Histochemical, Histopathological and Electron Microscopic Studies On BHC Fed Inbred Swiss Mice (1979)

[26] Evaluation of Carcinogenicity of BHC (Hexachlorocyclohexane)- Reversible and Irreversible Changes (1977)

[27] Effect of Associated Anion on Manganese Toxicity (1976, 1977, 1978 &1979)

[28] Neurobehavioural Toxicity of Lead in Experimental Animals (1990-91)

[29] Toxicological Studies on Reproduction and Neurobehavioural Effects of Formaldehyde (HCHO) (1990-91)

[30] Experimental Studies in Carbon Disulphide Toxicity (1991-92)

[31] Toxicological Evaluation of Formaldehyde (HCHO) on the Reproductive System in Rats (1991-1992)

a diminution in pregnancy in rats. The study says that there is a need for bio-evaluation of reproductive toxicity of formaldehyde. The chemical was also seen to alter neurobehavioural performance of laboratory animals[32] such as rats whose disturbed memory due to exposure to Formaldehyde hindered normal psychological activity.

Toxic effects of the two dyes, Remazol green and golden yellow[33], used in the textile industry, were studied using the water flea as the subject. Of the two the latter was found to be more toxic than the former. This was done to study the aquatic toxicity of the dyes and the water flea was used due to its sensitivity.

Carbon disulphide is an industrial toxic chemical that finds wide use in the rayon industry and is also widely used as a solvent since it can dissolve lipids and fats. Exposure to it is generally occupational. The purpose of the project was to develop a specific method for early detection of carbon disulphide toxicity. The rats exposed to the chemical were seen to develop hypothyroidism, a reduction in enzyme activities in the cells[34], a diminution in serum testosterone levels and testicular impairment, and a fall in testicular RNA, DNA and protein contents[35]. The study concluded that carbon disulphide at high doses causes toxicity to the male reproductive system and needed to be handled with care since it could also trigger adverse activities at the cellular level.

One of the studies on Formaldehyde admits that interpolation of animal behaviour to human beings is difficult but then goes on to quote studies saying that learning pattern of rats was similar to those of 18-month-old pre-verbal human children. Many studies state that long time formaldehyde exposure produces a range of psychological or behavioural problems or combined neurobehavioural effects like depression, irritability, decreased attentional capacity, impact on sleep and equilibrium.

[32] Neurobehavioural Effects of Formaldehyde in Male Albino Rats (1991-92)

[33] Toxicity Study of Dyes on Water Flea – Daphnia Magna (1990-91)

[34] Experimental Studies in Carbon Disulphide Toxicity (1996-97)

[35] Experimental Studies in Carbon Disulphide Toxicity (1995-96)

OTHER ENVIRONMENTAL STUDIES

Recognising the important role of pesticides in the Green Revolution and the National Malaria Eradication Programme, NIOH conducted a number of studies assessing the **carcinogenicity** of these chemical substances and their effect on workers involved in their production and application. Here we shall concern ourselves with studies concerning pesticide formulators and the laboratory experiments to understand the carcinogenic potential of pesticides like DDT[36] and Gammaxene (BHC)[37].

The studies in this case have focussed not only on workers engaged in the production of the pesticides but also on the environmental effects of these chemicals on those who utilise them. Pesticide formulators[38] and spray-men exposed to pesticides manifested symptoms like headache, nausea, vomiting, cough, breathlessness and irritation of the eye and skin. In these studies the researchers used biochemical indices like changes in enzymatic activity in red blood cells to ascertain the absorption of pesticides. The Electro Cardio Gram was used to ascertain the retardation in the heart rates of exposed workers.

Recognising the threat posed by the presence of these non-biodegradable chemicals in human beings and their environment the institute took up an examination of DDT residues in human fat of those not exposed to the pesticide occupationally and in food grains[39]. The examination revealed that the DDT level in human fat averaged 12.63ppm and in different food grains ranged from 7.69ppm to 11.15ppm, which are much above permissible levels. The study recommends 'judicious use of DDT to avoid food contamination' and acknowledges the difficulties in assessing effects of pesticides due to the slow response of the body.

High levels of air pollutants like sulphur dioxide, nitrous oxide and other respirable particulate matter were found within a two-kilometre radius of a fertiliser plant near

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[36] Carcinogenicity Testing of DDT (Dichloro-Diphenyl-Trichloroethane) In Laboratory Animals (Mice) (1974)

[37] Evaluation of Carcinogenicity of BHC (Hexachlorocyclohexane)- A Short Term Study (1976)

[38] Health Hazards in Pesticide Formulators (1978, 1979)

[39] 1976 Study of Pesticide Pollution from Chlorinated Insecticides Especially DDT in the Environment of Man and Other Livestock in the Country

Baroda, Gujarat. The study[40] opined that the prevalent levels of air pollutants in these areas would cause adverse health effects relating to the respiratory system.

PSYCHOLOGICAL STUDIES

In the 1970s the studies have examined areas like human factors involved in accidents, efficacy of protective gear like ear protectors in relation to psychological performance[41] and work efficiency[42].

A retrospective study of accidents[43] and the human factor involved in them in as recorded by the safety department in a textile mill during the preceding decade was conducted in 1975. Of 1075 recorded accidents the highest percentage of accidents was seen to occur in the age group 21-25 years followed by a fall and then a rise again in the 41-50 age group and then again a fall. The monthly payday showed a sharp rise in accidents and this was attributed to the probable psychological tension caused in anticipation of the salary. The weekly pattern of accidents for varying periods in the year showed a rather curious pattern. During the first half of the year when Thursday was the scheduled holiday the peak accident rate was seen on Sunday. Whereas in the second half when Sunday was the scheduled holiday the peak rate was observed on the Saturday. But at the same time in the first half the rate of accident was seen to be less on Thursday when some of the workers were working. Whereas the accident rate was high on Sundays that were scheduled holidays during the period from August to December.

The accident rates were lowest in the winter months and they gradually rose through the summer and reached the peak during the monsoons, especially in the month of August. This the researchers feel could be due to the high humidity and because there were more holidays in the month of August. During the day,

[40] Air Quality Monitoring around a Fertilizers and Chemicals Plant (1997-98)

[42] Efficacy of Ear Protectors in Relation to Psychological Test Performance and Working Efficiency (1977)

[43] Retrospective-cum-prospective Study of Accidents Involving Human Factor in a Textile Mill (1975)

the fourth hour of the morning shift showed peak rates of accidents after which the rates came down at the time of recess and rose again during the during the second hour of the second shift. The highest accident rate could be seen during the second hour after recess during the night shift that the researchers feel could be attributed to fatigue. The commonest parts affected were the superior extremity followed by the inferior extremities and then the neck and the head. The ring frame and the flying shuttle caused most number of accidents. The safety department of the mill under consideration did not keep records of the nature of accidents that were caused by different machines or parts of the looms like the bobbin, the shuttle, balance weight etc. The workers were not given wages for the period of absence from work owing to injuries. The researchers suggested that loss of earning to individuals due to the accidents could be used by the management to motivate the workers to participate in the Safety Programmes.

Other studies examined the efficacy of ear protectors[44] in relation to psychological performance of weavers in the weaving shed of a cotton textile mill. The noise survey showed noise levels of 100 decibels and above, which are beyond the comfort level of 90 decibels. The noise would come down to 60 decibels in the event of breaks but the weavers were seen to be taking breaks hardly lasting for five minutes. 52% of the workers disliked noise, 69% found noise annoying and 56% of them expressed discontent to work in noisy conditions. The workers opined that with reduction of noise work would become more enjoyable and efficiency would increase. But the researchers interestingly say that "these are only feelings and not facts'. They can be given due consideration when their performance levels show an actual increase with a reduction in noise through the use of ear protectors. Psychological tests to check manual dexterity, finger dexterity, motor coordination and intelligence levels were administered and the production and damage records were used to analyse the efficacy of the ear protectors. The study concluded that the ear protectors did not make a

[44] Efficacy of Ear Protectors in Relation to Psychological Factors (1975)

significant difference since they didn't do much to improve the efficiency and productivity of the workers.

Laboratory studies were also conducted on subjects who were non-technical subordinate employees to assess the effects of noise on motor manual performance[45]. Psychological tests were administered to assess the arousing influence of continuous noise for short exposures on neuromuscular behaviour in a controlled laboratory condition. Physiological changes like increases in pulse rates, oral temperature and blood pressure were monitored. The researchers concluded that noise had an arousal effect and enabled better performance in terms of manual dexterity and steadiness. The slight increase in blood pressure and pulse rate were thought to be positively associated with better activation of the 'organism'.

Most of the psychological studies in the 1990s have been designed to assess the specific effects and correlations between effects of various physical agents like heat and noise and the capacity to work, especially to perform mental tasks. Effects of heat and noise on efficiency of human performance of psychomotor tasks[46] were studied and it was found that heat and noise together produced beneficial changes in performance of the task of memory and search, two-hand co-ordination and reaction time at moderate difficulty level. This was assessed by time taken to perform the task under conditions of noise and heat and the changes in physiological reactions like blood pressure, body temperature and pulse rate were studied. The better performance due to the interactive effect of noise and heat was attributed to the state of arousal that they affected on the body.

OTHER STUDIES

The Directory of Industries was the first study of its kind that tried to collect information regarding factories in all the southern states of India excepting Andhra Pradesh. The study was conducted in 1977 with a follow up in 1978[47], by the Regional

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[45] A Laboratory Study of the Effects of Noise on Motor-Manual Performance (1975)

[46] Human Performance Capability in Psychomotor Tasks at Variable Difficulty Levels and Physiological reactions Under Noise and Heat (1990-91)

[47] Directory of Industries (1977, 1978)

Occupational Health Centre at Bangalore. The study collected data on the man-power employed in the factories engaging less than 250 workers and tried to ascertain distribution of factories in terms of the number of workers employed by them, for both public and private sector units. The study also carried details of total factories that were engaged in hazardous operations in Andhra Pradesh and Karnataka, as obtained from the Chief Inspector of Factories and individual factories. Those for Kerala, Pondicherry and Tamil Nadu were not available. The data showed that 3.5% of the total number of workers and 3.2% of the total number of factories in Karnataka were involved in dangerous operations and the figures for Andhra Pradesh were 7.3% and 4.5% respectively. The study notes that information regarding the manufacturing process, raw materials and intermediates in case of each factory, that would be useful in determining the total quantum of exposure to hazards, was not available with the Factory Inspectorates. The data clearly shows that the total number of factories is more in the private sector and so is the workforce.

Occupational cancer

Recognising the absence of information regarding occupational cancers in India, a collaborative project with the Cancer Registries of the National Cancer Registry Programme (NCRP) in India was organised to collect information about occupational cancers. Data collection was initiated at the Hospital Cancer Registries at PGI Chandigarh and Regional Cancer Centre, Thiruvanathapuram in 1990. Later the Cancer Institute at Madras also joined the project. Data collected constituted information regarding occupational history and personal habits. According to the findings, textile workers, wood workers and metal workers suffered a greater risk of lung cancer and painters and agricultural workers suffered increased risk of lymphatic and haematopoietic cancers. Among metal workers the welders seemed to be most susceptible to lung cancer. The agricultural workers and textile workers also ran a greater risk of developing oral cancer. The risk so quantified was adjusted for personal habits like smoking, alcohol consumption and tobacco chewing. The sample consisted of fewer workers from the chemical industry. But increased risk of susceptibility to oral cancers was seen among the agricultural labourers and owner cultivators who have

a higher exposure to agricultural chemicals than textile workers. This could be attributed to farming practices with little or no personal protection adopted while handling agricultural chemicals. The authors feel that social class would presumably not play the role of a confounding factor since a large proportion of the patients came from similar backgrounds.

