OCCUPATIONAL HEALTH AND SAFETY HAZARDS: A LITERATURE REVIEW AND AN EMPIRICAL STUDY OF A HOSPITAL'S EMPLOYEE INJURY EXPERIENCE FROM 1970 TO 1976

by

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ABSTRACT

Occupational health and safety concerns, though not new, have only recently emerged as vital factors in the economic and social life of Canadians at work. It appears that steps need to be taken by the health care system which has hitherto been motivated to care mainly for the sick, to channel more of its energy, resources and manpower towards the prevention of illness and accidents. To this end, this study was designed to investigate employee accidents in a health care facility in an attempt to determine causation by utilizing an epidemiologic model of host, agent and environment. It was hoped that these findings would lead to a model for planning better prevention programs.

The study was divided into two parts. The first part reviews the early history of occupational health, the international scene and the Canadian experience. Some general concepts derived from the field of accident research proved useful in analyzing hospital employee injuries. It was found that there was little direct evidence of these concepts used in the health care field.

The second part deals with the investigation of accident trends of hospital employees in a medium-size public general hospital in British Columbia. An epidemiologic study of 561 injuries that occurred over a seven-year period was undertaken to obtain comparative
data as well as to determine some of the underlying causes of accidents. Examination of the variations in the frequency of accidents by departments, age groups, length of employment, time of day and year, location of accidents, type of accidents, nature of injury and parts of the body involved provided some insights on the employee and environmental determinants of accidents.

Despite the high technology equipment and hazardous substances found in modern hospitals, very few accidents were recorded in areas where these were used. The great majority of injuries sustained are still the usual strains, cuts, bruises and burns, caused by over-exertion, sharp instruments, falls, and heat and steam.

A recommendation arising out of this study would be to initiate comprehensive occupational health and safety services in all hospitals, to include three basic components; a hazard control program, an infection control program and an employee health service. This program should include a full range of activities relating to health promotion, health protection, prevention and counselling service, to more truly reflect the objectives of the World Health Organization's definition of occupational health:

The promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of departures from health caused by their
working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological equipment and to summarize, the adaptation of work to man and each man to his job.
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love, patience and understanding, this thesis could not have been
completed.
Dedication

In Memory

of

Hideo and Tatsu Eguchi
Prologue

Health is that precious heritage
Of priest and layman, fool and sage,
It's worth a hundred times its cost
But no-one learns that 'til it's lost.

George Shepherd
Hospitals have been slow to recognize the health and safety hazards that confront their employees. This is understandable, as hospitals' prime concern has been the welfare of their patients. Nonetheless, it behooves hospitals now to direct equal consideration to the health of their staff. The myth that proximity to treatment facilities and health professionals magically keeps hospital workers free from injuries and disease prevailed until fairly recently, as occupational health and safety measures escaped priority consideration in most hospitals.

Traditionally, hospitals have not been involved in a comprehensive health care program for employees. Some have provided immunizations, first aid and infirmary care. Others have given pre-employment and annual medical examinations including routine laboratory tests and chest x-rays. These prototypes, however, are far from universal (Bonham, H. and Naruse, A.M. Brief to B.C. Health Ministry, May 1979). In the past, a few larger hospitals have supplied some recreational facilities such as tennis courts for staff use. With increasing capital costs and budget restrictions hospitals today have little room to manoeuvre in allocating funds for "non essentials." Most hospitals have safety committees as it is required by law.
(Industrial Health and Safety Regulations, Workers' Compensation Board of B.C. 1978: Sec. 404), but often they pay lip service to safety programs or give them faint recognition. Many hospitals still rely on "crisis management" and "corridor consultations" in coping with day by day staff contingencies. These methods, though expedient, are poor substitutes for a comprehensive employee health service. Such a service would embrace not only disease prevention and environmental health and safety protection but health promotion by education and provision of activities and facilities for the physical and mental well-being of all hospital employees. In the long run, hospitals would likely benefit as they discover that an occupational health program would enable workers to perform with optimum efficiency and permit them to maximize the care of the patients they serve.

A. STATEMENT OF THE PROBLEM

There is evidence that many hospitals have a rising incidence of occupational injuries. Table 1 presents total hospital employee injuries, reported to the Workers' Compensation Board of B.C. for the years, 1970-1976. If hospital injuries are to be controlled and reduced, hospitals must exercise increased vigilance and adopt preventive methods of control where none exist, or where existing controls are inadequately administered. Preventive methods must also
Table 1

Total Hospital Employee Injuries
Reported to the Workers' Compensation Board
for the years 1970 - 1976
Including Back strains (Excluding "Medical Aid Only" cases)
Paid for the First Time

<table>
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<tr>
<th>Year</th>
<th>Total Injuries</th>
<th>Total Backs</th>
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<tr>
<td>1970</td>
<td>744</td>
<td>256</td>
</tr>
<tr>
<td>1971</td>
<td>873</td>
<td>288</td>
</tr>
<tr>
<td>1972</td>
<td>1,264</td>
<td>397</td>
</tr>
<tr>
<td>1973</td>
<td>1,537</td>
<td>489</td>
</tr>
<tr>
<td>1974</td>
<td>1,905</td>
<td>595</td>
</tr>
<tr>
<td>1975</td>
<td>2,286</td>
<td>731</td>
</tr>
<tr>
<td>1976</td>
<td>2,254</td>
<td>812</td>
</tr>
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Source:
Statistical Records Section,
Finance Department,
Workers' Compensation Board of B.C.
include the employee's responsibility for his or her own protection. It is believed that most injuries are largely preventable by the application of good sound common sense and training. The cost of protection is small compared to the high cost of failure to protect.

Costs are a major factor in occupational injuries and disease, and will be enlarged upon in the more detailed discussion in this dissertation.

B. PURPOSE OF THE STUDY

This study proposes to examine the epidemiologic aspect of reported employee accidents in a medium-size public general hospital, to evaluate an employee safety program, and to lay the foundation for an effective hazard control program as part of an occupational health and safety service for hospital employees.

C. APPROACH TO THE LITERATURE

There is a paucity of information regarding employee accidents in hospitals. It is somewhat surprising, but a review of the literature revealed an absence of any real research work done in this particular field.

What would account for the dearth of information in this area? One obvious explanation is hospital accident studies
usually focus on patients rather than employees. Then too, accidents of hospital workers are likely viewed as minor, and as such, would not permit the attention accorded the more dramatic or fatal accidents occurring elsewhere. Perhaps the major reason which inhibits vigorous research investigations of hospital employee accidents is the lack of funds and sponsors. Whatever the reasons, there appears to be a near vacuum in research of occupational injuries in a hospital milieu (Currie, J.H., Sept. 1979, Kell, R.L., Sept. 1979).

Notwithstanding, some background information from which this study is developed was essential. As a consequence, the literature search was conducted along three well-defined areas: 1. This study of employee accidents in the work place will be viewed within the total context of occupational health and safety with prevention as the pervasive theme. Therefore, a glance into the past for events of historical significance seemed to be appropriate. The high level concern for the worker safety in the western world today owes its origin to the efforts of some early pioneers in the field, even before the Industrial Revolution. As well, in the 20th Century, identifying the major issues directly related to the ever burgeoning sphere of occupational health and safety seemed relevant.

The international scene will be briefly examined, where information was available, according to legislation,
administration and technical measures in various countries. This will permit Canadians to relate with various developments in occupational health and safety services in other parts of the world.

Canada is rapidly becoming a major industrialized country with all its attendant benefits and ills. The nation is perceiving that, indeed, some of its larger concerns may be centrally connected to the work environment. This is expressed by Dr. Nicholas Ashford (1976:3) of the Massachusetts Institute of Technology who says:

...the growing debate over health care and preventive medicine cannot proceed far without encountering probable occupational causation of a surprising proportion of disease. Problems of industrial productivity, work alienation and management - labour disputes relate increasingly to occupational health and safety. In addition, the monetary costs of job injury and disease are beginning to be more fully realized and deserve closer attention during a period of inflation and materials and energy shortages.

2. Some general knowledge of accident research was necessary to serve as a baseline and a point of departure for the study. Despite the lack of hospital employee studies, considerable accident research has been done in other settings by various professionals in the biological, social and physical sciences (McFarland, Ross A. 1964. Hale and Hale, 1972:9). Moreover, many theories and methods of study have been developed by
these different individuals and disciplines. But with the whole field of accident research in a state of flux it seemed prudent to consolidate some of this knowledge.

At this point, a comprehensive approach to the study appeared to be possible and desirable. Therefore, looking mainly at the vast array of work already done in traffic accidents and industrial injuries it was thought that the basic tenets which evolved from these studies could be applied in researching hospital employee accidents. Immediately however, the complexity of accident research became apparent. On the one hand, it appears, in these circumstances, the common denominator is the human component which should make comparisons simple. On the other hand, factors such as environmental influences, motivational responses and specific skills required, need to be considered which make comparisons difficult. Yet, it is possible to delineate similarities in human behaviour under like conditions. Hence, some lessons learned from one situation may justifiably be transposed to another situation. And there being sufficient parallels between hospitals and industry, a hospital situation may be equated to an industrial setting in studying occupational injuries. Therefore, this study of hospital employee injuries will reflect, in the main, accident research done on the industrial scene.
An exhaustive search of the field would be very difficult and unnecessary for the present study. Hence, some general findings will be discussed and a few selected studies will be cited.

3. The literature was also reviewed for information that would lead to an effective methodology for studying hospital employee accidents. Epidemiology was used as a conceptual framework in that it utilizes the three components of host, agent and environment; studies the demographic characteristics of events; attempts to determine causation; and is committed to prevention.

All three areas are elaborated upon in Part I, Literature Review.

The Literature Review will be as comprehensive as possible, not only because it will serve as a background for the study on hospital employee injuries but because it will attempt to consolidate much of the information available today on occupational health and safety hazards, into one manual.
1.1. Early History

The concept of occupational health and safety on the job is not new. As far back as the first century A.D., Pliny the Elder (23-70 A.D.), a Roman scholar and author of "Historia Naturalis" recorded a description of a protective mask used by workers subjected to lead fumes (Felton et al 1964:8). By 1472, Ulrich Ellenburg, a German Physician in Augsburg, was writing on the poisonous effects of mercury and lead, warning metal workers to avoid becoming contaminated. In the 16th Century, Paracelsus (1493-1541) son of a Swiss doctor, himself a physician and alchemist, writing from his own experience called attention to the real dangers involved in exposure to toxic materials in mines and smelters (Felton et al 1964:19). In the same era, a German mineralogist, Georg Bauer (1494-1553) known as Agricola, who later became a physician in a mining town, compiled a major treatise on mining. His "De Re Metallica" was published in 1556 and was considered a classic in metallurgy. In the twelfth section of this book, it described the diseases and accidents prevalent among miners and the means of preventing them.
The translation of this important work was done by Herbert and Lou Henry Hoover in 1912 (Felton et al 1964:17). The ideas planted by these early pioneers had uncertain and sporadic growth periods. Nevertheless, the threads of continuation managed to survive.

Ernest Mastromatteo (1976:9), Director Occupational Safety and Health Branch, International Labour Organization, addressing the Canadian Public Health Association in 1976, reported that early attempts at actual research into occupational disease and measures to protect workers were initiated by some clinical specialists as early as 1700. He said, moreover, that occupational cancer had been discovered for over 200 years. Mastromatteo also stated that Bernardino Ramazzini, an Italian physician (1633-1714), wrote a detailed "Discourse of Diseases of Workers" about this time. "De Morbis Artificum Diatriba" described the occupational diseases then known, such as the poisonous effects of lead and other metals encountered in mines (Felton et al. 1964:20).

1.2 Effects of the Industrial Revolution

The essence of the Industrial Revolution in Europe was the suddenness of change from a static agrarian society to a manufacturing society resulting in an unprecedented burst of economic growth. In turn, this activity rapidly gave rise to the factory system and converted the majority of the population
from country dwellers to urban workers. Adapting to a totally new way of life created great problems for the working masses during and after this transition.