A few studies have also addressed systemic aspects of occupational health service delivery. The study on occupational health service delivery in rural areas through PHCs has been selected because it is the only study of its kind, which tries to look at the larger systemic questions and the place of occupational health within General Health Service System. The first part of the study identifies the main occupational problems that the people working in the rural areas, covered by two PHCs in Dholka Taluka of Ahmedabad district[48], face. Hence various occupational problems associated with occupations like agricultural labour, weaving, rice milling, diamond polishing, carpentry automobile repair, brick making, pottery making and housework have been identified. The medical officers at the PHC were trained to identify occupation related accidents and illnesses. Then they were asked to fill the data of patients who came to them for treatment on a Performa. The data so collected was compared with the data obtained from a random household survey in the area of the two PHCs. The morbidity data showed that the information collected by the village survey was very similar to the information that was available at the PHC records.

## CONCLUSIONS

There have been a number of studies conducted at NIOH on small sector in the 1970s and the 1980s, focussing on the factory units in the small sector like ceramic and pottery units, sand grinding units, slate pencil units, foundries and rice mills. The studies examine health hazards in these units but studies rely only on quantitative measurements using instruments for assessing various hazards like noise, heat, dust etc. The threshold levels adopted are the ones that have been recommended by

[48] Occupational Health Care Delivery Through Primary Health centres to Workers in Rural Areas (1990-91)

American Standard setting institutions or the WHO. The standards are not questioned. Only physiological stress that is measurable using parameters like levels of enzymes, pulse rates etc is studied. The studies do not address address physical stress due to workload or nutritional status of workers, or the workers' access to amenities like housing, sanitation, recreation. The workers in the unorganised sector are also most vulnerable to the 'diseases of poverty' or infectious diseases. Data about ESI utilisation in 1990s and even before in the 1970s and 1980s as examined by Qadeer and Roy[49] show that the treatment is sought by workers for infectious diseases like dysentery, fevers, typhoid etc. the nexus between infectious disease and poverty is well recognised but there have been no attempts to ascertain morbidity profiles of industrial workers. Affliction from infectious diseases would make them more vulnerable to morbidity from accruing from stress and varying kinds of exposures at work.
The studies involve clinical and biochemical examinations of workers to understand effects of hazardous work processes. The technical nature of these studies obscures social and economic compulsions and effects of work in the unorganised sector.

The factors like hierarchical organisation of work, the quality of supervision, availability of rest periods and other factors in the work environment that contribute to stress at the workplace are circumvented and the focus of the studies is only the presence or absence of identifiable symptoms of disease. These factors also would contribute to the occurrence off accidents. There are no systematic studies of organisation aspects of work that are detrimental to disease and injury.

The trends in studies also show a fall in the number of studies pertaining to the workers in the unorganised sector. The labour reforms institutionalised by the State and resultant casualisation of labour would now see more workers becoming part of this unprotected sector. Neglecting their conditions of work and the diseases emanating

[49] Qadeer, I. & Roy, D. (May-June1989) Work, Wealth and Health- Sociology of Workers' Health in India, Social Scientist, Tulika Publications, New Delhi, Vol.17, No.5-6, pp.45-92

from them would essentially make their lives and work more invisible contributing to greater vulnerability.

In most of the cases the studies have not questioned the work process, it is taken as given and then the interventions are recommended within that process of production. The study examining conditions of slate workers after recognising the totally vulnerable situation of these workers to be working in such dangerous conditions goes on to measure only intricate details of the lung impairments using sophisticated medical instruments and tries to find curative possibilities to cure the workers. Silicosis is said to have no cure. Curative options are important to mitigate the suffering of those who are already suffering. But the study doesn't offer a word for those who could be protected by prevention not through the mere application of engineering or medical prevention but mitigation of all the circumstances that create such vulnerability for workers. The study does not even touch the issue of implementation of law or rules or structure of industry and labour force. It does not ask questions regarding structural importance of this kind of production process in the economy or the products so produced and how cheap and vulnerable labour translates in to greater profits for employers. .

None of the studies address systemic issues like the shortcomings of the legislations, the inadequacy of services and security cover provided by the ESI or poor statistical records of injuries and disease at the workplace. There is just one study in the 1990s that examines the possibilities of providing occupational health services in rural areas through a PHC. It is a recognition of the need for providing occupational health services through the general health service system. But this would require trained manpower to effectively diagnose the ailment and provide treatment along with, maintenance of records. The study shows that the health service system needs effective medical education to deal with occupational problems of people.

Interventions have mostly taken the shape of installing equipment to control agents like dust as was the seen in the case of the agate industry[50] or they have recommended education of workers to correct faulty behaviours like poor postures in the case of the

[50] An Intervention Study in the Agate Industry (1991-92)

study of back pain among employees of the ONGC[51]. Despite their observations stating long hours of travel to the workplace as the cause of back pain among the workers the researcher advocated their education to correct faulty postures as at work and during travel instead of recommending provision of housing near the workplace, by the corporation. This shows a tendency to blame the victims for their health problems indicating individual responsibility of health. Pre-employment medical examination to select workers who would be less susceptible to ill health that the exposures might cause is yet another example of an understanding that seeks to eliminate workers on the basis of 'susceptibility' that could be psychological or physiological. The prime purpose of these tests is 'elimination of defectives'[52], those whose employment will not be profitable to industry. The researchers recommend medical examinations prior to employment also as recommendations to identify 'susceptibility' by the ONGC near the place of work for the employees.

The study on quartz workers admitted the limitations of a prevalence study and stressed on the need for follow-up. The study makes recommendations where calls for medical examinations- pre-employment but it does not specify the purpose these medical examinations would serve in the case of an occupation, even short periods of exposure to which result in very high levels morbidity. A recommendation for periodic medical examinations is obsolete for workers in the unorganised sector. The study also fails to ask questions regarding the kind of the relations of production in which this process is taking place. The researchers maintain silence regarding the issue of implementation of law or rules or structure of industry and labour force. The suggestion to inform the worker regarding the damaging effects of the work would also lay the onus of ill health on the worker. This suggests the notion of free choice of occupation, irrespective of the disabling social and economic circumstances, which leave little choice for those who are insecure. The onus of prevention also lies on the worker in that it is suggested that he obey the instructions of the employer to save

[51] Low Back Pain Among Workers of the Oil and Natural Gas Commission (1977)

[52] Berman, D.M. (1978) Death on the Job- Occupational Health and Safety Struggles in the United States, Monthly Review Press, New York, pp.97

himself. The organisation of the production process is taken as given. And the researchers again have little to say regarding the role of governmental intervention to protect these workers.

The work done is also tremendously repetitive in nature. This especially true of the experimental studies on animals and also environmental studies. The studies themselves have conceded the limitations of extrapolation of the results of animal experiments to human beings on more occasion than one. The importance of such research is limited and can help in understanding prognosis of diseases which would be of help to deal with them through preventive and curative measures. But these interventions would also be clinical in nature and would not be able to deal with the systemic causes of health and disease in the industrial workers.

In case of the studies conducted on asbestos workers the authors quote studies conducted in the West that have shown negligible or not very severe effects of asbestos on workers involved in its production. The authors do not question the subjective notions and factors that underlie these so-called objective studies. Questions like who conducted the studies, who sponsored them and in what context have these studies emerged? In nearly all the studies on asbestos workers the researchers have examined the smoking habits of workers, to examine its effects on the lungs and how it aggravated certain changes that were already caused due to exposure of asbestos. Though important for analysis it could very well be utilised for blaming the workers for the health problems generated primarily by the nature of the work. These not make any recommendations for intervention in the area for prevention, other than personal protective equipment for the workers. All this is despite the path breaking work done by Sellikoff and colleagues in the United States showing the carcinogenic and fatal effects of asbestos in the same period. The studies are basically conducted to explore the effects of chrysotile asbestos on the health of workers.

For the study examining manganese exposure among workers in the dry cell manufacturing units the threshold levels adopted are the ones that have been

recommended by American Standard setting institutions or the W.H.O. The standards are not questioned whereas there has been earlier evidence of differential standards observed in different countries dependent on political orientation and the relative strength of the private sector in manufacturing in those countries. For example the Russian standards and TLVs were 10-200 less than those of the Americans[53].

In the 1980s also there were continuing explorations into work in the small sector units. The studies on the ceramic and glass units do not explore socio-economic conditions, wages, and hours of work. If they had done so, they would be able to make better associations of prevalence of TB with poor working conditions, low wages, long work hours, negligible food and rest and poor housing conditions to show how the 'occupational disease' silicosis gets exacerbated and more disabling when coupled with poor social and economic conditions of workers. The study does not even comment on the implications that this would have on compensation and treatment of workers suffering from both silicosis and tuberculosis.

The studies conducted in the 1980s regarding asbestos clearly show that working with asbestos even at levels lower than TLVs results in respiratory impairments. The study does not consider the option of exploring alternate materials to replace a substance, which is clearly hazardous.

Very few studies like the one referring to jute workers in Calcutta are insightful. This particular study looks at various aspects of the workers lives. Though there is no analysis at this point it very poignantly brings out the social and economic alienation that characterises the lives of these workers. The study is useful sociologically and corroborates the findings of Qadeer and Roy[54].

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[53] Navarro, V. (1986) The Labour Process and Health: A Historical Materialist Interpretation, Navarro, V (ed.) Crisis, Health and Medicine- A Social Critique, Tavistock Publications, New York, United States of America, pp.130

[54] Qadeer, I. & Roy, D. (May-June1989) Work, Wealth and Health- Sociology of Workers' Health in India, Social Scientist, Tulika Publications, New Delhi, Vol.17, No.5-6, pp.45-92

The researchers at best perceive workers as passive subjects. their perceptions and participation in the process for interventions matters little. Most of them are only asked to give their opinions through already structured questionnaires, beyond which the workers do not participate actively in the process of research neither are their perceptions regarding mitigating the ill effects of work taken into consideration.

In successive decades the institute's work has focussed on more and more micro aspects of the same problem, whether it is byssinosis due to cotton, or asbestosis or silicosis, or effects of exposure to pesticides, the macro issues have been completely sidetracked. The studies do not move beyond obviously visible phenomena. They do not also seem to concern themselves with repercussions other than that on the body due to the suffering from disease. The outcomes like loss of livelihood, or insecurity of livelihood have far reaching effects on various social and economic aspects of workers lives. Nor do the studies mention a word on the non-implementation of law in the organised sector or raise the questions of compensation, treatment or rehabilitation of the suffering workers. None of the studies comment on the need for treatment or rehabilitation of workers suffering from disease and disability nor do they suggest measures that can be taken to intervene at the policy level in order to create better conditions of work especially for the workers in the unorganised sector.

The psychological studies conducted at NIOH are in the same vein as those seen at AIIHPH. They also view the workers instrumentally as mere human capital that has to be manipulated in order to be most productive and efficient. The best conditions of efficiency and productivity are sought to be predicted through markers such as physiological reactions. Certain experiments have been conducted on groups other than workers such as college students to predict the effect of noisy and quiet environments on performance. Thus ignoring the effect of class differences and social circumstances on the mental stress.