Historians disagree as to the exact period of the Industrial Revolution. Most will concede 1750 is a convenient starting point because the first great burst of industrialization occurred in Great Britain during the second half of the eighteenth century (Grant, 1973:1-3). However, some steam driven inventions were in use a number of years before this date. Donald Hunter (1975:60-61) who wrote on the Industrial Revolution in the "Diseases of Occupations", places this period as 1760 - 1830. He claimed the complex series of events changed the face of England not only in the industrial, but also in the social and intellectual spheres.

The problems created by industry were due partly to the introduction of machinery in production processes, as in the cotton and wool trades. Workers were exposed to previously unknown hazards. One of the more unpleasant aspects of the factory system was the use of child labour (Grant, 1973:49). About this time, an English surgeon, Sir Percival Pott in 1775 described occupational cancer of the scrotum in chimney sweeps resulting from exposure to coal tars (Page and O'Brien, 1973:25).
Some time later, many notable English gentlemen with "a conscience" persuaded the government to protect the working class. In 1802 Sir Robert Peel succeeded in securing the enactment of a law for the protection of the health and morals of apprentices (Kober and Hayhurst, 1924). Other advocates of social reform; Charles Lamb, 1823; Charles Dickens, 1837; Charles Kingsley, 1863; and Lord Shaftesbury, 1875; stood out in sharp contrast to the apathetic politicians of the day (Hunter, 1975:142-145). Among these social reformers, Lord Shaftesbury was perhaps the most striking. He brought about many reforms in the mines and mills and was known as the "father" of Factory Acts for protection of women and children in Britain.

Though there were a series of factory acts from 1802 - 1878, the first serious attempt at control of working conditions was the Factory Act of 1833 (McKeown and Lowe, 1974:234). A further step towards improving the lot of the labourers was taken by Charles Thackrash, (1795-1833) a physician from Leeds. He devoted his life to the study and prevention of occupational hazards which accompanied industrialism. His treatise on occupational medicine was the first book of its kind to be published in England (Felton et al, 1964:28). In this era also, Sir Edwin Chadwick campaigned for public health and hygiene. In 1842, his celebrated "Report on the Sanitary Conditions of the Labouring Population of Great Britain" was published (Hunter, 1975:94).
Vital statistics began with William Farr. His efforts led to the first publication of the Registrar General's occupational mortality supplement in 1851. Subsequently it has been issued at ten year intervals. Thus:

For the last hundred years in England and Wales it has therefore been possible to tabulate the deaths of men according to the occupations which are recorded on the death certificates. Bringing these number of deaths, by age and certified cause, into relation with the numbers of men following different occupations, as recorded in the decennial census, gives, in terms of mortality, some indication and measure of special occupational hazards. In the Supplement to the thirty-fifth Annual Report, Farr pointed out that the mortality of needle manufacturers at 35 to 45 was excessively high and that earthenware manufacture was one of the unhealthiest trades in England (Hunter, 1975:95).

Still another leader worthy of mention was Robert Owen (1771-1858). He was a Welsh socialist and pioneered the cooperative movement in industry (Felton, 1973:28). However:

...despite the Owenites and other reformers, organized labour made little political headway until the second half of the nineteenth century. Trade unions although they existed, were illegal in most places .... The economy, indeed the whole society, was geared to the pursuit of profit, and the employers had all the ammunition (Grant N., 1973:53).

As in England, parallel developments and conditions were occurring in most of the western world. Albeit, conditions varied between one country and the next, the general course of events was surprisingly similar. Each country had its share of problems and produced its own experts on occupational health concerns.
Over the centuries, lead poisoning has been a plague on the working class. In France, in the mid nineteenth century, Tanquerel des Planches, an authority on plumbism described the severity of lead poisoning among unprotected workers, and tried to refute the common opinion that men who succumbed to lead poisoning were drunkards (Hamilton, A. 1943:6). Later in America in the early 20th Century, Dr. Alice Hamilton observed conditions at first hand and accepted social action on medicine's responsibility. She further substantiated the nature of lead poisoning and instigated genuine reforms for the protection of lead workers (Felton et al, 1964:32).

As plumbism became less threatening, other hazards to health appeared. Cancer-causing substances are now one of the major occupational concerns. In Germany, a physician, Dr. Rehn in 1895 recorded exposure to chemical agents in a dye factory as causing cancer of the bladder (Mastromatteo, 1976:9). More recently, in Canada, Dr. C. Mackenzie (1975:45-46) of the Health Care and Epidemiology Department of the University of British Columbia, with reference to cancer causing chemicals, traced the early history of some carcinogenic substances as being occupational in origin. He stated:

...Those cancers where a cause was known or strongly suspected all had an environmental origin, such as aniline dyes in factory workers, soot and coal of chimney sweeps, arsenic compounds in smelter workers....
The Industrial Revolution gathered momentum and by the end of the nineteenth century other countries were appearing on the industrial scene, notably Russia and Japan. Great Britain by this time, had begun to slip from its dominant position as the world's leading manufacturing nation. The new industrial giants were the United States and the German Empire (Grant, 1973:76-80). Though the scenario shifts the Industrial Revolution, in a sense, has not ended yet as changes are still taking place.

1.3 Twentieth Century Concerns

The pace of technological change did not falter after the creation of an industrial society in the western world, rather it accelerated. By the turn of the century, new industries, new machinery, new equipment, new sources of power and new forms of communications were appearing.

This rapidly expanding technology, to a great extent, is responsible for the current state of affairs in environmental and occupational health and safety problems:

1. The technology creates new problems.

2. There is little coordinated effort to pass on the knowledge about health and safety hazards attending the new technology (Ashford, 1976: 127).

After the initial surge of activity regarding worker
protection during the eighteenth and nineteenth centuries, there seemed to be remarkably little progress made since in hazard prevention and control. Many examples can be cited to substantiate this statement:

Two hundred years after chimney-sweeps were found with scrotal cancer because of exposure to coal combustion by-products, steel workers in Hamilton and Sault St. Marie, Ontario, are inhaling the same class of substances that produced the chimney-sweeps scrotal cancer. ... Seventy-five years after asbestos was known to cause fatal fibrosis of the lung, asbestos workers in the Yukon, British Columbia, Ontario, Newfoundland and Quebec have been found to be working in high levels of asbestos dust (Tataryn, L. 1979:11-12).

Most scientists will agree that the concerns of the work environment have suffered a time lag from the beginning of the twentieth century to the contemporary era because of the complexities created by the technological explosion.

In some areas scientists have been able to eliminate or reduce many of the occupational hazards that involve risk to workers. However, as former hazards become less important, newer ones seem to be created. Modern technology has been spawning health hazards at an alarming rate and these continue to multiply (Page and O'Brien, 1973:9). Thus, in the 20th Century, the dramatic interaction of man and industrialized society seem to be acting out its major role in the work place.
During the present century most of the toxic occupational hazards of the past, mercury, lead, arsenic and phosphorus have been fairly well eliminated or controlled. However, standardized mortality ratios indicate there remain substantial risks associated with the place of employment. Some of them are attributable to low income, nutrition or other factors, but the rest reflect the effects of the work environment. One of the obvious adverse features is the effect of industrial pollutants. Another is the high risk of work related injuries (McKeown and Lowe, 1974: 239).

In an interview in Vancouver, recently, Alfred Knudson, president of the American Society of Human Genetics and a researcher at the Philadelphia Cancer Research Centre said:

The world has moved from an "age of infections to an age of chemicals" with life-threatening infectious diseases declining but dangers from chemicals increasing (The Province, Vancouver, October 6, 1978:14).

He included all chemicals - herbicides, pesticides, the chemicals that are ingested and those which surrounded people at work and at home.

The danger that some of the many new organic compounds introduced into industry will prove to be toxic is a constant concern. Centuries later, the implications of Percival Pott's demonstration that exposure to soot could lead to cancer have become apparent to the general public:
...It has been estimated by Dr. John Higginson of the International Agency for Research in Cancer that chemical agents in the environment are responsible for 90 per cent of cancers which occur in people (Mastromatteo, 1976:12).

Lloyd Tataryn (1979:2) strengthens this statement in his report on Canadian industrial problems, "Dying for a Living", when he says:

Research scientists now agree that the vast majority of cancers are environmental in origin.

He quotes from a United States government report:

There is abundant evidence that the great majority of malignant neoplasms - probably 90 per cent of the total - are induced, maintained or promoted by specific environmental factors....Carcinogens must therefore be regarded as one of the most significant potential consequences of environmental contamination (U.S. Department of Health, Education and Welfare. March, 1970).

This high percentage includes those exposed to occupational hazards, and their families.

There are also reports of residents near chemical plants and nuclear plants being at increased risk for cancer. The recent near-disaster at Three Mile Island in Pennsylvania, and the evacuation of the near-by residents, remains the most dramatic illustration of the nuclear power industry's problems in the United States. Cancer risk evidence also extends to metal producing plants, smelters and steel mills.
Chlorine gas, another toxic chemical used extensively in mills to bleach pulp causes permanent damage to workers' lungs and respiratory tracts. This deadly gas was responsible for the largest and costliest evacuation in Canada's history when about 220,000 Mississauga residents were forced out of their homes (The Province, Vancouver, November 30, 1979:A4).

Going beyond the work environment, on a much broader scale with national and international implications, "acid rain" is today's great concern. Federal Environment Minister, John Fraser has said acid rain, which contains sulphuric and nitric acid from pollutants poured into the air from industrial chimneys and vehicle exhausts, is the most serious environmental problem facing Canada.

Undoubtedly the publicity regarding various environmental pollutants has raised the awareness of workers and the general public to the grave risks created in the work place:

By now we are all well aware that our rapidly developing technological society poses potential threats to human health - although the scope and extent of the hazards are often only vaguely formulated (Somers, E. Nov./Dec. 1979:388).

To keep ahead of the enormous changes technology has wrought, man must continually adapt. This creates a need for constant vigilance and continued preventive measure in order to survive, and maintain optimum health. This also requires
an understanding of change as an integral part of existence, recognition of the rapidity with which a need for change presents itself in today's society, and an acknowledgement of the complexity of the interactions that change initiates (Toffler, 1970).

1.3.1 Safety Hazards Versus Health Hazards

Occupational health hazards and occupational safety hazards are often distinguished by health and safety professionals, workers' compensation boards and employer activities as being related but different. Though it seems futile to separate these two interconnected aspects of occupational health, there is some merit in the practice. As Ashford (1976:68) points out, there are operationally significant distinctions reflecting:

1. the time frame in which the harm occurs or is recognized,
2. the cause of the harm,
3. the kind of professionals dealing with the problems, and
4. the extent to which the harm can be quantified monetarily and incorporated into the operating costs of the firm or business....

Safety Hazards

Safety hazards are generally recognized to arise in work environments which cause immediate or sometimes violent injury and is associated with equipment or the physical surroundings. The concern in safety is more likely to be the explosive nature of chemicals rather than their toxicology or
the long term effects of absorption. In the case of noise pollution, hearing loss is the major concern rather than the resultant stress related diseases. Thus, in safety, the focus seems to be on the time the worker is on the job.

Specific safety hazards presently existing are: fires and explosions, electrical hazards, machinery and equipment, operations requiring eye protection, operations requiring lifting and moving, transportation hazards, noise, heat stress, poor lighting, bacterial contamination and vibrations. The harm caused by these safety hazards are: falls, cuts, bruises, sprains, burns, broken bones, loss of limbs, infection, damage to eyes and hearing, disability and death.

The multiple effects of hazards are becoming widely known. Noise can reduce visual acuity and can increase the likelihood of accidents. Sometimes hazards combine in a synergistic way. For example, carbon monoxide is more toxic when the temperature is raised. (Ashford, 1976:71).

In recent times, safety on the job has had more recognition and wider acceptance by the employer than before, mainly because accidents are reportable to the workers' compensation system. Thus, injuries become a concern for the firm, its insurance carriers, and to its safety professionals (Ashford, 1976:68).
Health Hazards

Occupational health concerns itself with the preservation of the workers' health at work and extends this concern beyond the workplace to the home and community, and to the consequent effects of job-related health hazards.

In 1950 the World Health Organization (1963:4) defined the objectives of occupational health as:

The promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological condition.

Another definition of occupational health states:

Occupational health consists of those occupational or work-related factors potentially affecting worker (and secondarily community) health, the resulting effects on total health status, and the programs for the promotion of health and work adjustment (Chisholm, 1977a:190).

Unlike safety hazards, occupational health hazards are often difficult to recognize, slow-acting, cumulative, irreversible, complicated by non-occupational factors and can manifest themselves in sickness when the employee is no longer
working. The "chance" of dying from cancer because of occupational exposure and having a violent accident on the job may be equal.

Some specific health hazards with long term effects may be listed as: noise; harmful dusts that can cause asbestosis silicosis, beryllium disease, and byssinosis; some toxic gases, metals and chemicals; carcinogens of various types; heat stress, vibration, radiation and ergonomic factors. As in safety hazards, occupational health hazards may also combine in such a way that their effects are not merely additive but synergistic. Dr. E. Mastromatteo (1977:30) in his paper entitled, "Industrial Medicine in the World", to the Canadian Medical Association in June, 1977 warned that:

...occupational exposures are often multiple. There is evidence that the effects of combined exposures are important, eg: Dust and sulphur dioxide; benzpyrene and dust: etc. and account of this should be taken in the design of health studies...

This area dealing with the combination effect of health hazards has hardly been explored, yet the real world rarely presents isolated hazards.

At the present time, there is a disproportionate emphasis on accident prevention with the diversion of attention away from disablement and death caused by occupational diseases
(Ison, 1977:10). Put another way, safety on the job has long been recognized as a proper concern of management, but job-related disease has only recently become a social issue. Nicholas Ashford (1976:83) concludes:

The failure of the injury reporting system and the workers' compensation system to recognize occupational disease has contributed to the failure of society to realize the severity of occupational health hazards.

However, Dr. Robert Murray, (1974:20) Medical advisor, Trades Union congress of the United Kingdom has maintained a positive attitude:

...I do believe that in various sets of circumstances it is possible to engineer out the hazards, that by applying the techniques of occupational hygiene to the control of dust and fumes and gas and noise and heat, and all the other problems that are presented by industry, you can minimize the hazard.

1.3.2 Major Costs in Occupational Health.

The magnitude of occupational health problems and the attendant social costs of hazardous working conditions are not fully realized by the average citizen, average employer or average union member. As well, the various levels of government seem to be unaware of the gravity of the situation.

Canadian figures show, in 1974, there were over one million injuries involving loss of work time at a cost of over
half a billion dollars to employers in compensation assessments. A further estimate of $2 billion was lost due to occupational injuries in terms of lost production, material damage and retraining (Begin, M. 1978:272).

Many factors compound and cloud the issue of cost. For one thing, job related disease and injury are not always immediately identifiable as occupationally connected, within the framework of our existing health scheme. For another, workplace accidents and illnesses are not always recognized as such. Furthermore, many go under-reported and unrecorded. It is small wonder that the validity of current statistics is questioned.

Another disturbing factor that has distorted or suppressed occupational disease statistics has been the pervasiveness of the "industrial-medical complex" referred to by many health professionals and workers.

This situation can best be described as - the employees' perception that company doctors are pro-management over work-related diseases, even though doctors stress their job is to be impartial (Financial Times, 28 February, 1978:17). Though this medical reputation, to a great extent, is unwarranted and unjust, still, there are many instances wherein there is ample justification for such. Paul Brodeur (1973) in his book,
"Expendable Americans" speaks of the industrial-medical complex, which he felt hindered the recognition and control of occupational diseases. Lloyd Tataryn's (1979) account of the politics of industrial death in his "Dying for a Living", is replete with examples of collusion between doctors and industry to suppress information of hazardous conditions in the workplace. In fact, he goes further and includes some scientists hired by industry:

In almost any occupational and environmental health controversy, medical doctors and scientists have testified that the working and living conditions under attack were in fact harmless. But the medical and scientific surveys used to rationalize the contaminated conditions have usually been shown to be faulty and industry-sponsored (Tataryn, 1979:164).

The industrial-medical complex has led to some serious consequences. Not only has it caused untold human suffering, costs and death to workers in certain occupations, but it has concealed pertinent information which might have effectively pursuaded management and governments to enforce stricter regulatory and control functions at the workplace.

In an address recently, to a scientific conference, Dr. Franklin Hicks, (Vancouver Sun, 11 June, 1980:B5) chief architect of the federally-created Canadian Centre for Occupational Health and Safety in Hamilton, Ontario, said:

...a vigorous occupational health and safety program would almost prove more profitable for industry because of the extremely high cost of work injuries.
Costs of occupational injury and disease are generally assessed in terms of lost wages, medical expenses, insurance claims, production delays, lost time of co-workers and equipment damage. But at best, these figures are grossly underestimated.

According to Ashford (1976:84-85) the present costs are reflected in:

1. The numbers of job-related injuries, diseases, disabilities and deaths;
2. Lost work days;
3. The population exposed to potential hazards;
4. Workers' compensation costs;
5. Workers' perception of the magnitude of occupational health and safety problems may in fact be much larger than currently available statistics indicate....

He also recognized there are a host of costs not "internalized" in any accounting system. The human dimension of pain, suffering, degradation, family dislocation are incalculable but are equally as significant as the economic dimensions.

The costs of occupational injuries and disease will be dealt with according to Ashford's categories:

1. The numbers involved in occupational disease and injury are enormous. As stated previously, each year more than a million individuals are affected by workplace fatalities, accidents and diseases. Provincial workers' compensation boards have records showing:
On a typical day in Canada, every eight hours, more than 4000 workers are injured on the job (Rabinovitch, 1979:21).

In the United States, an average of one in ten workers experienced a job-related injury or illness during 1972. Preliminary Bureau of Statistics estimates indicate that a total of 5.6 million recorded job-related injuries and illnesses were sustained by Americans during that year - exclusive of the public sector, mining and railroads, agriculture and self employed (Occupational Safety and Health Reporter, 1974: 1062).

A recent disease specific study done by the Department of Health, Education and Welfare in the United States estimated that 20-38 percent of all cancer deaths are due to on-the-job exposure to carcinogens (Rabinovitch, 1979:21). More frightening still, the rate of industrial injuries has been steadily climbing in recent years (Ashford, 1976:84, Begin, M. 1978:271). An American survey done in 1971 indicated a continuing increase in the rate of work injuries in manufacturing to a level of 15 per million man hours worked - the highest rate of industrial accidents in twenty years (Ashford, 1976:85). Despite these astonishing figures, there is concern that the magnitude and seriousness of occupational disease are considerably understated. Therefore it would seem wise to go beyond any government records to ascertain the facts.
A true picture of the crisis in health and safety in Canadian workplaces as stated by Rabinovitch (1979:21-22) considers:

(a) Accidents and diseases not reported to local compensation boards (failure to report is a significant problem arising from ignorance of some workers, and pressures from employers anxious to maintain a "clean company record");

(b) Individual claims rejected by compensation boards on questionable grounds;

(c) General wear and tear on the human body (such as recurrent problems of the spine and back) not yet fully accepted as a workplace hazard;

(d) Incidents which are under-reported, through assignment of injured workers to "light duty tasks", use of holiday time for recuperation and non-inclusion in statistics of the initial day lost when the incident occurs.

Further reasons for under-reporting of workers' ailments in Canada has been enunciated by Terance Ison (1977:4-6), law professor at Queen's University and former chairman of The Workers' Compensation Board of British Columbia. He says

(a) It is fairly common to find that a complete occupational history has not been taken by an attending physician, even in cases in which it might establish an industrial base for the disease.

(b) There is no systematic and national program for monitoring new chemicals used in production. Not only are they largely untested for their health effects but it is common to find chemical compounds being introduced that are not even identified... A patient may be unable to tell his doctor exactly what it is he works with or has worked with, even when the questions are asked.
(c) Some industrial diseases which result in permanent disability or death can be caused by exposure for periods of less than five years, sometimes less than one year. But with some of these diseases, and cancer is a good example, the disablement may not result until twenty years or more after termination of the exposure to the "cancer causing substance". Even when a worker changes his job after a period of exposure, some diseases continue to develop. Not only does this time lag postpone the community knowledge of the origins, but it may also reduce the prospects of the cause being correctly determined when the disease becomes noticeable and disabling.

(d) There has not been a systematic and national program of research into incidence and causes of industrial diseases. In many situations, the research has not been done, or has not been done to a sufficient extent to provide an answer in a particular case.

(e) An aggravating factor is that occupational medicine has not yet become a recognized specialty in Canada and there are not sufficient training programs for doctors willing to specialize in this area.

Obviously multiple factors must be taken into account when arriving at a realistic assessment of costs due to occupational injuries and disease.

(2) When one considers the level of worker health, this is perhaps better indicated by the total lost work days. It is possible that a considerable proportion of absenteeism due to sickness presently attributed to non-occupational causes is in fact job-related. In the United States 25 million work days, excluding fatalities were lost during 1972 (Ashford 1976:85). In Canada, the figure is arrived at somewhat differently. Statistics show 70 million work days lost in 1976 (Rabinovitch, 1979:22). The Canadian figure includes both temporary and
permanent disabilities, the time lost due to compensated fatalities and an estimate of time lost due to non-compensated cancer fatalities and to other causes of under-reported incidents - but does not include a further range of industrial diseases which will some day be shown to have specific connections with working conditions, namely stress related diseases, mental disorders, alcoholism and various cardio-vascular illnesses. One cannot help but feel the level of worker health or ill health must be a significant factor in productivity of a firm and the G.N.P.

Work place injuries and diseases are likely the largest single source of lost production in the economy. In Canada, the 70 million lost days is at least six times greater than the annual loss of time due to lock-outs and strikes (Rabinovitch 1979:22). Provincially, the figures are much the same, for example, in 1973 in Alberta there were 165,552 days lost to strikes and lock-outs, while man days lost for temporary injuries were 707,465 (Stopps, J. 1976:67). In the United States, the recorded time lost as a result of occupational illness and injury is roughly ten times the man days lost to strikes (Ashford, 1976:85). Data from Great Britain suggests similar figures. It was reported in 1967 there were eight times as many work days lost due to occupational injuries as reported to the Workers' Compensation Board as compared to work days lost due to strikes (Ashford, 1976:85).
There is every indication that work safety and worker satisfaction need to be made a priority issue—as a social right and a responsibility under a national health care scheme—involving the best efforts of both labour and management. As for governments, it is important that they recognize cleaning up the work place may be an investment they cannot afford to ignore.

(3) Exposure to potential hazards varies according to occupations. For example, loggers, miners, construction and transportation workers and other "blue collar" personnel generally are more at risk to occupational injury and disease than other workers. Figures for 1972 in The United States, show the accident rate for the following manufacturing industries to be: timber, 25.1; metal products, 22.8; food 19.3; textiles, 11.6; chemicals, 9.9; and the book trade, 7.5 (Hellen, 1974:38). The figures indicate percent of workforce in each trade per year.