Mental health of a worker is not determined only by his physical state, but is closely linked with other factors like autonomy at work, dignity, recognition, control and a large number of factors in society, the refusal to acknowledge these factors shows a

narrow individualistic focus that serves more top blame the victim or his physiology for the problems. The psychological studies also rely more on quantitative analysis emotions and affective states of workers, modelling them on natural sciences. They negate the role of social influences that cannot be controlled and thus obscure the realities that construct mental states of human beings who are also social beings.

**Conclusions:**

An examination of the entire period post 1947 to 1998 reveals interesting trends about the direction in which research in the area of workers' health is heading. The trends can be summarised as follows:

- In order to understand the effects on the health of the workers there is a growing reliance on clinical and biochemical examinations and measurement of levels of harmful physical agents, using specific instruments.
- During Rao's tenure as the Head of the Section of Industrial Hygiene and Physiology there was an emphasis on studies that examined the social circumstances of workers lives. He himself also represented 'an alternative stream' of thought within occupational health, as it existed at that point in time. His work involved an analysis of the discipline at systemic levels and his recommendations also spanned areas as broad as creation of regulatory legislation, maintenance of statistical records etc. His interdisciplinary perspective attempted to build linkages of occupational health with other professions like labour welfare officers, social workers and social scientist in understanding and addressing the then existing problems associated with industrialisation and urbanisation.
- This perspective slowly waned with the emergence of work in areas like health physics and industrial hygiene that was pioneered by NL Ramanathan who went on to become the first director of the NIOH. He promoted the cause of experimental and clinical studies as against observational studies and surveys. During the subsequent years an increasing reliance on experimental and clinical methods to assess the physical and psychological effects of work on the health of workers was observable.

- The movement in choice of study subjects is illustrative of the movement in choices of commodity production made in India and abroad. The earlier studies from the 1950s to the early 1970s had focussed on the jute and cotton textile industries that were the largest at that time. During the 1960s the first toxicological studies made their appearance though they were just 2 in number at the AIIHPH. In course of the subsequent decades with greater diversification in commodity production and utilisation, there was a growing emphasis on the chemical industry the mid 1970s. Initially pesticides were the focus of study but industrial solvents and dyes followed in the 1980s and 1990s.
- The shift in the nature of the studies is also a shift in the usefulness of the research to various sections of people in society. In Rao's understanding research in the area of occupational health needed to be of utility to the social scientist, the administrator, the hygienist and the medical practitioner. But the transition from research with moorings in this interdisciplinary tradition to hardcore 'scientific' research in the biomedical paradigm using the methods and techniques of biomedicine symbolises a centralisation of control of knowledge and power in the hands of a few experts who will now define disease and health in parameters that they choose and that establish their control.
- A progressive narrowing of parameters of health and disease is reflected in the shift from observational studies in factories to experimental studies on animal subjects. This shift in the level at which health and ill health are being studied is a result of proliferation of more complex technologies in the realm of production and in the realm of medicine.
- The trend reflects an increasing failure to address the social, economic and political causes and effects of ill health accruing from employment in hazardous industries, and a tendency to blame the worker who is himself the victim of these hazardous exposures.
- This trend that seeks causes of disease within specific measurable substances and its effects on specific parts of the body also suggests increasingly individualistic measures of prevention. In case of chronic diseases like cancer due to asbestos the effort is constantly to study smoking habits of individuals whereas the

carcinogenic potential of asbestos is well known and documented. The effort is to shift the onus of ill health from the production process manned by the employer to the worker's behaviour and lifestyle. All the studies on asbestos exposure study smoking habits of workers, though most of them have shown that the smokers do not show significant changes in vital capacities of the lungs due to smoking.

- This shift is also a reflection of the movement of social processes from a context of a degree of state intervention in the area of workers health, immediately after independence and efforts on the part of the labour movement to keep issues of labour alive and the struggle potent in the 1960s and 1970s; to a context where the State is abdicating all the responsibilities befitting a welfare State and the private sector is becoming the dominant player in the realm of production. Labour movement stands week and fragmented and increasing casualisation owing to labour reforms have taken away the teeth of protective legislation for workers. In such a context, research has moved from one that perceived social and political circumstances of workers lives and work to be detrimental to health to one that focuses on the immediate causes of disease in the worker's body or his immediate environment. They ignore the social power relations that determine the environment of exposures to certain physical conditions of work, which also determine how a worker fits into that particular work environment. By ignoring these fundamental roots that create disabling environments for workers one may only be able to recommend measures that are, at best, extremely limited in scope, and at worst, misleading and dangerous.

# CONCLUSION

The trajectory that Occupational Health Research in India has followed is closely associated with the movement in the social and political environment of society along with the State's perspective and its commitment to the cause of the working class in India. This perspective in turn is shaped by the interaction of contending social forces that exist in society.[1] Various perspectives of knowledge may coexist at a given point in time. But the State through its covert and apparent policies and actions creates conditions that influence the presence and varying visibility of different perspectives. The State's perspective thus plays an important role in orienting the direction of knowledge generation and defining the 'mainstream' and the 'marginal' bestowing legitimacy to a given paradigm at a particular point in time.

Post independence there was a great emphasis on the centrality of industrialisation in the Nehruvian dream of development. Thus the industrial worker was the focus of social-security and health provisioning in the form of the ESI and the earlier proposed Industrial Health Service. These provisions were also made with a view to conserve the small section of skilled labour that was employed in the industries. The establishment of the Section of Industrial Hygiene and Physiology, to train manpower and generate knowledge in the field through research was also a step in this direction.

For the establishment of this new field expertise was borrowed from the more developed and industrialised West. The Section of Industrial Hygiene and Physiology was established under the leadership and expert guidance of Prof. NPV Lundgren who had been sent by the WHO specifically for this purpose. His writings[2] are illustrative of his

[1] Banerjee, D (1986) Social Sciences and Health Services Development in India: the Sociology of Formation of an Alternative Paradigm, Lokpaksh, New Delhi.

[2] Lundgren, N.P.V. (1953) Job Analysis and Placement of Workers, ICMR Symposium on Industrial Health, Bombay; Rao, M.N. & Lundgren, N.P.V. (1955) A Review of Occupational Health in India, ICMR Special Report Series No.29.

perspective entrenched in the dominant stream of occupational health as it had developed in the United States and Europe in the 20th century.

But MN Rao's conceptualisation of occupational health that gave importance to the social and economic underpinnings of health coexisted with the conservative understanding of the same that was borrowed from the American context. The existence of an alternative perspective in a State-sponsored institution for medical education and research was fostered within an environment of the State's commitment to the cause of securing social justice and equity for the people of the country. This was reflected in the recommendations of the Bhore Committee, the State's efforts to invest in developing basic health services, community development programmes to deal with poverty, a social orientation of medical education, and the recognition of linkages between health and access to employment, social sector services of public health and education.

At the same time it is important to remember that occupational health has been an obscure field in the area of medicine. And it has been so in the Indian context as well. The low priority accorded to it in the formal health planning process has been verified in the examination and analysis of the important government reports and documents. And the limited nature of State-intervention in the area of workers health is also reflected in the fragmented character of legislation and social security provisioning. Intervention by the State in the realm of labour welfare had constantly occurred in the face of stiff opposition and reluctance on the part of the capitalist class in India[3].

The gradual shift in content of occupational health research is evident through the late 1960s and the 1970s when there is an ascendance of the dominant paradigm of occupational health rooted in the tradition of biomedicine. This paradigm had now initiated a slow transition from observational studies and surveys to experimental toxicological studies and clinical assessments. Around the same time there were a

[3]Qadeer, I. & Roy, D. (May-June1989) Work, Wealth and Health- Sociology of Workers' Health in India, Social Scientist, Tulika Publications, New Delhi, pp.45-92

number of articles published that pushed for the importance of the roles of the engineer[4] and the medical practitioner in the area of occupational health. There was a growing emphasis on the primacy of disciplines like industrial hygiene and health physics.[5] This shift mirrored the changes in Indian industry. New and more sophisticated technologies and processes were being put to use in the production of more complex commodities like chemicals, plastic and microelectronic equipment. It was also a reflection of the dynamic within the discipline itself and the need felt by the professionals within it to obtain greater 'scientific legitimacy'.

By the 1990s the research in the area of occupational health had now progressively narrowed down to more and more micro parameters of defining health and illness from physiological to biochemical and immunological causes and effects of disease in the industrial workers. Research as is pursued today at the NIOH is far removed in character from MN Rao's endeavours to study the effects of work on health. It has now moved in its focus, methods and techniques of studying health problems in the industry. The worker has lost the centrality that was accorded to him by Rao and some of his colleagues even those whose interests in occupational health stemmed primarily from concerns of productivity and efficiency of the worker. The research has now become an end itself. The methods of study are experimental, centred in a laboratory environment and the techniques used involve more quantification of observable causes and symptoms.

Current research does not deal with the health problems at varying levels unlike MN Rao's work that examined both micro and macro aspects. In the case of jute dermatitis[6] he studied the aetiology of the disease in the workers in the jute mill and identified the agent of causation associating exposure to the structural constraints which poverty laid on

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[4] Majumder, N (1958) Role of Engineers in the Industrial Health Service, Alumni Association Bulletin, AIIHPH, Vol.7, pp.18

[5] Ramanathan, N.L. (1957) Industrial Health Physics – New Concepts in the Study of Physical Environment in the Industry, Indian Journal of Industrial Medicine, Vol.3, pp.24.

[6] Rao, M.N. (1943) A Note on Occupational Dermatitis in the Jute Industry in India, Indian Journal of Medical Research, pp.

basic needs like amenities for bathing and clean clothing that could prevent the aggravation of the disease. Along side the same time he also recommended the need for legal recognition[7] of jute dermatitis as an occupational disease that affected jute workers in India.

As a physician working in the field of occupational health, he perceived it as an important part of public health that required interdisciplinary action in collaboration with other disciplines in social sciences and other professions in the industry. He thus tried to define the role of the practitioner in the industry. That research conducted must be of use to social scientists and administrators besides scientists was one of his primary concerns. Hence his kind of research was done with a definite understanding to intervene in real life situations of workers in the industry at varying levels.

Whereas, research at the NIOH creates highly specialised knowledge that is of very limited use in terms of intervention. It constitutes study designs that examine one problem repeatedly, examining more and more micro aspects, as in the case of asbestos exposure. The studies in the 1970s examined carcinogenicity and pulmonary impairments due to exposure. Subsequently in the 1980s and the 1990s the same studies were being conducted in addition to which studies examining immune responses of workers also were carried out. But these studies did not point to the structural social and economic factors that led to those exposures, like the significance of the asbestos industry in India, the recruitment practices followed, what part of it employed contract or casual labour etc. Neither did they comment on other aspects like failure of the implementation machinery to enforce laws or the absence of treatment and rehabilitation facilities for suffering workers.

The methods of study currently at use in research at the NIOH subscribe to the dominant paradigm of occupational health that was defined by the industrial establishment in the context of laissez faire capitalism in the United States. Thus the use of biomedical methods and techniques of assessment and analysis have effectively masked the social,

[7] Rao, M.N. & Banerji, B. (June, 1952) Does Occupational Dermatitis exist in Indian Industries? Indian Medical Gazette, pp.265-268.

political and economic causes of disease. The definition of concepts in occupational health and industrial hygiene has been influenced by the private sector to serve its purpose of increased labour productivity and profit maximisation. Thus the concepts of illness and health were defined in order to save costs and enhance profits. The definitions so created served to shroud power relations in society that created conditions generating disease. These power relations were shaped by the organisation of production as it existed in the United States that defined the choice of the path of development in which workers had little control.

The rise of this paradigm and now its supremacy in the realms of State-sponsored research in India has occurred in a context where the welfare state is fast retreating from its commitments and leaving the ground open for private players. The economic policies it is pursuing, the related casualisation of labour and erosion of protective legislation are contributing to worsening of working conditions. The encouragement of investment in fast growing sectors like chemicals along with incentives to entrepreneurs and foreign investors have promoted the growth of hazardous industries, employing causal labour in an unregulated manner. There is enough documented evidence on the appalling condition of work in EPZs[8] and the chemical belt in Gujarat[9] among industries.

The State has maintained a deafening silence on this immiserisation of the working class. And the nature of current research at NIOH is part of this silence. It is only serving the purpose of reinforcing the absence of the worker from the discourse on health, with its starting point not located in the suffering of workers but in the concerns of productivity for the benefit of the industrial establishment and the glory of the discipline in 'scientific' research for its own sake.

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[8]Swaminathan, P. (2002) Labour- Intensive Industries but Units without 'Workers': Where will ILO's Social Dialogue Begin?, Madras Institute of Development Studies, Chennai.

[9] Rajagopal, R. (1995) The Chemical Industry in Gujarat- a Rapidly Industrialising Zone in Hesselberg, J. (ed.) Industrial Pollution: The Chemical Industry in Gujarat, India Research Proposals, FIL Working Papers, No.5, University of Oslo, Norway.

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## APPENDIX I

### GLOSSARY

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|---|---|
| 1. Antibodies | A protein produced in a vertebrate when any foreign substance like a parasitic microbe gains access into it. The antibody kills it and makes its poison innocuous. |
| 2. Asbestosis | Chronic inflammation and congestion of the lungs due to excessive inhalation of asbestos dust |
| 3. Carcinogenicity | Potential of a substance to produce cancer |
| 4. Cheilosis | A disorder associated with Vitamin B deficiency causing redness and lesions of the lips |
| 5. Chromatid | One of the two strands of a chromosome formed during cell division. |
| 6. Crepitation | Crackling sound associated with lung disorders |
| 7. Cytochemical | Associated with chemicals in the cell |
| 8. Endotoxins | A toxic substance that remains in the organism that produces it |
| 9. Enzyme | A protein that promotes chemical change |
| 10. Glossitis | Inflammation of the tongue |
| 11. Hypothyroidism | Decreased activity of the thyroid gland |
| 12. Immunoglobulin | A protein in the blood plasma that confers immunity |
| 13. Ovaractomise | Removal of the ovary by surgery |
| 14. Peritoneal | Pertaining to the abdominal cavity or its membrane lining |
| 15. Pleural | Pertaining to the membrane lining of the lungs |
| 16. Pulmonary Function Test | A medical examination pertaining to the function of the lungs |
| 17. Serum | The fluid part of the blood |
| 18. Silicosis | A disease of the lungs that is caused by continually breathing dust from quartz or silicates |

## APPENDIX II

**STUDIES AND ARTICLES FROM THE SECTION OF INDUSTRIAL HYGIENE AND PHYSIOLOGY OF THE ALL INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH**

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# APPENDIX III

## STUDIES FROM THE NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH

### 1974

1. Short and Long Term Effects of BHC on Malaria Spray men in Gujarat State.
2. Carcinogenicity Testing of DDT (Dichloro-Diphenyl-Trichloroethane) In Laboratory Animals (Mice) (1974)
3. Study on effect of precipitation on air pollution.
4. Study of Sulphation Rate in Ahmedabad city.
5. Health Hazards in small-scale Industries, Non-Ferrous and Stainless Steel Foundries (1975)
6. Biomedical Engineering Research- Noise level meter.
7. Test of Biochemical Indices of Lead Absorption in Workers Occupationally Exposed to Lead (1975)

### 1975

8. Short and Long Term Effects of BHC on Malaria Spraymen in Gujarat State.
9. Experimental Evaluation of Carcinogenicity of BHC in Pure Inbred Swiss mice.
10. Health Hazards in small-scale Industries, Non-Ferrous and Stainless Steel Foundries (1975).
11. Test of Biochemical Indices of Lead Absorption in Workers Occupationally Exposed to Lead.
12. Efficacy of Ear Protectors in Relation to Psychological Performance.
13. Health Hazards in Rice Mill Workers.
14. Retrospective cum prospective study of accidents involving human factor in a Textile mill.

### 1976

15. Second Follow up Study on Long Term Effects of DDT on Malaria Spray men in Gujarat state.
16. Study of Pesticide pollution from Chlorinated Insecticides Especially DDT in the Environment of Man and Other Livestock in the Country (1976)
17. Evaluation of Carcinogenicity of BHC (Hexachlorocyclohexane)- A Short Term Study (1976)
18. Toxicity Evaluation of Organochlorine Insecticides in Army Spray men.
19. Clinical and Pulmonary Tests of Workers in an Asbestos Cement Factory (1976)
20. Health Hazards in Small-scale Industries, Ceramic and Pottery Health Hazards Industries (1976)

21. Carcinogenicity Testing of Asbestos Fibres (1976)
22. Effect of Associated Anion on Manganese Toxicity (1976)
23. Experimental Studies on Manganese Toxicity (1976)
24. Efficacy of ear protectors in relation to psychological performance.
25. A Laboratory Study of Psychological Tests in Hot Environments.
26. Study of Workers Exposed to Organic and Inorganic Lead in Various Types of Industries.
27. Early Detection of Health Impairment due to BHC (Hexachlorocyclohexane) exposure (1976)

## 1977

28. Health Hazards In Small- Scale Industries- Ceramic And Pottery Industry
29. Study Of Garage Workers Exposed Tc Lead.
30. Occupational Exposure To Trace Elements.
31. Study On Occupational Health Problems In Tobacco Workers.
32. Health Hazards Of Pesticides To Applicators: Pest Control Operators And Warehouse Workers.
33. Carcinogenicity Testing Of Asbestos Fibre- A Preliminary Study.
34. Experimental Studies In Manganese Toxicity.
35. The Effect Of Associated Anion On Manganese Toxicity.
36. Efficacy Of Ear Protectors In Relation To Psychological Test Performance And Working Efficiency.
37. Low Back-Pain Among Workers Of Oil And Natural Gas Commission (Ongc).
38. A Portable Detachable Hot-Dry And Hot-Humid Chamber.

## 1978

39. Health Hazards In Small-Scale Industries: Ceramic And Pottery Industries.
40. Evaluation Of Occupational Exposure To Trace Metals: Manganese Exposure In Dry Cell Units.
41. Health Hazards In Pesticide Formulators.
42. Toxicity Of Chrysotile Asbestos on Chinese Hamster Ovary Cells in vitro.
43. Early Changes In Serum Proteins And Liver LDH-isoenzymes in Mice Exposed to Technical Grade BHC.
44. Experimental Studies In Manganese Toxicity.
45. Comparative Epidemiological Studies Of The Effects Of Pollutants.
46. Maze Learning of Swiss Inbred Mice in Quiet and Noisy Conditions
47. Design and standardisation of a Portable Audiometric Booth (ROHC-Banglore).
48. Directory Of Industries.
49. Occupational Hazards In Coir Workers.
50. A Preliminary Study to Enquire into the Utility of Temporary Threshold Shift of Hearing Levels.

## 1979

51. Comparative Epidemiological Studies of the Effects of Pollutants.

52. Study Of Petrol Fillers Exposed To Lead.
53. Health Hazards In Pesticide Formulators.
54. Health Survey Of Shift Workers In A Textile Mill Of Ahmedabad.
55. Environment Cum Medical Surveillance In Asbestos Cement Factories.
56. Evaluation of Attenuation Characteristics of Individual Ear Protectors.
57. A Study of Hearing Sensitivity among Weavers of a Textile Mill.
58. Effects of Chrysotile Asbestos (AP-1) on Sister Chromatid exchanges in Chinese Hamster Ovary Cells.
59. Experimental Studies In Manganese Toxicity.
60. Influence Of Toxic Metals On The Memory Forming Processes- Experimental Studies In Lead.
61. Occupational Health Hazards In Cotton Workers. (ROHC).

## 1981

63. Comparative epidemiological studies of effects of air pollutants.
64. Developments of method for predicting occupational fatigue resulting from work component. Part-II : Technique for quick appraisal of physical work capacity.
65. Occupational health problems among beedi tobacco processing workers.
66. Health hazards of slate- pencil workers at Mandsaur.
67. Environmental cum medical survey in asbestos cement factory.
68. Malathion toxicity in relation to malnutrition. Part-I: Protein deficiency in experimental animals.
69. Bioassay of Lindane (Gamma BHC) for possible carcinogenicity in pure inbred swiss mice.
70. Experimental studies on Manganese toxicity.
71. Under nutrition and lead toxicity- an experimental study.
72. Influence of oral lead acetate on cognitive functions and learning in rats.
73. Design, construction and attenuation characteristics of an acoustic chamber.
74. Occupational health hazards in coir workers. (Phase-III) (Health Status) (1981)
75. Occupational health hazards in a catalyst manufacturing unit. (1981)
76. An enquiry into lead absorption in a battery manufacturing unit at Banglore (1981).
77. Air pollution survey in Banglore(1981)
78. An occupational health survey of licensed railway porters with special reference to their work stress. (1981)
79. Director of industries in Eastern India. (1981)

## (1983-84)

80. Occupational Health Problems Among Tobacco Workers- Intervention Programmes (1983-84) Occupational Health Survey of Women Workers Engaged In Beedi Making (Rolling) (1983-84)
81. Comparative Epidemiological Studies on Effects of Air Pollutants (1983-84)
82. Sound Level Measurements at the Compressor House of a Petroleum Crude Stabilization Unit of Oil and Natural Gas Commission (ONGC) (1983-84)
83. An Epidemiological Survey of Byssinosis in Textile Industry of Ahmedabad (1983-84)
84. Role of Microbes in the Causation of Byssinosis Endotoxin Levels in Respirable Dust (1983-84)

85. Occupational Health Survey of Women Workers Engaged in Beedi Making (Rolling) (1983-84)
86. Health Hazards in Wool Industry (1983-84)
87. Health Hazards in Glass Industry (1983-84)
88. Heat Stress in Glass Industry (Medium Scale) (1983-84)
89. Health Hazards in Fluoride Industry (1983-84)
90. Health Hazards among Workers Involved in Manufacturing BHC- Part I And II (1983-84)
91. Effects Of BHC on Antipyrine Half- Life and Pentababitone Sreeping Time- A Comparative Evaluation with Exposure to Cadmium and Carbon Tetrachloride (1983-84)
92. Effects of Hexachlorocyclohexane on Polyamine Metabolism- Short Term Studies in Swiss Inbred Mice (1983-84)
93. Malathion Toxicity in Rats Pretreated with Cadmium and Carbon Tetrachloride (1983-84)
94. Effect of Lead on Human Sperm and other Semen Constituents (1983-84)
95. Experimental Studies in Manganese Toxicity (1983-84)
96. An Episode of Massive Fish Mortality in Lake Kankaria in Ahmedabad- A Case Study and Follow Up Surveillance (1983-84)
97. Studies on Heat Exchange Phenomena between Human Body and Environment with Reference Exposure. Part – II: Convergence of Deep Body and Surface Temperatures As a Measure to Occupational of Heat Tolerance (1983-84)
98. Pulmonary Functions Tests in Slate- Pencil Workers – First Follow Up Study (1983-84)
99. Performance Efficiency under Various Illumination Levels (1983-84)
100. Study of Workers Exposed to Nickel and Cadmium in Battery Manufacturing Unit (1983-84)
101. Air Pollution Study in Banglore City-1983.
102. Errors In Estimation of Total Leucocytic Count- Appropriate Technology Appliance to Prevent Hand Injuries in Coir Yarn Spinners (1983-84)
103. A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1983-84)