Numerous workers are affected, still today, by the major health hazards such as asbestos, cotton dust, silica, lead and carbon monoxide. The Occupational Safety and Health Administration in the U.S.A. chose to concentrate its early health enforcement efforts on these five hazards for three reasons: (1) They were considered serious health hazards; (2) They are substances which can be measured and monitored; and (3) Large numbers of workers are exposed to them (Ashford, 1976:86).
Uranium and coke production also create grave risks in industry (Page, J. and O'Brien, M. 1973:25-26). Workers exposed to these hazards suffer disproportionately higher injury and disease. Ashford (1976:86) quotes:

...of the 6000 men who have been uranium miners, an estimate 600-1100 will die during the next 20 years as a result of radiation exposure, principally from lung cancer. Coke-oven workers as a group are two and a half times as likely to die from lung cancer as steel workers who do not work in coke plants, and are seven and a half times as likely to die from kidney cancer....

More recently vinyl chloride monomer has been cited, in the United States, Canada and elsewhere in the world as hazardous in certain production facilities with observed connections to certain types of cancer (Cralley, L. and Atkins, P. 1975:46. Science Council of Canada, Report No. 28, 1977:22).

Augmenting this list of chemicals, as many as 12,000 toxic substances are in widespread use throughout industry. Approximately 3000 new chemicals are synthesized annually with one in six entering the industrial market (Ashford, 1976:88). Chemical agents come in the form of solids, liquids, gases, or combinations. They can be inhaled, ingested or absorbed through the skin. To be inhaled, the chemicals may be in the form of gas, vapour, smoke, dust, mist or fume.
Some of the workers' concern surrounding chemical agents can be understood:

Of the estimated half million substances found in the occupational environment, only 450 have become subject to T.L.V.'s and many of these maximum exposure limits are sadly out of date (Page and O'Brien 1973:45).

Threshold limit values (TLV's) are permissible limits of exposure to environmental agents on the job and refer to time weighted average concentrations which apply to an eight hour work day, forty hour week. The TLV's widely used in North America have been established by the American-Conference of Government Industrial Hygienists (Mastromatteo, 1977:22).

The most important means by which injurious substances enter the body is the respiratory system. Much of the respiratory disease that plagues workers is known to be job-related. In Canada, Grzybowski and Yeung's research (1978) has corroborated the findings of several previous studies detailing serious long abnormalities due to grain dust. Grain handlers, then, are in the high risk category for respiratory occupational diseases.

Occupational disease, is not necessarily confined to the industrial worker. Dentists are exposed to x-rays, mercury and anaesthetics which correlate significantly with nervous disorders, leukemia and lymphatic malignancies. Likewise, it has been observed that administrators and executives are more prone to coronary diseases than scientists and engineers (Ashford, 1976:86).
Some studies of late, however, have indicated that coronary heart disease is no longer limited to executive types. It is becoming much more common among semi-skilled workers. The question that must be asked is, are there different types of stress responsible or are there other causes of coronary thrombosis that need to be addressed (Pomerleau, O. et al., New England Journal of Medicine, 1975:3).

How has the new technology affected various occupations? Indeed, increasing technology has wrought many changes. On the one hand, the introduction of high speed steels and dry drilling has increased the range of occupational hazards in many industries. On the other hand, some heat stress and physical stress that workers, less than a hundred years ago were subjected to, are virtually unknown today. Physical agents such as ultra-violet radiation, electronic equipment including video terminals and micro-wave appliances are now in common use. None of these have been time-tested for long term health hazards for workers handling them. Yet there has been great improvements made in noise, vibration and heat control and radiation safety. As well, automated machinery in the lumbering industries has markedly reduced the risk of physical injury. However, loggers are still in the highest risk category for occupational injuries. Dusts have changed but perhaps not reduced. As the old hazards become less
formidable, new ones appear on the scene. It is obvious technology can have both beneficial and negative effects. Do the benefits outweigh the risks in all occupations?

(4) Workers' compensation costs also vary with different occupations. Traditionally, the pulpwood industry and long-shore-men's work have been considered extremely hazardous. Whatever the level of risk in certain categories, the overall medical, legal and administrative costs are substantial without addressing the direct costs of insurance premiums.

The present method of administering workers' compensation is less than perfect, sometimes resulting in increased pain and suffering for the victim. There have been cases of workers wrongly advised to delay seeking medical aid in order to improve their chances of obtaining a bigger settlement (Ashford, 1976:88). In the United States, The National Commission on State Workmen's Compensation Laws has proposed reforms to correct such inadequacies and other loop-holes in the system. It is estimated that compliance with all of its recommendations will result in cost increases ranging up to 65% in some States.

...These figures moreover, are likely to be a substantial understatement, particularly if occupational disease becomes more widely compensable as a result of the commission's recommendation (Ashford, 1976:89).
In Canada, the British Columbia Federation of Labour in May, 1978 sent a brief to the Health Ministry confronting the Workers' Compensation Board and the medical profession for their "biased" approach in settling back injury claims which constitute 65% of all appeals to the Boards of Review. The Federation stated that claimants have insurmountable hurdles placed in front of them as each new back injury is reported. Furthermore, there is no written policy available. The rejected claims are so abundant that the economics of the situation must be questioned:

This cost factor includes the extra time spent by an adjudicator, medical costs of both the claimant and the Workers' Compensation Board Medical Department, time spent by the Boards of Review and union representatives as well as officials of the Department of Labour (The B.C. Federation of Labour, 1978:13).

A legitimate case could be made of the Federation's stand. It may be a reasonable solution to assess upwards Workers' Compensation premiums in those occupations which report a high proportion of back injuries. Acceptance of claim need not be automatic, but the injured worker may obtain a more favourable hearing. Continued rejection appears to be futile and costly.

(5) From the workers' point of view, there has been a noticeable shift from wage demands to fringe benefits in recent years on the North American continent. The magnitude of the occupational health and safety problems faced by employees is finally being realized.
Quinn reports in The Monthly Labor Review (November 1973:35), that health and safety hazards were more frequently cited than any other labour standards problem area (Ashford, 1976:89). A typical membership survey of working conditions conducted in the United States in the early 1970's by the Research Staff of Allied Industrial Workers' International Union gave similar results.

In rating the importance of a variety of possible job improvements, the respondents rated "better health and safety practices" (79%), and "better contingency protection" (71%) as "very important", which prompted the research team to state:

"In the face of considerable controversy over the issue of job safety and health as a major federal concern, it is interesting to note that the results of the present study indicate that union members do have a real concern about this issue (Donoian, H.A. and Brotslaw, I. 1973:37).

(6) The true extent and the social cost of occupational safety and health problems are impossible to compute. As stated previously, currently available official statistics can only hint at the magnitude of work place injuries, which is chronically distorted due to frailties in the system. Moreover, there has been a pervasive bias towards safety in recent years, as previously suggested. Yet the potentially far more important social problems of occupational illness and disease are generally ignored due mainly to difficulties in obtaining accurate records (Ashford, 1976:92-93). For these reasons, the presently
available statistics greatly underestimate the seriousness of the country's occupational health problem and social costs of hazardous working conditions.

1.3.3 Research and Prevention

The primary role of research in occupational health is in expanding the understanding of the causes of occupational disease and injury in order to improve the methods of prevention—both mental and physical causes. Much of the research knowledge will be dependent upon the studies of other disciplines such as, environmental sciences, medicine, public health, and the social sciences. The problems of the general and work place environment are intimately connected and need to be pooled together.

Environmental health research has generally enjoyed governmental support and has been taught at schools of public health or environmental medicine. To a lesser degree, safety research is performed in a few university schools for safety and departments for industrial engineering but mainly in private organizations, such as the National Safety Council, the National Fire Protection Association, or the insurance companies (Ashford, 1976:98). And yet, ironically, the focus in industry and governments has been on safety measures to prevent injuries with
workers obliged to take responsibility for themselves, rather than safeguards to prevent occupational and environmental diseases with employers taking more responsibility (Ison, T. 1977:10).

In Canada, the Workers' Compensation Board of British Columbia has done some very commendable work in research. It has supported a number of health and safety studies which are extremely relevant to occupational health. One of the studies was detecting breathing problems, allergies and other possible effects of the working environment on the health of pulp and paper workers. Dr. Grzybowski who spearheaded the project stated:

"The Board recognizes that to get meaningful prevention, you've got to have meaningful research" (W.C.B. News Sept/Oct. 1978:1).

In another move to promote occupational health research, the Workers' Compensation Board entered a joint funding project with the British Columbia Lung Association to conduct surveys where workers are exposed to conditions which may damage the lungs (Workers' Compensation Board News, Sept/Oct. 1978:2). More recently, in June, 1979 it co-sponsored the first advanced course in safety held at the University of British Columbia with the B.C. Safety Council. The Workers' Compensation Board also has excellent laboratory facilities where injurious substances are monitored in workers and contaminants are measured in work places.
The present Board's focus appears to be shifting from straight compensation and rehabilitation to education and prevention, as well as research. The media have been used extensively in the past few years to educate the public in the dangers of the workplace. Television commercials have been particularly effective in accident prevention. However, the Board's advertising has been criticized because it tends to place the onus and blame on the employee without a counter-balancing share of responsibility put on the employer. Moreover, safety hazards are graphically illustrated but other factors such as industrial pollutants have not had equal coverage.

Research into the causes of accidents, which can have far reaching implications for both occupational and general safety is acknowledged. But for the most part, in Canada as well as the United States, this research has concerned itself with motor vehicle safety, transportation safety and accident prevention in the home. Concern for product safety and equipment safety are still comparatively new fields (Ashford 1976:100).

The behavioural scientists and health care researchers have been studying the effects of stress as co-factors in heart disease and other degenerative diseases. Research to clarify the role of stress has major implications for prevention in occupational health.
Ashford (1976:102-107) refers to three useful studies that have contributed to the delineation of research needs in environmental health sciences, namely, "Chemicals and Health", (1973) "Man's Health and the Environment - Some Research Needs" (1970) and "Man, Materials and Environment" (1973). Probably the most useful of the reports is, "Man's Health and Environment - Some Research Needs." It itemizes many research needs regarding industrial exposure, and postulates:

There are innumerable instances in which technology is available for the prevention or elimination of environmental hazards, but it is not employed for personal, social or economic reasons.

It appears now that man has been unable to keep pace with the acceleration of technology. And it can also be said that occupational and environmental injury and disease may be the result of his inability or unwillingness to adapt socially or biologically. However, Ashford (1976:107) asserts:

Solving occupational health and safety problems will necessitate both the development of new technology and some abandonment of the old. The form that the solutions take will depend critically on how we view causation, and hence prevention, in specific cases.

1.3.4 Summary and Future Implications

It is obvious by now that attempts to separate general health and occupational health, or mental health from physical health will be counter productive. Unilateral approaches to
solving one aspect of a set of problems can only lead to ridiculous outcomes, for example as happened in the United States:
1) removing DDT from the general environment has led to the use of a substitute pesticide that is much more dangerous to the farm workers who handle it; 2) the Environmental Protection Agency (EPA) air quality standards for the general environment do not seem to bear any relationship to the Occupational Safety and Health Administration's (OSHA) standards for the workplace. For example, the EPA's standards for sulphur dioxide and particulates are much more stringent than those of the OSHA, although exposure is especially high in the workplace (Ashford 1976:126). The rationale has been:

...That community standards are usually for 24 hours per day or for longer periods and they apply to the total population in the community including infants, elderly people and the ill. Work exposure standards on the other hand, generally apply to fitter persons between the ages of 18 and 65 years of age and for 8 hours a day (Mastromatteo, 1977:23).

What is not taken into account is the interrelationship between the exposure to environmental agents at the workplace and in the community. Only when this factor is taken into consideration can realistic exposure standards be set. Some coordination of effort appears necessary and past due.

The proliferation of chemicals into the general and occupational environment if not checked, could spell disaster. Appropriate safeguards are often not available or disregarded due
to ignorance of the dangers involved. The patent system encourages monopolistic competition and is partly responsible for this proliferation. The issue of control is crucial to solving the problem. Therefore, social control of technology must be attempted through legislative processes, backed by government, the scientific community, industry, labour and an informed public.