## (1984-85)

104. Comparative Epidemiological Studies on Effects of Air Pollutants (1984-85)
105. Monitoring of Airborne Concentrations of Organochlorine Insecticides in an Urban Area (Ahmedabad) (1984-85)
106. Low Level Noise and Intellectual Performance (1984-85)
107. An Epidemiological Survey of Byssinosis in Textile Industry in Ahmedabad- Studies on Immunoglobalius and Serum Proteins (1984-85)
108. Role of Microbes in Causation of Byssinosis (1984-85)
109. The Health Status and Anthropometric Parameters of Working in Small-Scale Industries (1984-85)
110. Health Hazards in Glass Industries (1984-85)
111. Health Hazards in Slate- Pencil Workers. Part-I: Electro-Cardiographic Changes in Slate Pencil Workers. Part-II: Peak Expiratory Flow Rate as an Index of Ventilatory Capacity (1984-85)
112. Acetylator Phenotype And Risk of Bladder Cancer: Approaches to High-Risk Groups (1984-85)
113. Health Survey of Workers Involved in the (I) Manufacturing of BHC (II) Effects of Long Term Exposure of BHC on Polyamine Metabolism in Swiss Inbred Mice Liver (1984-85)

114. Effect of Lead on Adreno-Gonadal System (1984-85)
115. Experimental Studies on Manganese Toxicity (1984-85)
116. Toxicity of Environmental Chemicals on Fresh Water Fish (1984-85)
117. Studies on Heat Exchange Phenomena between Human Body and Environment with Reference to Occupational Exposure. Part-III: Efficiency of Work in Heat (1984-85)
118. Environmental Monitoring in Electroplating Sections- Report of the Environmental Survey Carried out at Electroplating Sections of HMT Watch Factory (1984-85)
119. Follow Up Study of Workers Exposed to Nickel and Cadmium in a Battery-Manufacturing Unit (1984-85)
120. Air Pollution Study in Banglore City- (1984)

## (1985-86)

121. Evaluation of Health Hazards in Quartz Crushing Industry and Evaluation of Dust Control Measures (1985-86)
122. Health Hazards in Glass Bangle Industry (1985-86)
123. The Effects of Times of Day on Cognitive and Visuo-Motor Performance (1985-86)
124. Studies on Heat Exchange Phenomena between Human Body and Environment with Reference to Occupational Exposure. Part IV: Basis of Software for a Rational Environmental Warmth Index (1985-86)
125. A Study of the Occupational Health Effects on Workers Employed in a Large Transport Workshop (1985-86)
126. An Epidemiological Study of Byssinosis in Textile Industry of Ahmedabad (1985-86)
127. Role Of Microbes in the Causation of Byssinosis: Quantitative Assessment of Gram Negative Bacteria (GNB) (1985-86)
128. Health Survey of Pot-Room Workers in Aluminium Manufacturing Industry (1985-86)
129. Acetylator Phenotype and Risk of Bladder Cancer: Approaches to High Risk Groups (1985-86)
130. Health Status and Anthropometric Parameters of Women in Small Scale Industries (1985-86)
131. Organisational Role- Stress- It's Nature and Coping Pattern in Women Executives of Junior and Intermediate Levels (1985-86)
132. Calibration of Exposure Chamber System (1985-86)
133. Health Survey among Workers Involved in Manufacture Of BHC- First Follow Up Study (1985-86)
134. Evaluation of Delayed Neurotoxicity Following Acute Organophosphate Insecticides Exposure in Man (1985-86)
135. Experimental and Field Studies on Manganese Toxicity (1985-86)
136. Effect of Lead on Adreno-Gonadal System in Rats (1985-86)
137. Toxicity of Metal (Cadmium) on Fresh Water Fish (1985-86)
138. Assessment of the Working Environment of Thermic Oil Firing Section and Engineering Design Sections and Morbidity Survey of the Workers in New Government Electric Factory (NGEF), Banglore (1985-86)
139. Medical Survey of Workers Employed in Electroplating Units of HMT Watch Factory, Banglore (1985-86)
140. Acceptability of Handgrip Developed by ROHC (S) for the Use of Coir Yarn Spinning to Prevent Hand Injuries (1985-86)

141. Prevalence of Lead Poisoning Among Printing Press Workers in Banglore (1985-86)
142. A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1985-86)
143. Pneumoconiosis Due to Mica Dust Inhalation in the Mica Processing Industries In India- A Follow Up Study (1985-86)

## (1987-88)

144. Study of Respiratory Morbidity in Agate Workers (1987-88)
145. An Intervention Study in Asbestos Cement Factory (1987-88)
146. Health Hazards in Glass Industry – Hygiene Survey in Medical Glass Unit (1987-88)
147. The Combined Effects of Noise and Illumination Components of Visual Search and Neuromotor Tasks (1987-88)
148. Effective Management of Heat Exchange under Adverse Environmental Condition. Part-I: Influence of Air Velocity on Thermo Regulatory Parameters (1987-88)
149. Experimental Studies on Manganese Toxicity (1987-88)
150. Toxicological Studies on Reproduction and Neurobehavioural Effects of Industrial Solvents (1987-88)
151. A Preliminary Study on the Microflora of a Solvent Processing Factory (1987-88)
152. Biochemical, Immunological and Cytogenetic Changes in MIC Exposed People at Bhopal : A Follow Up Study (1987-88)
153. Experimental Evaluation of Promoting Potentiality of BHC (HCH) in Albino Rats using Aflatoxin B1 as Hepatocarcinogen (1987-88)
154. Assessment of Working Environment and Morbidity of Persons Employed in the Factory Manufacturing Latex Condoms. Part-I: Environment Surveillance Part-II Medical Surveillance (1987-88)
155. Pnemoconiosis due to Mica Dust Inhalation in Mica Processing Industries in India- A Follow Up Study (1987-88)

## (1988-89)

156. Study of Silicosis in Sand Grinding Workers (1988-89)
157. The Acute Effects of Heat on Neuro- Psychological Changes and Physiological Responses under Noise Condition (1988-89)
158. A Study on Indoor Air Quality (1988-89)
159. Development of a Device (Step Wedge Penetrometer) To Standardize the Technique in Chest Radiography and Detecting Errors in Alignment and Cantering of X-Ray Beam (1988-89)
160. Health Hazards in the Workers of a BHC Manufacturing Unit (1988-89)
161. Experimental Studies on Manganese Toxicity (1988-89)
162. Toxicological Studies on Reproductive and Neurobehavioural Effects of Formaldehyde. Part-I: Neurobehavioural Study Part-II: Reproductive Study (1988-89)
163. Bioaccumulation of Heavy Metal Cadmium in Fish (1988-89)
164. Toxicological Screening and Exposure Assessment for Hazardous Chemicals through Microbial Screening (1988-89)

## (1989-90)

165. Prevalence of Asbestosis in Asbestos Mines (1989-90)
166. Cotton Dust Exposure in the Ginning Industry (1989-90)
167. Measurement of Real Ear Attenuation of Indigenous Hearing Protection Devices on Various Frequencies. (1989-90)
168. Polycyclic Aromatic Hydrocarbon Concentrations in the Work Environment of Glass Industry (1989-90)
169. Toxicological Evaluation of Pan Masala (1989-90)
170. Controlled Inhalation Exposure Studies on Methyl Isocyanate (1989-90)
171. Toxicological Studies on Reproduction and Neurobehavioural Effects of Formaldhyde (1989-90)
172. Toxicity and Exposure Assessment through Microbial Screening (1989-90)
173. Microbial Test Systems for Genotoxicity Screening (1989-90)
174. Measurement of Neurotransmitter Receptor Activity (1989-90)
175. Monitoring of Work Environment and Health (1989-90)
176. Effects among Workers Engaged in Ferroalloy Plants (1989-90)
177. Study Of Pneumoconiosis in Underground Coal Miners in India (1989-90)
178. Ambient Air Pollution around Lead Smelting Factory (1989-90)

## 1990-91

179. Role of Circulating Immune Complexes in Immuno pathogenesis of Non Occupational Pneumoconiosis in Villages in Central Ladakh.
180. Immunological Profile of Workers having Asbestosis.
181. Health Effects of Methomyl- A Carbamate Insecticide on Spray Operators.
182. Cotton Dust Exposure in the Ginning Industry
183. Dispersion of Air Pollutants from a Single Source-Mathematical Model Testing.
184. Human Performance Capability in Psychomotor Tasks at Variable Difficulty Levels and Physiological Reactions under Noise and Heat Conditions.
185. 'Workman'- A Biomechanical Model for Ergonomics Application.
186. Controlled Inhalation Exposure Studies on Methyl Isocyanate.
187. Experimental studies on Manganese toxicity.
188. Neurobehavioural Toxicity of Lead in experimental Animals.
189. Toxicological Studies on Reproduction and Neurobehavioural Effects of Formaldehyde.
190. Toxicity Study of Dyes on Water Flea, Daphnia Magna.
191. Toxicity and Exposure Assessment through Microbial Screening.
192. Microbial Test Systems for Genotoxicity Studies.
193. Detection of Genotoxic Activity in Particulate Air Pollutants.
194. Occupational Health Care Delivery through PHCs to Workers In Rural Areas.
195. Occupational Cancer

## 1991-92

196. Intervention Measures Adopted in Asbestos Milling Units in Cuddappah in (AP).
197. Cotton dust exposure in ginning industry- intervention studies.
198. Determination of illumination conditions in the weaving shed of a textile mill.
199. An intervention study in Agate industry.
200. Health monitoring of workers manufacturing and formulating Organophosphate Insecticides.
201. Immunological profile of workers exposed to pesticides.
202. Residue of Organophosphate Insecticides in human blood samples in Ahmedabad (rural) area.
203. Exposure Study in the Vicinity of a Lead Processing Plant.
204. Ergonomics of Sewing Machine Operation of Women.
205. Experimental studies on Manganese toxicity- Effect of Carbonicillin supplementation.
206. Effects of lead on 5-HT induced contractions of Rat Ileum.
207. Neurobehavioural effects of Formaldehyde in Male Albino rats.
208. Toxicological Evaluation of Formaldehyde on Reproductive System in Rats.
209. Experimental studies in Carbon Disulphide toxicity.
210. Toxicity studies on Complex Industrial Effluents on Fish.
211. Toxicity Exposure Assessment through Microbial Screening.
212. Microbial Test Systems of Genotoxicity Studies
213. Occupational Cancer.
214. Survey to check validity of 'RADIO DATE' in Collaboration with ICMR Headquarters.

## 1992-93

215. Cotton Dust Exposure in Ginning Industry.
216. Health effects of Cyfluthrin, Malathion and DDT on Spray Operators.
217. Evaluation of Joint Related Problems among a Pesticide Manufacturing Plant Workers.
218. Clinical and Biochemical Investigations in Workers Involved in the Manufacturing of Hexachlorocyclohexane (BHC).
219. Occupational Cancer.
220. Occupational health care delivery through PHCs to workers in rural areas.
221. Evaluation of comfort of indigenous hearing protection devices.
222. Utility of Human Model Workman in Biomechanical Strain Assessment.
223. Survey to Check Validity of Viewer's Statements regarding Quitting pof Tobacco Habit 'RADIO DATE' in Collaboration with ICMR Headquarters.
224. Determination of Nickel in chocolate and other edibles.
225. Carcinogenic evaluation of herbicide, 2, 4- Dichlorophenoxy Acetic acid (2, 4-D).
226. Experimental studies in Manganese toxicity- Dose- Response Effect.

227. Effects of organic and inorganic Mercury on Serum Total and Perchloric Acid Soluble Sialic Acids in rats.
228. Experimental studies on Carbon Disulphide toxicity.
229. Toxicity study of textile industrial effluents on water flea and fish.
230. Toxicity and exposure assessment through microbial screening.
231. Microbial test system for Genotoxicity studies.

## 1993-94

232. Intervention Strategy And Health Surveillance In Agate Industry- A Follow Up Study.
233. Cotton Dust Exposure In Ginning Industry- Intervention Studies.
234. A Comparative Evaluation Of Environment In Underground And Open-Cast Asbestos Mining And Milling Units In India.
235. Cognitive Efficiency As a Function Of Time Of Day.
236. Modelling Heat Stress And Strain Assessment For Human Heat Exposure.
237. Occupational Cancer.
238. Estimation Of Dietary Intake of DDT And BHC.
239. Urinary B2-M And Rbp as Sensitive Parameters for Biological Monitoring of Cadmium Exposed Workers.
240. Determination Of Nickel In Chocolate And Other Edibles With Quality Assurance Programme.
241. Experimental Studies On Manganese Toxicity: Alteration In Lipid Profile and Some Biochemical Parameters.
242. Acute Cadmium Effects On Protein Bound Hexose In Rats. Response Of Rat Anococcygeus Muscle To Norepinephrine Under The Influence Of Carbondisulphide.
243. Experimental Studies On Carbondisulphide Toxicity
244. Development Of The Toxicity Testing Methods For Industrial Effluents. Toxicity And Exposure Assessment Through Microbial Screening.

## 1994-95

245. Cotton Dust Exposure In Textile Mill Processing: Coarse And Fine Cotton And Intervention Strategies.
246. Occupational Health Surveillance, Health Status And Hygiene Survey Of A Chlor-Alkali Plant. Immunological And Biochemical Studies In Workers Exposed To Inorganic Mercury.
247. Studies In Benzidine And Benzidine-Based Dyes.
248. Alterations In Affective States Under Different Times Of Day.
249. Modelling Of Heat Stress And Strain Assessment For Human Heat Exposure- Part-Ii- Predictive Human Responses To Heat. Er
250. Occupational Cancer
251. Genotoxic Effect Of Cypermethrin In Mice: Study On The Abnormality Of Sperm Head Morphology.
252. Comparative Studies of Hexachlorocyclohexane on Calcium Translocation on Norepinephrine Induced Contractions in the Rat Vas Deferens and Seminal Vesicle.

## 1996-97

253. Assessment Of Human Exposure To Formadehyde.
254. Acute Pesticide Poisoning And Role Of Plasma Cholinesterase As A Diagnostic Indicator.
255. Studies On Pesticide Formulators.
256. Evaluation Of Neuro-Psychological Functions In Lead Workers.
257. Modelling Heat Stress And Strain Assessment For Human Heat Exposure.
258. Microbial Test Systems For Genotoxicity Studies.
259. Role Of Endotoxins In The Aetiopathogenesis Of Byssinosis: A Preliminary Study On Gram Negative Bacteria (Gnb) And Endotoxins In Ginning House.
260. Air Quality Survey Around A Cement Factory.
261. Monitoring Toxicity Of Effluents Of A Pesticide Industry.
262. Sperm Head Shape Abnormalities And Sperm Counts In Rats After Short Term Chronic Carbondisulphide Exposure.
263. Development Of Toxicity Testing Methods For Industrial Effluents.
264. Trace Metal Effects On Pentabarbitone Induced Sleep In Rats.
265. Experimental Studies On Carbondisulphide Toxicity.
266. Occupational Health Survey Among Electroplating Workers From Wrist Watch Dials Manufacturing Factories. (Rohc, Banglore).
267. Environmental Health Hazards Around An Aluminium Smelter Plant. (Rohc, Calcutta).

## 1997-98

268. Noise Exposure Survey in Offshore Installations (Bombay High).
269. Occupational Health Hazards among Salt Manufacturing Workers in The Little Rann of Kutch.
270. Evaluation of Efficacy of a Modified Agate Grinding Machine.
271. Serum Residue Levels of Persistent Organochlorine Compounds in Pesticide Formulators.
272. Cardiotoxic Biochemical Changes in Workers Exposed to Methomyl Formulation – A Short Term Exposure Study in Repacking Unit.
273. A Study on Carbon Disulphide Exposure and its Health Effects in Rayon Workers.
274. Industrial Hygiene, Safety And Welfare Conditions in Industrial Units of Ahmedabad City.
275. Evaluation of Health Status of Workers Working in Industrial Estates of Ahmedabad
276. A Preliminary Study of Welders with Reference to Thyroid Function.
277. Air Quality Monitoring Around a Fertilizers and Chemical Plant.
278. Role Of Endotoxins In The Aetiopathogenesis Of Byssinosis: A Preliminary Study On Gram Negative Bacteria (Gnb) And Endotoxins In A Ginning House.
279. Studies On Toxic Effect Of Cypermethrin In Mouse After Chronic Exposure.

280. Development Of Toxicity Testing Method For Industrial Effluents.
281. Effect Of Zinc In Acute Toxicity Due To Trace Metals In Rats.
282. Biological Monitoring Of Workers Employed In Electroplating Section From A Telephone Manufacturing Unit At Banglore. (Rohc, Banglore).
283. Noise Level Monitoring In Diesel Engine Power Plant In Banglore. (Rohc, Ban.)
284. Epidemiological And Environmental Study in and around an Aluminium Smelting Plant. (Rohc, Calcutta).

## SELECTED STUDIES THAT WERE ANALYSED IN DETAIL

1. Health Hazards in Small-Scale Industries, Non-Ferrous and Stainless Steel Foundries (1974)
2. Health Hazards in Small-Scale Industries, Non-Ferrous and Stainless Steel Foundries (1975)
3. Health Hazards in Small-Scale Industries, Ceramic and Pottery Health Hazards Industries (1976)
4. Health Hazards in Small-Scale Industries, Ceramic and Pottery Health Hazards Industries (1977)
5. Health Hazards in Small-Scale Industries, Ceramic and Pottery Health Hazards Industries (1978)
6. Health Hazards in Small Scale Industries: Ceramic and Pottery Industries (Further Studies) (1980)
7. Health Hazards in Glass Bangle Industry (1985-86);
8. Health Hazards in the Glass Industry: Hygiene Survey in a Medium Glass Unit (1987-88)
9. Preliminary Study of the Health Hazards in the Woollen Carpet Industry (1980);
10. Health Hazards in the Wool Industry (1983-84)[1]
11. Cotton Dust Exposure in the Ginning Industry (1990-91);
12. Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1991-92);
13. Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1993-94);
14. Cotton Dust Exposure in Textile Mill Processing Coarse and Fine Cotton and Intervention Studies (1994-95)
15. Cotton Dust Exposure in Textile Mill Processing Coarse and Fine Cotton and Intervention Studies (1995-96)
16. Occupational Hazards in Coir Work (Pilot Study) (1979)
17. A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1983-84)
18. A Preliminary Enquiry into Occupational Health Status of Jute Mill Workers (1985-86)
19. Assessment of Health Status of Jute Mill Workers (1987-88)
20. Health Hazards in Quartz Crushing Industry and Evaluation of Dust Control Measures (1985-86)
21. Clinical and Pulmonary Tests of Workers in an Asbestos Cement Factory (1976)
22. Environmental cum Medical Surveillance in an Asbestos Cement Factory (1979)
23. Environmental cum Medical Surveillance in an Asbestos Cement Factory (1980)
24. Environmental cum Medical Survey in an Asbestos Cement Factory (1981)
25. Intervention Study in an Asbestos Cement Factory (1987-88)
26. Low Back Pain Among Workers of the Oil and Natural Gas Commission (1977)
27. Immunological Profile of Workers Having Asbestosis (1990-91)

28. Health Monitoring of Workers Manufacturing and Formulating Organophosphate Insecticides (1991-92)
29. Early detection of Health Impairment due to BHC (Hexachlorocyclohexane) exposure (1976)
30. Biochemical, Histochemical, Histopathological and Electron Microscopic Studies On BHC Fed Inbred Swiss Mice (1979)
31. Evaluation of Carcinogenicity of BHC (Hexachlorocyclohexane)- Reversible and Irreversible Changes (1977)
32. Effect of Associated Anion on Manganese Toxicity (1976, 1977, 1978 &1979)
33. Neurobehavioural Toxicity of Lead in Experimental Animals (1990-91)
34. Toxicological Studies on Reproduction and Neurobehavioural Effects of Formaldehyde (HCHO) (1990-91)
35. Experimental Studies in Carbon Disulphide Toxicity (1991-92)
36. Toxicological Evaluation of Formaldehyde (HCHO) on the Reproductive System in Rats (1991-1992)
37. Neurobehavioural Effects of Formaldehyde in Male Albino Rats (1991-92)
38. Toxicity Study of Dyes on Water Flea – Daphnia Magna (1990-91)
39. Experimental Studies in Carbon Disulphide Toxicity (1996-97)
40. Experimental Studies in Carbon Disulphide Toxicity (1995-96)
41. Carcinogenicity Testing of DDT (Dichloro-Diphenyl-Trichloroethane) In Laboratory Animals (Mice) (1974)
42. Evaluation of Carcinogenicity of BHC (Hexachlorocyclohexane)- A Short Term Study (1976)
43. Health Hazards in Pesticide Formulators (1978, 1979)
44. 1976 Study of Pesticide Pollution from Chlorinated Insecticides Especially DDT in the Environment of Man and Other Livestock in the Country
45. Air Quality Monitoring around a Fertilizers and Chemicals Plant (1997-98)
46. Efficacy of Ear Protectors in Relation to Psychological Test Performance and Working Efficiency (1977)
47. Retrospective-cum-prospective Study of Accidents Involving Human Factor in a Textile Mill (1975)
48. Efficacy of Ear Protectors in Relation to Psychological Factors (1975)
49. A Laboratory Study of the Effects of Noise on Motor-Manual Performance (1975)
50. Human Performance Capability in Psychomotor Tasks at Variable Difficulty Levels and Physiological reactions Under Noise and Heat (1990-91)
51. Directory of Industries (1977, 1978)
52. Occupational Health Care Delivery Through Primary Health centres to Workers in Rural Areas (1990-91)
53. Health Hazards in Small-Scale Industries, Non-Ferrous and Stainless Steel Foundries (1974&1975)
54. Occupational Hazards in Coir Work (Pilot Study) (1979)
55. Environmental cum Medical Surveillance in an Asbestos Cement Factory (1980)
56. Intervention Study in an Asbestos Cement Factory (1987-88)
57. Low Back Pain Among Workers of the Oil and Natural Gas Commission (1977)