Efforts to improve occupational health and safety however, are not likely to be successful in the absence of the worker's interest, responsibility and control of some aspects of his work environment. Workers need to be educated and trained to exercise appropriate precautions in order to prevent occupational disease and injury. At the same time, every possible means could be explored by management to take responsibility for reducing industrial contamination, improving plant and equipment design, making changes in products or materials handled by employees, and offering occupational services, to guard the health of their workers. Preventive measures then, include all efforts by management and labour to reduce to a minimum the ravages of the work place.

There are general control measures which could help in reducing the hazards created by industry, as advocated by Paul Falowski, Environmental representative of the United Steel Workers of America:
(a) **Substitution**  Very often a non-poisonous material can be substituted for a poisonous one without affecting the product.

(b) **Handling Methods**  If it is necessary to handle dangerous materials, it should be done in such a manner to reduce exposure to workers. In practice, this involves the use to enclosed systems of processing, preferably under reduced pressure. Other methods include wet handling instead of dry, brush painting instead of spraying and vacuum cleaning instead of sweeping.

(c) **Ventilation**  If possible, local exhausts should be used at all points where toxic substances may escape into the workroom. Examples of local exhaust are the spray booth, hoods, exhausted chromium plating tanks and grinding wheels. When a local exhaust is not possible, general ventilation is required with subsequent increased cost of heating in cold weather. Recirculation of air containing free silica or toxic materials should not be permitted.

(d) **Segregation**  Processes using dangerous materials should always be segregated so that a minimum number of workers are exposed.

(e) **Personal Protective Equipment**  Respirators, special clothing, gloves, goggles and protective cream may be required. Care should be taken to obtain the right equipment for the hazard in question.

(f) **Personal Hygiene**  Good personal cleanliness should be practiced. Workers should wash carefully at the end of each work shift and before eating. Under certain conditions, showers at the end of the work day are necessary. A regular program to provide clean work clothes is essential when toxic materials that can be absorbed through the skin are handled. A double locker system, one for street clothes and one for work clothes is often desirable.  

(Falkowski, no date:16).
Conclusion

The literature has revealed huge discrepancies in the health care delivery system as it affects working people. A co-ordinated policy is definitely required for safeguarding man's total health, both in and out of the work place. Serious consideration needs to be given to education and research, the market mechanism and regulatory activities.

In the final analysis,

How we approach the present and future problems in occupational health and safety will be a reflection of our sense of equity and justice as it appears to the individual in our society (Ashford 1976:130).
CHAPTER 2

THE INTERNATIONAL SCENE IN OCCUPATIONAL HEALTH

Occupational health and safety pose great problems in the world today. Accidents and disease take a heavy toll among workers in many countries. More than 100,000 fatal occupational accidents occur in the world annually (World Health, 1974:3). In addition, occupational accidents and diseases are responsible for heavy economic losses to nations great and small. Still other problems such as soul-destroying monotony and stresses of modern production methods in the highly industrialized societies are matters of grave concern. No less serious are the social and cultural problems brought about by rapid industrialization and urbanization in the developing countries - reminiscent of the effects of the industrial revolution in the industrially developed countries more than two centuries ago.

2.1 Some Global Problems

In the highly industrialized countries, about one worker in ten is reported to have a workplace accident each year. To cite a few examples; in 1971 in West Germany, nearly 2.6 million work injuries or occupational diseases were reported among 27 million workers. In the same year in France, nearly 1.1 million occupational injuries were recorded among 13 million workers.
Similarly, in the United States in 1972, as mentioned in a previous text, more than 5.6 million cases, excluding farms, railways and mines were recorded among 58 million employees. Though there has been a reduction in the total numbers of fatal accidents in some of these countries, despite the increasing numbers of workers, the tendency is not universal (Hellen, E., 1974:36).

These figures give only a rough idea of the immensity of the problem, as statistics published in different countries are not directly comparable. A major difficulty is that the minimum period of disability which is stipulated for recording workplace injuries varies from one country to another (Hellen, 1974:36). However, the national figures that do exist reveal an extremely serious situation.

Taking a look at the third world countries, World Health (1974:3) reported that of a total of 7,770,000 workers in Brazil in 1972, there were 1,470,000 who sustained injuries or were victims of occupational disease. And more specifically in some of these developing nations, up to 23 percent of miners and workers in quarries suffered from fibrotic pneumoconiosis, and in others a 60 percent prevalence of byssinosis and other respiratory conditions was found to be fairly common.
Perhaps the most neglected workers are those in small industries all over the world, who Dr. El Batawi (1974:5), Chief, Occupational Health, at the World Health Organization, refers to as the "forgotten masses". These are workers in flax-processing plants along the Nile Delta, or in the dusty quarries in Malaysia and Singapore, and in the dim-grain-milling plants in Burma. Their hours are long and arduous, and workers often include the young and the old.

The definition for small industries differs from country to country, however:

...it has been agreed by the sub-committee, of the Permanent Commission and International Association on Occupational Health, that all work establishments employing fewer than 50 workers - fall into this category. This decision was made mainly for statistical purposes and to facilitate surveys and field studies as well as the planning of occupational health care programmes (El Batawi, 1974:7).

Thus defined, small industries contribute considerably to industrial production and employ a large part of the total work force in both the emerging countries and the developed countries.

In India the population engaged in cottage and small industries is estimated at 8.4 million compared to 2.2 million in large-scale production. In Indonesia 94 percent are engaged in small plants among 3 million people working in the manufacturing
industry. In Argentina 78 percent of all industrial sites employ between 10 and 50 workers. Elsewhere, in the technologically advanced nations, the proportion of industrial operations with fewer than 50 persons is: France 90 percent, Sweden 70 percent, Switzerland 73 percent and the United States 48 percent (El Batawi, 1974:7).

In contrast with the large scale industries, which now recognize the need to maintain a healthy productive workforce, these small enterprises, especially in the developing countries rarely have access to health facilities. The individual establishments are either too small to organize a service or are often too poor to afford it. Yet the hazards of these small plants can be serious.

Besides the health problems, the small industries are often caught in a legal dilemma over which government departments are responsible for them. Workers exposed to occupational hazards are supposed to be protected by law in most countries, but there have been many failures in the application of legal provisions for them.

...even in some of the highly industrialized countries, the legislation may be administered by different governmental bodies concerned with health, labour, industry, social security, and pensions (El Batawi, 1974:6).

With theoretically adequate legislation, small industries still suffer the most. Their numbers alone, and their
wide distribution make it impossible for health and labour inspectors to cover them satisfactorily. Apart from a chronic manpower shortage of health personnel, the problem of introducing control measures becomes a frustrating experience. The conditions and layout of the work often defy any recognized environmental control methods. Moreover, many small-scale employers are technically unable to appreciate the need for occupational health and safety measures or to install them — and the employees are ever fearful of losing their jobs.

Added to these economic and administrative difficulties, the small industries in the developing countries, often encounter innumerable social problems of limited education and low income. Furthermore, since labour unions in the third world countries gain their strength from large concentrations of factory workers, they are of little help to the small plant workers. At the same time, the small scale operators do not merit recognition by the larger establishments. Therefore, neither from the workers' nor the employers' perspective have voices been raised to protest unsatisfactory working conditions (El Batawi, 1974:7).

Since the plight of the small industries has global applications, who then should speak for them?

In 1971, a meeting of World Health Organization consultants took the initiative and reviewed the health problems
of small industries in France, Sweden, the United Kingdom and the Soviet Union. They agreed that a study of a systematic approach to these problems was required in industrialized and developing countries alike. Since then, WHO has assisted field studies on the environment and health conditions in small industries in a number of countries all over the world. The results of these studies were to be used in 1975 to prepare guidelines to assist governments and health authorities in organizing adequate health services for those hitherto neglected small industries (El Batawi 1974:8).

The only practical approach would appear to be the grouping of small firms in a shared occupational health service, with accompanying strategies of training and education for those involved:

... even with this arrangement, small plant health services would not likely be viable without some form of government support (Mastromatteo, 1977:25).

Having touched upon a few of the immense problems pertaining to occupational health and safety on the international scene, it may be relevant, at this point, to study the objectives of the international organizations concerned with these global issues. The question also arises, how are the nations of the world facing the problems encountered by their working populations?
2.2 World Organizations

The International Labour Organization (ILO) and the World Health Organization (WHO) have been the two most active international organizations in occupational health and safety.

International Labour Organizations

Established by the Treaty of Versailles, the International Labour Organization has been involved in worker health and safety since 1919 (Mastromatteo, 1977:17). In the years following its inception, this Body adopted 54 Conventions and 52 Recommendations directly related to occupational health and safety. One of the more important of the Conventions requires a government to institute a state factory inspection system. Among the Recommendations, there are specific ones pertaining to the establishment of occupational health services and control of workplace hazards (Ashford, 1976:515).

In 1959, an occupational health service was defined in Recommendation 112 of the forty-third session of the Geneva Conference of the International Labour Organization, as:

A service established in or near a place of employment for the purpose of;
(a) protecting the workers against any health hazard which may arise out of their work or conditions in which it is carried out;
(b) contributing towards the workers' physical and mental adjustment, in particular by the adaptation of the work to the workers and their assignment to jobs for which they are suited; and
(c) contributing to the establishment and maintenance of the highest possible degree of physical and mental well-being of the workers (Gauvin, 1968:322).

More recently, the International Labour Organization has adopted Conventions on occupational cancer, air pollution, and noise and vibration at work (Mastromatteo, 1977:17). The hope is that extensive adoption of these Conventions and Recommendations in the industrialized world would instigate uniform safety standards and work practices.

Among its other activities, the International Labour Organization is known for facilitating the exchange of information and operating technical assistance programs in countries who seek its help (Ashford, 1976:516).

**The World Health Organization**

The World Health Organization has strongly promoted occupational health since 1948. Its objectives are similar to the International Labour Organization's. It believes that occupational health encompasses not only the prevention of injury and occupational disease, but takes into account the workers' physical, mental and social well-being off and on the job. Like
the International Labour Organization, the World Health Organization offers direct scientific-medical assistance to member countries. However, philosophically the two organizations have different approaches. Unlike the International Labour Organization, the World Health Organization is committed to the unification of occupational and general health care. Hence, it advocates a central health authority in governments, whereas the International Labour Organization would separate occupational health and general health in their respective departments of labour and public health (Ashford, 1976:516).

In another area, the World Health Organization has been responsible for development of criteria documents on many important industrial substances (Mastromatteo, 1977:18).

Despite their different approaches, there is no doubt that both the International Labour Organization and the World Health Organization have contributed much to the exchange of information and scientific-medical expertise, and have greatly influenced the setting of international standards in occupational health and safety.

There are other world bodies which have been involved in concerns of the environment. The European Economic Community, so far, has focussed on developing uniform standards for the general environment but with less emphasis on the work environment. The Organization for Economic Cooperation and Development is also beginning to realize the importance of environmental and quality-of-life issues. The United Nations Conference on the Environment, like the others,
concentrate on the general environment rather than on the occupational environment (Ashford, 1976:516). However, the importance of all these international bodies should not be underestimated. Global issues such as nuclear fall-out and acid rain require international cooperation, and the presence of these organizations augurs well for the future.

Yet another group of international organizations on health matters, deal with the special dangers of radiation. This group comprises; The International Commission on Radiological Protection, (ICRP) The WHO International Reference Centre on Environmental Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation, The International Labour Organization and the International Radiation Protection Association, all of which attest to the need for radiation protection and standards (Williams, R., 1977:13-14).

Among these international agencies, the International Commission on Radiological Protection, formed in the 1920's, commands great esteem:

Its various radiation protection recommendations form the basis for the regulations, norms, standards, codes and laws issued by other international organizations as well as by national governments (Williams, R., 1977:14). Because radiobiology experts from all over the world participate in its committees, this prestigious Body's recommendations have become very close to international consensus standards.
2.3 Occupational Health in Selected Industrialized Nations

Among the industrialized nations today, there are many governments demonstrating their concern with hazards that affect their populations, by passing laws and implementing programs both in the occupational and general environments. Though they share similar concerns about combatting the harmful effects of industrial pollutants:

Their governments differ in style and approach, reflecting the socio-political values indigenous to their societies (Bates, D.V., 1977:7).