58. Immunological Profile of Workers Having Asbestosis (1990-91)
59. Health Hazards in Small Scale Industries: Ceramic and Pottery Industries (Further Studies) (1980)
60. Health Hazards in Glass Bangle Industry (1985-86)
61. Health Hazards in the Glass Industry: Hygiene Survey in a Medium Glass Unit (1987-88)
62. A Preliminary Study of the Health Hazards in the Woollen Carpet Industry (1980)
63. Health Hazards in the Wool Industry (1983-84)
64. Cotton Dust Exposure in the Ginning Industry (1990-91)
65. Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1991-92)
66. Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1993-94)
67. Cotton Dust Exposure in Textile Mill Processing Coarse and Fine Cotton and Intervention Studies (1994-95; 1995-96)
68. Role of Endotoxin in Aetiopathogenesis of Byssinosis- A Preliminary Study on Gram Negative Bacteria (GNB) and their Endotoxins in a Ginning House (1995-96; 19s96-97; 1997-98)
69. Health Hazards in Slate Pencil Workers at Mandasaur (1981)
70. Health Hazards in Slate Pencil Workers (1984-85)
71. Study of Respiratory Morbidity in Agate Workers (1987-88)
72. Evaluation of Occupational Exposure to Trace Metals – Manganese exposure in a Dry Cell Manufacturing Unit (1978)
73. Medical Survey of Workers employed in the Electroplating Units of HMT Watch Factory in Bangalore, ROHC (Southern), (1985-86)
74. Assessment of the Working Environment of the Thermic Oil Firing Section and Engineering Design Sections and Morbidity Study of the Workers- in the New Government Electric Factory, ROHC (Southern), (1985-86), Bangalore
75. The Assessment of the Working Environment and Morbidity Patterns of the Workers Employed in a Factory Manufacturing Latex Condoms, ROHC (Southern), (1987-88)
76. Occupational Health Survey of Women Workers Engaged in Beedi Making (Rolling) (1983-84)
77. Occupational Health Problems Among Beedi (Tobacco) Processing Workers (1981)
78. Environmental cum Medical Survey in Asbestos Milling Unit (1989-90)
79. An Intervention Study in the Agate Industry (1991-92)
80. An Intervention Strategy and Health surveillance in the Agate Industry (1993-94)
81. Evaluation of Efficacy of a Modified Agate Grinding Machine (1997-98)
82. Carcinogenicity Testing of Asbestos Fibres (1976)
83. Carcinogenicity Testing of Asbestos Fibres- A Preliminary Study (1977)
84. Toxicity of Chrysotile Asbestos on Chinese Hamster Ovary Cells in Vitro (1978)
85. Effects of Chrysotile Asbestos (AP-1) on Sister Chromatid Exchanges in Chinese Hamster Ovary Cells in Vitro (1979)
86. Assessment of Occupational and Environmental Exposure to Lead and its Health Impact on Workers and Population Residing in the Vicinity of a Lead Smelting/ Refining Unit (Industry Sponsored Project) (1995-96)
87. Epidemiological and Environmental Study in an Aluminium Smelter Plant (1997-98)
88. Lead exposure Study in the Vicinity of a Lead Processing Plant (1991-92)
89. Study of Occupational and Environmental Health problems in and around an Aluminium Smelter Plant (1995-96)
90. Immunological Profile of Workers Exposed to Pesticides (1991-92)
91. Cardiotoxic Biochemical Changes in Workers Exposed to Methomyl Formulation- A Short Term Exposure Study in a Repacking Unit (1997-98)

92. Cognitive Efficiency as a Function of the Time of the Day (1993-94)
93. Alterations in Affective States Under Different Times of the Day (1994-95)
94. A Study on Carbon Disulphide Exposure and its Health Effects on Rayon Workers (1997-98)
95. Occupational Health Surveillance, Health Status and Hygiene Survey of Chlor-Alkali Plant (1994-95)
96. Environmental Monitoring in Electroplating Sections- Report of the Environmental Survey Carried out at Electroplating Sections of HMT Watch Factory (1984-85)
97. Follow Up Study of Workers Exposed to Nickel and Cadmium in a Battery-Manufacturing Unit (1984-85)
98. Air Pollution Study in Banglore City- (1984)
99. Noise Exposure Survey in Offshore Installations (Bombay High).
100. Occupational Health Hazards among Salt Manufacturing Workers in The Little Rann of Kutch.

**APPENDIX IV**

## STUDIES CONDUCTED AT THE NIOH

In the 1980s as a continuation of the earlier studies that had been conducted on the pottery and ceramics industries another study[1] examined the health hazards of workers engaged in this profession. It examined the physical condition of the workers through X-rays and carried out extensive environmental sampling of the all the departments of the ceramics units. The study observed that the free silica and other dust concentrations were higher than the TLV in all other departments of pottery except the packing department. The prevalence of silicosis was closely associated with the levels of environmental dust concentrations, free silica and with the duration of work. The exposed workers also showed the impaired pulmonary functions like reduced vital capacities. They manifested lower weights as compared to the controls since they were also more vulnerable to and suffering from tuberculosis along with their silicotic impairments. This prevalence of the former was seen to increase with radiological severity of silicosis; it also increases the progression of the silicotic lesions.

A project to study[2] the hazards associated with the **glass bangle industry** was started in 1983. The workers, it was observed were exposed to sever heat strain but suffered lower physiological strain. The study in 1985-86 reported environmental conditions wherein the respirable dust levels far exceeded the TLV prescribed by the ACGIH. The Hygiene Survey conducted in 1987[3] showed that the noise, illumination intensities and the concentrations of gases like carbon monoxide and sulphur dioxide were all below the prescribed TLVs.

The preliminary study exploring health hazards in the **woollen carpet industry** in Jaipur[4] showed workers to be suffering from respiratory complaints like chronic cough,

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[1] Health Hazards in Small Scale Industries: Ceramic and Pottery Industries (Further Studies) (1980)
[2] Health Hazards in Glass Bangle Industry (1985-86)
[3] Health Hazards in the Glass Industry: Hygiene Survey in a Medium Glass Unit (1987-88)
[4] A Preliminary Study of the Health Hazards in the Woollen Carpet Industry (1980)

tightness in the chest at the time of work, pain in the chest and breathlessness. Backache and joint pains, weakness, loss of weight and transient dizziness are other problems that the workers said that they faced. The environmental and medical survey carried out in 40 units of the wool industry[5] in Bikaner, Rajasthan recorded the prevalence of high levels of respiratory allergy in wool workers and chronic bronchitis. The dust levels in the blow room; card room and sorting departments were higher than the recommended TLV for non-specific dusts.

The studies on the **cotton industry** in the 1990s focussed on the effects that different kinds of cotton fibres had on the pulmonary functions of workers in the ginning industry.

The workers exposed to long staple cotton fibres in two ginning units[6] were observed for their Forced Expired Volume (FEV%) percentage and compared with controls before the beginning and end of the 7-hour shift. The change in FEV % was seen to be negligible in both male and female workers and was deemed attributable to the seasonal nature of the work, which may result in an improvement in the pulmonary function when exposure ceased. 40.5% of the workers complained of cough, shortness of breath and chest tightness and were considered symptomatic. Their decline of FEV was less as compared to the workers in the cotton industry who had been tested in earlier experiments. This was also considered to be possibly due to the seasonal nature of the ginning industry.

The earlier environmental hygiene surveys conducted in cotton textile mills and ginning units revealed that the dust levels there far exceeded the permissible level of .5mg/cubic meter. The respiratory morbidity in cotton workers was found to be caused by a broncho-constricting agent in the leaves and not in the seeds or fibres. Thus most of this was present in the trash that got separated out from cotton fibres. Thus a few studies in the 90s concentrated on intervention to reduce the trash content of cotton[7] on the recommendation of the Scientific Advisory Committee of NIOH. This was sought to be done through the pre-cleaning machine after ginning and by modifying the method for harvesting cotton. The use of the machine was more effective for the long

[5] Health Hazards in the Wool Industry (1983-84)
[6] Cotton Dust Exposure in the Ginning Industry (1990-91)
[7] Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1991-92)

staple variety, which was already clear of the trash due to direct hand picking during harvesting. The short staple cotton was found to be freer of trash when picked directly from the boll at the field rather than being separated from the boll at home. This was adjudged a better method since it would provide more employment and was effective for the workers in the ginning unit where the pre-cleaning machine was of little use since it could be put to use only after ginning.

The studies conducted in 1989 and1990 at the institute had reported that 30% of the workers in the blow rooms and 38% of those in the card rooms suffered from byssinosis. The study to assess intervention strategies was continued in 1993-94[8] and it concluded that hand picking of cotton should be supplementary to engineering controls and personal protection as part of intervention strategies.

It was discovered at a later study that exposure to cotton dust was higher in the case of a mill processing coarse cotton as compared one processing fine cotton[9] which had less trash content. The dust concentration was seen to exceed the prescribed TLVs in the blowing and carding sections of the spinning department of both the mills and were higher still for the mill using the coarser variety of cotton. The study also concluded that utilisation of good quality cotton with less trash should be part of an effective intervention strategy along with engineering controls and personal protection.

Concurring with the evaluation of dust and intervention studies in the cotton industry the institute also conducted studies that examined the role of endotoxins in the development of byssinosis[10]. The studies were done to test the hypothesis indicating that contamination of cotton fibres with gram-negative bacteria and their endotoxins could be primarily responsible for the causation of byssinosis. The bacteria E.agglomerans was then identified and isolated as the dominant bacterial flora present in the work environment of the ginning and pressing sections of the gin house. The prevalence rates of byssinosis in the blow room and the card room of the two factories was 18.5% and 50% in one mill and 36% and 28% in another respectively. The

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[8] Cotton Dust Exposure in the Ginning Industry- Intervention Studies (1993-94)

[9] Cotton Dust Exposure in Textile Mill Processing Coarse and Fine Cotton and Intervention Studies (1994-95; 1995-96)

[10] Role of Endotoxin in Aetiopathogenesis of Byssinosis- A Preliminary Study on Gram Negative Bacteria (GNB) and their Endotoxins in a Ginning House (1995-96; 19s96-97; 1997-98)

concentrations of airborne endotoxins and gram-negative bacteria in the ginning and press section of the mill were found to be significantly higher than those in the office of the mill. Thus the study concluded that the presence of the gram-negative bacteria and its endotoxins in the working environment of the gin house lead to the development of symptoms related to byssinosis.

The institute took up the study of **slate pencil workers** at Mandasaur[11] in a context when a lot of public attention was focussed on these workers due to the high levels of morbidity of these workers. Studies revealed that the dust concentrations in the slate pencil units were far above the TLV recommended by the ACGIH. The overall prevalence of silicosis was 54.5%. Most of the male silicotics were below 25 years of age[12]. Nearly 31% of the workers showed restrictive and obstructive pulmonary disorders. The progression of silicosis was very high with rapid mortality. 23 workers died within a period of 16 months at a mean age of 34.6 years. Smoking habits had an adverse but non-significant effect on the severity of silicosis. The study went on to assess the various ECG measurements to analyse the cardiac problems in the workers and also looked at pulmonary impairments among the workers.