In a background study for the Science Council of Canada, examining how the three governments of the United Kingdom, the United States and Sweden regulated and controlled exposure to six human health hazards, (mercury, oxides of nitrogen, vinyl chloride, asbestos, lead and radiation) Roger Williams (1977:10) had this to say:

It has not been possible to treat the countries concerned in an exactly similar comparative, fashion - their differences are simply too great to permit this. Nor has it been possible to deal equally with each of the six hazards, both because the countries themselves have not dealt equally with them, but because the information to hand tends to be different in kind and unequal in amount.

In the following pages a brief description of occupational health services within the major world powers is presented, not for the purpose of comparison, but with a view to understanding how occupational health problems are perceived and dealt with in these countries. As well, some aspects or approaches of certain countries may have application to the Canadian scene. To this end, the legal,
administrative and technical aspects of occupational programs are considered in capsule form for the following nations; France, Germany, Great Britain, Japan, the Soviet Union, the United States and the Scandinavian countries.

France

The Occupational Health Services was legislated in France in 1946. This program applies to all employers in France and includes workers on the farm, in the mines, factories and commercial establishments.

Companies are required by law to provide one hour per month of physician time for each 10 factory workers or 20 office workers. The employers pay the full cost of this service. Small firms requiring less than 32 hours per month may obtain prorated occupational physician services from inter-company groups. These inter-company groups have government and union representatives on their boards (Mastromatteo, 1977:7-8).

All workers have compulsory pre-employment and periodic examinations. The intervals for periodic examinations are determined by the occupational physicians who assess the degree of risk encountered by the individual. The purpose for these examinations, when the law was first enacted, was to protect the general health of workers, when priority was placed on reconstruction after World War II, and the need for a healthy labour force.
Occupational physicians in France must have a postgraduate diploma in Occupational Medicine, however, their duties include only preventive medicine. They cannot provide primary care, hence:

This has tended to impede the development of comprehensive occupational health services (Mastromatteo, 1977:7).

Augmenting the Occupational Health Services' program are the medical labour inspectors in the Ministry of Labour who assist in development and enforcement of health standards.

Yet another ministry involved is the Social Security Agency which has a medical staff who deal with claims adjustment and rehabilitation. This agency has its own inspectorate and can levy special assessments for employers contravening safety and health requirements. Furthermore, Social Security funds support a National Research Institute in Occupational Safety and Health (Mastromatteo, 1977:8).

Germany

The Federal Republic of Germany passed legislation in recent years requiring firms to employ medical and safety experts. Occupational Medical Services are administered through the Department of Labour and Social Order. To supply these services with the necessary physicians, engineers and other health specialists, a major manpower training program is under way.

At the plant level, joint occupational safety and health committees have been operative for many years.
Of added interest, insurance companies in Germany, besides the governmental agencies, are involved in setting standards and conducting inspections for their members (Mastromatteo, 1977:13).

Great Britain

State involvement in occupational health and safety in the United Kingdom dates from the early 1800's. Though there have been former Public Health Acts during the Industrial Revolution, dealing mainly with sanitation, the most recent ones affecting workers and the general public were passed in 1974. These are the Health and Safety at Work Act and the Control of Pollution Act (Halsbury, 1975: 1083).

The Health and Safety at Work Act is based to a great extent on the work of the Committee on Safety and Health at Work, chaired by Lord Robens and reported in 1972 (Robens Report). Part I of the Act provides for:

...one comprehensive and integrated system of law dealing with the health, safety and work activities of work people and the health and safety of the public as affected by work activities; and to establish a Health and Safety Commission and Executive to be generally responsible for administering "the relevant statutory provisions" (Halsbury, 1975:1083).

The Health and Safety Commission comprises an independent chairman, three union members, three employer nominees, two local authority nominees and one member from the non-governmental safety organizations. Though it is independent of government, it is
responsible to Parliament through the relevant Minister (Employment, Public Health). Its mandate includes; general administration of the Act, promotion of research, proposing of new regulations, and provision of an advisory and information service (Williams, 1977:25).

The commission's operating arm is the Executive which consists of three persons appointed by the commission, with one person designated as director (Halsbury, 1975:1094). The Executive combines the former inspectorates of Factories, Mines and Quarries, Nuclear Installations, Alkali and Clean Air, and Explosives. It also includes the Safety in Mines Research Establishment and the Employment Medical Advisory Service. The Executive has some 1400 inspectors who operate from 18 regional offices (Williams, 1977:26).

Reporting for the Science Council of Canada, Roger Williams, (1977:26) writes:

The scope of the new Act is uniquely comprehensive. It protects some five million employees not covered by previous legislation, and in effect, virtually all workplaces and all people at work are now included. Further, the general public is to be protected and informed about hazardous activity which might affect them:

It has therefore in effect, been accepted in Britain, that there should be no sharp distinction between the workplace and the general environment so far as the regulation of hazards is concerned (Williams, 1977:26).

However, the mechanics of working this out between the local authority and the government authority are as yet unclear.
Part II of the Act under the title Employment, re-enacts certain provisions of the Employment Medical Advisory Service Act of 1972 (Halsbury, 1975:1083). The Employment Medical Advisory Service, referred to above, provides advice on health aspects related to the workplace to governments, unions and employers. In addition, it is responsible for carrying out periodic examinations of workers exposed to health hazards and assists in worker rehabilitation (Mastromatteo, 1977:6).

At the workplace, the Health and Safety at Work Act provides for the establishment of joint occupational safety and health committees. Physicians in the United Kingdom are employed by most of the larger firms to provide occupational health services (Mastromatteo, 1977:6).

An interesting feature of the British Act is that it is an enabling one. It gives the minister and commission broad powers, subject to formal processes of consultation, to establish and, as appropriate, to amend the Act's detailed provisions:

...The intention is to promote a system which can respond quickly and effectively to future technical and medical developments in the determination and control of hazards (Williams, R., 1977:26).

For this purpose, Regulations and Codes of practice are used:

Regulations are subsidiary legislation made under delegated powers and are, therefore, enforceable through the Courts via the criminal law...Codes of Practice are not legally binding in the same way as regulations ....(Williams, 1977:27).

The Robens Committee had recommended that Codes were to be
preferred to Regulations wherever possible, hence:

There has been some criticism to the Robens Report in its approach to self-regulation, self-inspection and the use of industry-wide codes of practice to replace detailed governmental regulations (Mastromatteo, 1977:5).

Nicholas Ashford, (1976:514) somewhat sceptical of the feasibility of self-regulation at the federal level, (i.e. warnings instead of first-instance sanctions, flexible non-statutory work practices rather than rigid standards, the discretionary power of inspectors) concedes:

Both the National Institute of Safety and Health and The Occupational Safety and Health Administration spokesmen have praised the Robens Report and supported adopting of its recommendations in the United States - especially the recommendation that "self-regulation" be the operating norm.

A plan for health and safety committees in hospitals is on the drawing board to be incorporated into The National Health Service. But because of the huge operating costs involved, it has not as yet been implemented (Crichton, A. 1977).

Japan

The responsibility of occupational health protection in Japan is vested in the Industrial Safety and Health Department in the Ministry of Labour. Also administered by the same Ministry is the National Institute of Occupational Health.

Japanese firms, depending on the number of employees, are obliged to hire safety and health supervisors and industrial physicians. As well, they must establish occupational safety and health committees.
A recent interesting development in Japan is the proposal to establish a College of Occupational Medicine subsidized by the government (Mastromatteo, 1977:16).

**Soviet Union**

In Russia, there are Central Institutes for Occupational Health administered by the Health Ministry and by the Trade Unions. These institutes develop health standards, and district hygiene stations provide advice and consultation on occupational health (Mastromatteo, 1977:14).

Dr. Nikolai Izmerov (1974:22), Director, Institute of Work Hygiene and Occupational Diseases, Academy of Medical Sciences of the USSR, writing in World Health, said the first institute for research in occupational diseases was set up in 1923 in Moscow to develop preventive action and promote healthier working and living conditions. It is now part of the USSR Academy of Medical Sciences and is responsible for research on work hygiene and occupational diseases.

A set of "Principles governing the Labour Legislation of the USSR and the Union Republics" was adopted in January, 1971. Of particular importance in this new legislation for the health protection of workers, is the right to healthy and safe working conditions (Izmerov, 1974:25).

Health care for workers is provided by physicians employed by the State Health Services. They are usually located either within
enterprises, depending on their size or in community centres. Inspection of enterprises is done by the trade unions (Mastromatteo, 1977:14).

Recent events in Russia show great strides in worker safety and health. According to Izmerov (1974:22), in the chemical industry, mechanization and automation have been used to protect workers from harmful compounds. Highly effective ventilation systems are installed in all factories, all apparati are hermetically sealed, and operations designed to run continuously have replaced those requiring periodic stoppages. New chemicals are prohibited by law without prior authorization from the state, the less toxic substances are used wherever possible.

Following the attention given to working conditions in chemical plants, serious cases of poisoning among workers have practically disappeared from the USSR, and the incidence rates of chronic occupational poisoning have steadily decreased. Carcinogenic substances are prohibited, without exception (Izmerov, 1974:22).

Albeit, in the Soviet Union, standards for airborne gases, vapours, dusts, fibres and physical agents are set at a much lower level than those of the west, Mastromatteo (1977:14) postulates:

In part, this is due to differences in interpreting harmful response in animals.

and stated:

Despite the published exposure standards, however, the level of airborne contaminants appeared much higher in the Soviet plants which I visited.
United States of America

The Occupational Safety and Health Act (OSHAct) in the United States was passed by congressional action in 1970 (United States Code, 1971:1852).

This Act was the first comprehensive attempt by the federal government to assure safe and healthful working conditions for working men and women and to integrate former Acts relating to occupational health. The safety and health standards promulgated under several previous laws for example, the Walsh-Healy Act of 1936, were deemed to be occupational safety and health standards issued under this Act, as well as under such other Acts (United States Code, 1971:1855).

Prior to 1970, the federal government's involvement in industrial health and safety regulations of non-government employees was limited to certain industries such as maritime, construction and mining and certain businesses with federal contracts. The primary regulation of industry was at the state level (Ashford, 1976:142):

But the general pattern of neglect on the part of the states eventually led to federal action and the passage of the Occupational Safety and Health Act of 1970 (Ashford, 1976:51).

Three main Agencies have been set up within the federal government to administer and enforce the Occupational Safety and Health Act. According to Ashford, (1976:144-145) these are;

1. The Occupational Health and Safety Administration (OSHA) is located within the Department of Labour, and is required to set standards and to conduct inspections of workplaces. It has the power to issue
citations against employers and to assess penalties for violations.

2. The Occupational Safety and Health Review Commission is an independent quasi-judicial review board which rules upon all challenged enforcement actions. It consists of three members appointed to 6-year terms by the President.

3. The National Institute for Occupational Safety and Health (NIOSH) in the Department of Health, Education and Welfare (HEW) is primarily a research body. It is responsible for developing and recommending occupational safety and health standards. This Agency is specifically required to publish a list of all known toxic substances and the concentrations at which these substances exhibit toxic effects.

In addition to these three Agencies, there is a National Advisory Committee on Occupational Safety and Health (NACOSH) which consists of "representatives" of management, labour, occupational safety and health, professionals and the public. This agency is required to advise, consult with and make recommendations to the Ministers of Labour and Health, Education and Welfare (Ashford, 1976:145).

The Occupational Safety and Health Act was promoted by good intention - to reduce the annual rates of accidents and diseases of occupations (Williams, 1977:65). Further:

The OSHAAct was a major legislative initiative bringing virtually all employees in the U.S. under federal coverage, the vast majority of them for the first time (Williams, 1977:65).
Be that as it may, among other criticisms, two areas of weakness became apparent in the implementation of the Act. One was a case of "too much too fast," the other, "too little too slow."

To illustrate, the "special duty" clause of the Occupational Safety and Health Act allows for adoption of existing national consensus standards, (any occupational safety and health standard which has been so designated by the Secretary - United States Code, 1971:1854) within two years of the Act's coming into force. Some 170 existing standards never intended to have the force of law were promulgated within the two year period.

It does not seem to have been much considered when the OSHA Act was passed that neither the federal nor the consensus standards had received the scrutiny necessary if they were to become legally binding, and on the total workforce (Williams, 1977:66).

There were severe criticisms that too many unsatisfactory simplifications had been made when voluntary guidelines suddenly became statutory standards. It now appears that the government rushed through legislation in a complex technical field where it had very little previous experience.

The second weakness in carrying out the Occupational Safety and Health Act seems to be a bureaucratic malaise which prevents or delays objectives being achieved. For example, the "general duty" clause pertaining to hazards states:

This has been defined by the federal courts, and to succeed under it OSHA must show the hazard in question could in principle be eliminated, and that practical means for eliminating it are at hand (Williams, 1977:66).
Moreover, the Act provides for standards which must contain particular sampling techniques, analytical methods, medical tests, work practices, monitoring and record keeping, and hazard warning arrangements as well as basic environmental limits. However, the standards taken over by the Occupational Safety and Health Administration were essentially environmental guides, and nothing more (Williams, 1977:66).

There seems to be a general inertia that has engulfed the implementation process of the Occupational Safety and Health Act. The root of the problem appears to be in the Occupational Safety and Health Administration:

Since so few health standards have been adopted by OSHA and the enforcement of the general duty obligation to provide a safe and healthful workplace is not likely to be pursued, workers remain essentially unprotected from health hazards (Ashford, 1976:294).

There is also doubt that the Occupational Safety and Health Administration will monitor the state programs effectively in the occupational health area because of its poor relationship with the National Institute for Occupational Safety and Health. In an overview of "Industrial Medicine in the World", Mastromatteo (1977:15) mentions in the United States, the National Institute of Occupational Safety and Health has submitted over 50 criteria documents but relatively few have been promulgated as standards by the Occupational Safety and Health Administration.
Ashford (1976:295) had this to say:

OSHA has not taken any initiative to act on NIOSH's priority list of 113 toxic substances or on the 1000 to 2000 toxic substances and agents NIOSH deems significant enough to require federal standards... and since OSHA has virtually no health expertise in-house, the problems of occupational health remains largely ignored.

Furthermore, the Occupational Safety and Health Administration has not undertaken a significant program of information dissemination to workers or to the general public. However, the Occupational Safety and Health Administration is to be reorganized and its previous policies evaluated. Perhaps a new commitment and new priorities may emerge (Ashford, 1976:299).

The Scandanavian Countries

Mention must be made of the developments in some of the Scandanavian countries. They are highly industrialized nations and have been for many years in the forefront of health delivery systems.

Sweden

In Sweden, occupational health and safety issues are combined in the National Board of Occupational Safety and Health which is responsible to the Minister of Labour.

Swedish occupational safety legislation dates back from an 1889 Act with the first labour inspectors being appointed in 1890. The Workers Protection Act of 1949 and the setting up of the National Board of Occupational Safety and Health in the same year became a
benchmark in Swedish social legislation (Williams, 1977:107). In 1970, a Work Environment Commission was appointed, and more recently Sweden has introduced legislation requiring the prescreening of chemicals used in industry (Mastromatteo, 1977:9).

Recent legislation also calls for compulsory labour management cooperation. Worker safety delegates in each plant are empowered to assess safety and health risks. The appointment of worker safety delegates has necessitated major training programs to be set up (Mastromatteo, 1977:9).

Central ministries are very small in Sweden. Consequently, they confine themselves to policy matters. Legislation is typically developed by specially appointed commissions. These commissions usually comprise 5-10 members selected from government and opposition parties, labour and management, interested organizations and relevant professions.

The Swedish system has some disadvantages and some advantages. On the one hand, it is time-consuming and cumbersome. For example, after several years in closed session the commissions present their reports to parliament. On the other hand, the process is thought worthwhile to promote democratic government, with a uniquely thorough and mature consensual approach (Williams, 1977:108). However one assesses the Swedish system, one must concede by international standards, the Swedes are among the healthiest peoples in the world.
A quotation used by Roger Williams in the background study for the Science Council of Canada in comparing the occupational and general environment regulations in the United Kingdom, United States and Sweden, says:

"If countries....were classified according to:

(1) their willingness to spend money on the environment;
(2) their economic wealth....;
(3) anti pollution laws; and
(4) the needed public support to help government agencies carry out their work; then Scandanavia would certainly be in class A with Sweden at the top". (Williams, October, 1977:107).

There are some original funding schemes in occupational health care that merit attention. A Swedish Work Environment Fund, raised by an industrial payroll assessment of all employers in Sweden, including government enterprises, provides monies for research to prevent occupational injuries and diseases. In another area, Swedish Health Insurance Funds are used to subsidize up to 50 percent of the medical and nursing costs for occupational health services in small plants. This has provided a powerful incentive for employers of small firms to establish occupational health clinics (Mastromatteo, 1977:9).

A recent interesting event with powerful implications for occupational and environmental considerations was Sweden's democratic vote on March 23, 1980 for more nuclear power generation. A total of 58 percent were in favour of bringing six more reactors into operation. However, two-thirds of them added that all twelve reactors
should be phased out in 25 years and other energy sources made available. Though 39 percent of the voters indicated a willingness to accept a lower standard of living, the majority vote indicated that national need can enhance the respectability of this controversial energy source (Province, the Vancouver Editorial, 25 March, 1980:B1).

**Finland**

The approach to occupational health services in Finland generally follows the Nordic pattern. The National Board of Health and the National Board of Labour Protection co-operate and report to the Minister of Social Affairs and Health.

According to Mastromatteo (1977:10), every place of work with more than 20 employees must have an occupational safety and health committee. Under Finnish law, the employer provides pre-employment health examinations and periodic screening for workers exposed to hazards.

Depending on the size of the firm, the employer may select the type of medical service that suits him, whether it is independent occupational health services, joint occupational services with other enterprises, private physician practice or community health centres. In Finland, as in Sweden, employers may be partially reimbursed (up to 60 percent) for occupational expenditures from the Sickness Insurance Fund (Mastromatteo, 1977:11).
In studying the major characteristics of the occupational health services in the European countries, Nicholas Ashford (1976:509) compares the American scene with the European approach. His summarized observations may have some significance to Canadians as they contemplate their own occupational health efforts. Dr. Ashford found in many European health services that:

1. Leadership in the various agencies responsible for occupational health and safety has the necessary health and safety expertise.
2. The counterpart of the National Institute of Occupational Safety and Health (U.S.) is at a higher organizational level within government - or is an independent organization.
3. Where a national organization exists, its capability makes research relevant to critical occupational health and safety problems.
4. The government consults with the employers, and first-instance citations are infrequent. Warnings and improvement notices are the major enforcement mechanisms.
5. Standards are generally regarded as guidelines, and the inspector has discretionary power.
6. The inspectors are more specialized and are better trained than their American counterparts.
7. Physicians are very often part of the inspectorate system.
8. There are legal requirements for occupational health services in the workplace, or in case of small firms, for participation in a joint medical service.
9. Occupational disease has been recognized for many more years in Europe than in the United States. Therefore, it has figured extensively in compensation and control purposes.

10. Safety and health have an equal emphasis.

11. Since occupational disease is compensable, employers respond well to economic incentives that remove health hazards on the job.

12. A major portion of the workforce is organized.

13. Either works' councils or joint health and safety committees, even for small firms, are generally mandated by law.

14. Employers and employees generally accept health and safety to be a joint responsibility.

15. Employers and employees are usually equally represented in the agencies and organizations responsible for occupational health and safety.

16. Collective bargaining is often done at the federation rather than at the plant level.

17. There is a great national commitment to provide a safe and healthy workplace and a great sense of fair play.

18. Preventive medicine plays a prominent role in job health and safety.

19. Industrial hygiene is incorporated within the duties of the plant physician or safety engineer as part of their expertise. It is not developed as a specialty as is the case in the United States.

20. Ergonomic factors that are conducive to both the mental and physical well-being of the workers receive considerable attention.
21. The transfer of ideas on workplace safety occurs readily across national boundaries.

22. Great importance is given to international cooperation and the need to agree on standards and work practices.

2.4 The Developing Countries

The concept of occupational health and safety is still fairly new in the emerging nations of the world. The major obstacles of lack of knowledge and training in modern health matters, cultural differences and often poor economy are likely to impede progress in this field. But preventing occupational injuries and disease is just as vital in the developing countries as it is in the highly industrialized countries. Within the global village the nations have a responsibility to work together for the betterment of the world's population. Having over two hundred years lead time, the developed countries must show the way.

Workers in the small industries in these developing nations have almost insurmountable problems. These problems were discussed in a preceding section on the "International Scene."

The world's economy is still largely agricultural, and agriculture still dominates the developing regions. Three quarters of the working population in the world are engaged in agriculture, though this proportion varies in advanced and developing countries. A substantial part of the rural population in Asia and
and Africa lives and works under the conditions of a developing society (Macuh, P., 1974:10).

Though occupational health problems in agriculture are not the same everywhere, nations that have been oppressed and exploited for centuries have not attained the level of agricultural development enjoyed by their more affluent counterparts in the rest of the world. These more primitive societies are still plagued by infectious diseases such as zoonosis and tuberculosis as well as parasitic diseases, and:

...although somewhat on the decline, are still a real hazard for rural populations engaged in agriculture, especially in the developing countries (Macuh, 1974:13).

Proper protective and preventive measures are required, along with adequate instructions. Dr. Mastromatteo (1977:16) suggests:

Technical co-operation assistance to developing countries should first emphasize the development of basic information and basic infra structure rather than the installation of sophisticated analytic equipment.

Since agricultural production is continually increasing to meet world demand, it is important to do everything possible to protect the health of the people who produce food. There is much that needs to be done in the developing countries. There is much that can be done for them by the developed nations. Continued exploitation is unjust. Merely sharing technology is insufficient. A real concern for the dignity, welfare and health of the third world countries must be demonstrated by the "have" nations. This final
point is crucial to the success of any social or economic program directed towards the protection of the emerging countries. In this way all nations can benefit within the "global village".

Conclusion

A profile of occupational health in various countries has revealed that the workers' health is indeed a global concern, not only in the industrialized nations but in other parts of the world. The many world organizations reflect this global responsibility and individuals are beginning to realize that "no man is an island".
CHAPTER 3

THE CANADIAN EXPERIENCE IN OCCUPATIONAL HEALTH

There is a new awareness of occupational health and safety in Canada today. David Chisholm (1977b:1), Long Range Planning Branch, Department of National Health and Welfare, says in a discussion paper on Occupational Health and Safety:

After languishing in the shadows of public health and health care advancements during the past several decades, and the more recent concerns for the general environmental quality and its impact on health, the field of occupational health and safety has come alive in the mid-1970's. This long overdue public, government, labour, management, professional, and scientific interest has been accelerated by the increased recognition of the contribution of the workplace to physical and mental health problems.