The institute took up the studies pertaining to the **agate industry**[13] according to a Gujarat High Court Directive after many newspaper reports of a large number of workers dying due to silicosis caused by occupational exposure to the dust generated when grinding and polishing the stone. This is a cottage industry, so it does not fall under the purview of the Factories Act, and thus is part of the unorganised sector. There are no records regarding employment of workers. The industry is characterised by a high labour turnover. The prevalence of respiratory symptoms like dyspnoea, cough, expectoration, chest pain, was very high among the agate workers, especially among the grinders. The hazards of silicosis especially severe progressive fibrosis were limited to the grinders. 39.8% (96) of the male and 34.2% (39) of the females were suffering from silicosis. The prevalence of silicosis was higher among females. Of

[11] Health Hazards in Slate Pencil Workers at Mandasaur (1981)

[12] Health Hazards in Slate Pencil Workers (1984-85)

[13] Study of Respiratory Morbidity in Agate Workers (1987-88)

these 23 i.e. 9.5% of the males and 14 i.e. 12.5% of the females showed radiological symptoms. The study observed that 34% of the males and 27% of the females suffering from silicosis were below the age of 30 years and in 60% of the cases silicosis was seen to occur in less than 10years of exposure as a grinder. The installation of a dust control system developed at the Institute, in one the agate-manufacturing units in Khambatt, Gujarat brought down the levels of total and respirable dust below the TLV levels and it elicited favourable responses from the workers. This was done according to the orders of the Gujarat High Court.

The study on **Manganese** exposure in a dry cell manufacturing unit[14] observes high concentration of manganese in urine excreted by workers despite the fact that the ambient manganese in the unit did not exceed the TLV levels prescribed by the ACGIH, but feels that it would not affect the health of the workers.

The Regional Occupational Health Centre at Bangalore has also conducted studies for some other public sector concerns like HMT Watch Factory[15] and the New Government Electric Factory[16] situated there. The observation of workers at the HMT factory's electroplating unit to ascertain the health status of workers entailed the detailed examination of the 83 workers to examine them for respiratory and skin problems that they had been complaining of. This was supported by investigation like estimation of haemoglobin levels, analysis of blood and urine and pulmonary function tests. The researchers concluded that morbidity in the electroplating units was seen to be similar to the morbidity in the general population.

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[14]Evaluation of Occupational Exposure to Trace Metals – Manganese exposure in a Dry Cell Manufacturing Unit (1978)

[15] Medical Survey of Workers employed in the Electroplating Units of HMT Watch Factory in Bangalore, ROHC (Southern), (1985-86)

[16]Assessment of the Working Environment of the Thermic Oil Firing Section and Engineering Design Sections and Morbidity Study of the Workers- in the New Government Electric Factory, ROHC (Southern), (1985-86), Bangalore

The latter study monitored the levels of pollutants like the Suspended Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Total Acid and the temperature and the humidity in the workplace. All the pollutants were found to be less than the TLVs prescribed by the ACGIH in the thermic oil section of the factory.

The assessment of the working environment and morbidity patterns of the workers employed in a factory manufacturing latex condoms[17] was undertaken. The study was carried out through medical examination of the workers by a team of two physicians and a laboratory technician. Majority of the employees fell in the age group of 30-49 years. Women were mostly employed in the packing section, the intersection transfers were rare. The control group consisted of the administrative staff consisting of the routine administration, personnel and welfare sections, accounts and management, not involved directly in production.

**Beedi work**[18] among women in the lower economic sections caused headache, nausea, gastric problems along with respiratory problems like dyspnoea and cough. The women also suffered from lower back pain due to sustained physically strenuous work performed while being seated in uncomfortable postures for long duration. These conditions worsened because the women also had to engage themselves in housework after working in the factory. Their poor economic condition was also detrimental to their health in other ways. This was reflected in their poor nutritional status and the resultantly low body weights. The medical examinations[19] (electrocardiography and blood examinations) revealed the case of mild nicotine toxicity among the workers.

In the 1990s NIOH took up intervention measures in the asbestos milling units[20] in Cuddapah district of Andhra Pradesh. These measures included total or partial

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[17] The Assessment of the Working Environment and Morbidity Patterns of the Workers Employed in a Factory Manufacturing Latex Condoms, ROHC (Southern), (1987-88)

[18] Occupational Health Survey of Women Workers Engaged in Beedi Making (Rolling) (1983-84)

[19] Occupational Health Problems Among Beedi (Tobacco) Processing Workers (1981)

[20] Environmental cum Medical Survey in Asbestos Milling Unit (1989-90)

enclosure of jaw crushers, installation of edge runners and vibrators. Similarly training programmes were also organised for workers by the owners in respect of usage of protective gear and health education. The frequent follow up by the DG of Mines Safety and NIOH ensured a fall in the dust levels below the TLV of 2micro grams per cubic meter in the semi-automatic milling units and the other units also registered a fall dust concentrations.

The earlier study conducted in 1987-88 had described the respiratory morbidity caused due to exposure to silica in course of the work. The airborne concentration of silica in these factories was 42 times the recommended TLV for total dust concentrations in the work environment. Hence as an intervention measure NIOH developed an exhaust system with a water-spraying device[21] that resulted in a substantial reduction in the dust levels. With the installation of dust control devices the total respirable dust concentrations were reduced to the extent of 88% and 83% respectively. The use of a wetted jute-cloth screen and water spraying at the source added to the efficiency of the exhaust system. The system was subsequently improved and replaced with a more cost effective dust control device devised in collaboration with the Gujarat Rural Technology Institute (GRTI). The levels of dust generated though reduced from earlier are still above the permissible levels. The medical surveillance[22] that followed showed no significant difference in pulmonary functions evaluated using parameters like the Forced Vital Capacity (FVC). About 20% of the workers had a progression of lesions due to silicosis, 11.6% had static lesions and 11.6% had developed fresh silicosis owing to the earlier exposure. The incidence rate of silicosis among the workers was 15%. But 7% of the workers showed a regression in the tubercular lesions seen earlier, 9.3 % had a static case of lesions and 16.3% showed a progression while there were 5.8% new cases. The machine was further modified[23] in collaboration with the Savalia Research Centre and the installation of the exhaust system at the grinding machines was made compulsory by the orders of the High Court of Gujarat in 1997. The NIOH

[21] An Intervention Study in the Agate Industry (1991-92)

[22] An Intervention Strategy and Health surveillance in the Agate Industry (1993-94)

[23] Evaluation of Efficacy of a Modified Agate Grinding Machine (1997-98)

continued to work with GRTI to improve the system in order to make it more effective and economical.

**Experimental Studies**

Tests were conducted on Swiss mice to assess the carcinogenicity of chrysotile asbestos fibres. These tests were conducted in much the same manner as the ones involving BHC, they involved the administration of chrysotile fibres and dust to the animals through various routes to simulate possible exposures in human beings. The first study[24] in 1976 showed that asbestos dust produced medium sized granulomas in the mice. The second experiment conducted in 1977[25] examined the effects of different kinds of asbestos samples from Andhra Pradesh and Rajasthan at different concentrations on Swiss mice. Inflammatory changes and pre-cancerous lesions were observed in the lungs. Asbestos was seen to cause degenerative changes in the ovary cells of Chinese hamsters[26] depending on the concentration of the dose and the period of exposure with the increase of which the changes were more rapid, asbestos was also seen to affect the cell division[27] in ovary cells of the Chinese hamster even at the lowest concentrations. A study to assess effects of occupational and environmental exposure to lead examined lead levels in the blood and urine of workers in a lead smelter plant[28]. Within the smelter plant the ambient lead concentrations exceeded the recommended TLV (recommended by ACGIH and adopted by India). Blood and urine lead levels in workers far exceeded those of the controls. The article also observes that India has no regulatory standards for urine and blood levels of lead in case of occupational exposure to the same. The study observed that the mean lead in the control population that consisted of the population in the surrounding village itself

[24] Carcinogenicity Testing of Asbestos Fibres (1976)

[25] Carcinogenicity Testing of Asbestos Fibres- A Preliminary Study (1977)

[26] Toxicity of Chrysotile Asbestos on Chinese Hamster Ovary Cells in Vitro (1978)

[27] Effects of Chrysotile Asbestos (AP-1) on Sister Chromatid Exchanges in Chinese Hamster Ovary Cells in Vitro (1979)

[28] Assessment of Occupational and Environmental Exposure to Lead and its Health Impact on Workers and Population Residing in the Vicinity of a Lead Smelting/ Refining Unit (Industry Sponsored Project) (1995-96)

showed sub-clinical absorption of lead. This according to the study is a matter of concern since lead is seen to cause neurobehavioural and learning disorders in children. Lead absorption among type foundry workers and painters was studied through biochemical indices. The indices chosen were the Haematocrit, lead in Blood, lead in Urine and certain enzymatic activities. Environmental lead in the type foundries was found to be much lower than the TLV of 200 micro gms. But higher than the Russian TLV of 10 microgms per cubic meter. Both the workers were seen to have absorbed significantly large amounts of lead but they did not manifest even the early signs of toxicity. The authors call for an examination of lead absorption from non-occupational sources in order to correctly assess the occupational absorption and the total body burden of lead.

Ambient dust levels were seen to be very high in the anoding unit of a aluminium smelter plant[29], but the exposure to fluoride though was well below permissible levels. About 26% of the workers were seen to be suffering from varying degrees of dyspnoea, bronchitis and tightness in the chest. 77% of the workers in the pot room suffered from joint pains, 9% suffered from skin irritations and 32% complained of abdominal pain.

High levels of exposure to lead were also observed in the vicinity of a lead processing plant[30]. Environmental contamination could be dealt with by treating the effluents effectively before discharging them. The management and workers must be educated on safe hygienic practices to control exposure.

Mottling of teeth symptomatic of flourosis and abnormalities of the bone resulting from exposure to high levels of fluoride in pond water due to airborne origin of fluoride from the nearby aluminium smelter plant[31] was seen in individuals from the surrounding villages.

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[29] Epidemiological and Environmental Study in an Aluminium Smelter Plant (1997-98)

[30] Lead exposure Study in the Vicinity of a Lead Processing Plant (1991-92)

[31] Study of Occupational and Environmental Health problems in and around an Aluminium Smelter Plant (1995-96)

Similar results were obtained in a study involving workers exposed to pesticides[32] like Malathion, Cyfluthrin and DDT in the 1990s. Some of the immunological entities like IgM, C3, C4 and Rheumatic Factor did not show any change whereas the others showed a marked increase over the levels in the control subjects. And these levels were seen to increase with the duration of exposure. Increased activity of enzymes like Lactate Dehydrogenase and Hydroxy Butyrate Dehydrogenase both associated with activity of the heart was seen in workers involved in formulation of methomyl a carbamate group of insecticides[33]. This according to the study was indicative of cardiotoxicity.

Another study[34] looked at cognitive efficiency as a function of the time of the day and concluded that it was ore accurate during early morning, noon or early evening hours. The speed of performance was better from late morning to late evening as the oral temperature increased.

A similar study tried to correlate the variations in the eight affective states namely, physical freshness, mental depression, alertness, physical health, forgetfulness, cheerfulness and wakefulness during different times of the day with the changes in body activity level as reflected by the oral temperatures[35] during the work hours. Five of the affective states physical freshness, alertness, anxiety, cheerfulness and wakefulness increased at the beginning of the morning session and decreased towards the end of the session. The oral temperatures were seen to increase towards the early evening and then decrease at the end of the day. Statistically appreciable correlations were seen between affective states and the oral temperatures. The study recommends that job allocations could be made in accordance with the pattern of the time of the day variations to optimise overall health and work efficiency.

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[32] Immunological Profile of Workers Exposed to Pesticides (1991-92)

[33] Cardiotoxic Biochemical Changes in Workers Exposed to Methomyl Formulation- A Short Term Exposure Study in a Repacking Unit (1997-98)

[34] Cognitive Efficiency as a Function of the Time of the Day (1993-94)

[35] Alterations in Affective States Under Different Times of the Day (1994-95)