Nevertheless, credit must be given where governments have taken protective action on such hazards as asbestos, lead, mercury, oxides of nitrogen, radiation and vinyl chloride. For example, in the case of lead:

Government actions within Canada have taken a variety of forms: drinking water standards, maximum permissible levels of lead in commercially-available foods, consumer protection prohibitions on, for example, paint and toys, occupational guidelines on threshold limit values, emissions and ambient air quality standards, and establishment of expert committees and task forces. The major mining, smelting and manufacturing industries have installed control technology to reduce emissions both within and outside their operations and have made available protective equipment to be used by their workforce. Organized labour and public safety groups have publicized the hazardous conditions to which people are subjected through collective bargaining demands and prosecution of
polluters, and have thereby precipitated
government action at both the provincial and
federal levels (Science Council of Canada No.28,

Economics, employer apathy, lack of knowledge of hazards,
inconsistent government controls all have played their part in
delaying worker protection. Compounding the situation, the
acceleration of technology has contributed greatly to the confusion
and delay. For one thing, there are technological advances today
that enable finer and more accurate measurements of particles and
trace metals in the ambient environment than was possible previously.
Hence, guidelines followed in the past may no longer be relevant
today. Since the experts do not always agree, they tend to avoid
definitive stands which deter rapid pronouncements in changing
situations (Stopps, J., 1976:65-66). This perhaps accounts for the
statement:

...acceptance of occupational health has not kept
pace with the increase in knowledge of potential or
real health hazards, of our enhanced skills and methods
for diagnosis of occupational diseases, nor of methods
for control of the working environment....(Watkinson,

3.1 Occupational Health Status

Simultaneously looking back at some accomplishments in the
field of occupational health and safety, and anticipating future
action in this direction, Health and Welfare, Canada has this to say:
During the past century improvements in working conditions and the quality of working life in Canada have been considerable, reflecting concerns and efforts by governments, professionals, management and labour. Legislative and regulatory action, although complex and uneven, at times have been substantial, as have been the efforts and achievements in safety protection and education, occupational health services, and workers' compensation. Nevertheless, the rapid development of new physical hazards to which increasing numbers of workers are potentially exposed has reemphasized, and accelerated interest in, these concerns about worker health. Even more apparent are the adverse effects of psycho-social factors ubiquitous to many occupations yet intimately linked to community life and personal lifestyle characteristics (Occupational Health in Canada - Current Status, 1977:48).

The Canadian status in occupational health and safety will be reviewed briefly under the headings; events, laws and programs.

3.1.1 Events

The working document, "A New Perspective on the Health of Canadians" (Lalonde, 1974) served as a great impetus for promoting the preventive aspects of health care in Canada. The Health Field Concept (Human Biology, Environment, Lifestyle and Health Care Organization) which is introduced in the publication is comprehensive enough to involve occupational health and safety under any one of the divisions, but particularly under Environment. This category comprises:

...all those matters related to health which are external to the human body and over which the individual has little or no control...(Lalonde, 1974:32).
To further stimulate those interested in the area of occupational health and safety, they perhaps may take seriously the statement:

...Finally, the Health Field Concept provides a new perspective on health, a perspective which frees creative minds for recognition and exploration of hitherto neglected fields (Lalonde, 1974:33).

Clive Dennis (1976:64), Executive Director, The Prairie Institute of Environmental Health, referring to the document, said it:

...is truly an outstanding exposition of health needs and no occupational health specialist should fail to digest this document and apply its concept to occupational health. Each characteristic of the Health Field Concept...is intimately related to health and safety in the workplace...

One critic of the Lalonde Report (McEwan, D., 1979), feels after five years since its publication there has been no positive action or follow through by the federal government in attaining its objectives - that its health promotional activities are of doubtful value.

At present, there appears to be no federal plan for further implementation of the document. Given the division of powers vested in the Canadian constitution, the provinces will most likely be left with the strategies of implementation. Did the Lalonde Report merely identify needs and provide the vision? Or was it the first step in an overall grand design for a prevention program in health care for Canada?
The rebirth of interest in occupational health and safety was further sparked when:

Occupational health was identified as a priority issue by the Federal and Provincial Deputy Ministers of Health in June, 1975 (Chisholm, 1976:1). possibly fuelled by some accident statistics furnished by Labour Canada for 1975 (Figure 1, Table 2).

As momentum continued to gather, the Canadian Public Health Association took an important step forward in occupational health in Canada. It organized the first National Conference on Occupational Health in 1976 in Toronto. Representatives from industry, labour, government, law, various health disciplines and the general public attended. The conference placed the seal of approval on occupational health services and programs as an integral part of health services and health care (Canadian Journal of Public Health, Sept/Oct. 1976).

Another step forward took place in 1978 in Ottawa, with the establishment of the Canadian Centre for Occupational Health and Safety. This centre was set up initially to promote occupational health and safety on the job, in an effort to reduce loss of work time (CPHA Newsletter, October, 1978:4). To insure an unbiased approach to occupational issues, the centre was established as an independent self-governing body which reports to Parliament but is part of no government department or agency. It is guided by three main principles:
Figure 1

Man-Days Lost: Strikes vs. Injuries

Man-days lost due to strikes and lockouts compared to man-days lost to work related injuries (excluding fatalities).

Canadian figures in millions of man-days.


Occupational Safety and Health Directorate
Canada Labour, Ottawa
### Table 2

**Comparison of Overall Injury Incidence Rate and Disabling Injury Frequency Rate**

*for industries under Federal jurisdiction*

<table>
<thead>
<tr>
<th>By Province</th>
<th>Injury Incidence per 100 Employees</th>
<th>Disabling Injury Frequency Rate</th>
<th>By Industry Division</th>
<th>Injury Incidence per 100 Employees</th>
<th>Disabling Injury Frequency Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newfoundland</td>
<td>5.42</td>
<td>13.47</td>
<td>2. Banking</td>
<td>0.64</td>
<td>0.80</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>27.90</td>
<td>19.97</td>
<td>3. Bridges and Tunnels</td>
<td>13.81</td>
<td>20.00</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>2.27</td>
<td>1.88</td>
<td>4. Broadcasting</td>
<td>4.79</td>
<td>6.15</td>
</tr>
<tr>
<td>Quebec</td>
<td>15.16</td>
<td>14.93</td>
<td>5. Communications</td>
<td>5.15</td>
<td>4.78</td>
</tr>
<tr>
<td>Manitoba</td>
<td>19.09</td>
<td>24.25</td>
<td>7. Feed, Flour and Seed</td>
<td>19.59</td>
<td>31.92</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>12.36</td>
<td>17.57</td>
<td>8. Grain Elevators</td>
<td>23.73</td>
<td>27.74</td>
</tr>
<tr>
<td>Alberta</td>
<td>20.10</td>
<td>23.41</td>
<td>9. Longshoring</td>
<td>45.25</td>
<td>43.24</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>21.30</td>
<td>30.81</td>
<td>10. Mining</td>
<td>74.08</td>
<td>165.29</td>
</tr>
<tr>
<td>British Columbia</td>
<td>12.65</td>
<td>16.27</td>
<td>11. Pipelines</td>
<td>8.13</td>
<td>8.78</td>
</tr>
<tr>
<td>Yukon Territory</td>
<td>24.07</td>
<td>60.58</td>
<td>12. Postal Contractors</td>
<td>9.72</td>
<td>10.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>14. Road Transport</td>
<td>23.10</td>
<td>55.54</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15. Water Transport</td>
<td>16.30</td>
<td>25.40</td>
</tr>
<tr>
<td>Canada Total</td>
<td>14.43</td>
<td>19.57</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disabling Injury Frequency Rate = \[
\frac{\text{Number of disabling work injuries} \times 1,000,000}{\text{man-hours worked}}
\]

Source: Occupational Safety and Health Directorate, Labour Canada, 1975
(a) The desire to work openly and provide information freely.
(b) To support research in order to provide facts without value judgments.
(c) To maintain its independence so that it may speak out strongly on vital issues (Canadian Nurses Association, October 1978:3).

The council of governors has an equal number of representatives from labour and industry. Each province and territory receives representation and the federal government has four members - a total of 39. The purpose of the centre is to serve as liaison, nationally and internationally, with all agencies, groups and individuals concerned with hazards in the workplace - its main concern is to promote safety at work (Law, C.E., Financial Post, March 10, 1979:12).

During its formative year, the Canadian Centre for Occupational Health and Safety maintained a low profile. However, it appears to be gearing into action according to a few news releases. The Council is preparing to host the Triennial World Congress for the Prevention of Accidents and Illness at Work in 1983 (Law, C.E., March 10, 1979: 12). In May, 1980, David Cohen a spokesman for the Centre, announced a computerized occupational health hazard information service will be set up at an initial cost of $1.5 million. The idea of the service is to put information on radiation, chemical hazards, safety regulations and specific background on risks in the workplace, directly into the hands of the Canadian workers so that they can make
informed decisions on what affects them (Vancouver Sun, May 30, 1980:A3).

The Canadian Centre for Occupational Health and Safety has great potential to act as a catalyst in the maturation process of occupational health in Canada. Furthermore, this national Body could facilitate a smooth implementation of occupational health and safety legislation at all levels of government in Canada.

Further evidence of heightened interest in occupational health and safety has been; The Science Council of Canada's research and studies on exposure to hazards, 1977, and the first conference of the Council on Protective Equipment for Canadian Workers (COPE) in 1978.

Events such as these and others all attest to a growing concern in Canada of the health factors and health effects that are intimately involved with the well being of all working Canadians and the general public. As the decade of the 80's begins, the future looks bright.

3.1.2 Laws

The subject of laws is indeed a very extensive and complicated one. Apart from acknowledging the difference between laws regarded as individual justice in common law, and legislation of groups by statute law or other methods of regulation, this section will deal exclusively with statute law as it affects workers' health.
Concerning the health of Canadian workers, the current swing to prevention requires support at all levels, systematically including legislation, resource allocation and planning. Reinforcing this statement, Suttie B. (1976:8) says:

However more visible the rewards of treatment over those of prevention may be, we dare not with impunity ignore the need for a greatly increased effort in the prevention of occupational and environmental health hazards.

Legislation concerning prevention of hazards and worker protection is highly varied in Canada. To understand the process, it is necessary to go back into history. In the British North America Act (1867) there is no term of reference to health responsibilities in the Powers of Parliament other than (a) "Quarantine and the Establishment and Maintenance of Marine Hospitals" and (b) "Indians, and Lands reserved for the Indians" (British North America Acts, Consolidated, 1967:25). This has enabled each provincial legislature to make exclusive laws in relation to certain classes of subjects such as "Hospitals", "Local Works" and other "Matters of a merely local or private Nature in the Province" (B.N.A. Acts, Consolidated, 1967:27-28). This explains why occupational health and safety legislation may be covered by different departments in various ministries and why man-made hazards affecting working people and the general population are subject to a wide variety of legislative controls at the federal and provincial levels.
In a background study for the Science Council of Canada, Robert Franson et al (1977:27) classified the relevant legislation into ten categories:

1. General pollution control statutes;
2. Industrial safety, workers' compensation and occupational health legislation;
3. Special statutes dealing with particular contaminants;
4. Motor vehicle statutes;
5. Public Health statutes;
6. Food and Drug statutes;
7. General Contaminants statutes;
8. Statutes regulating development and use of particular resources;
9. Statutes regulating specific industries;
10. Consumer safety statutes.

Within these ten categories, there is much duplication and overlapping between categories, between provinces and in relation to the federal statutes.

However, under the category, Industrial Safety, Workers' Compensation and Occupational Health Statutes, most provinces have protection laws for workers in one ministry or another. All provinces as well as the federal government have enacted industrial safety legislation (Franson et al 1977:29-30).
According to Health and Welfare Canada's publication, "Occupational Health in Canada - Current Status" (June, 1977), there are six provincial governments that consolidate most occupational health and safety activities in the Department of Labour. These are Alberta, Saskatchewan, Manitoba, New Brunswick, Nova Scotia and Ontario. Three provinces, namely, British Columbia, Newfoundland and Prince Edward Island delegate most occupational health and safety activity to the Workers' Compensation Board. Quebec as yet has no single focal point for overall occupational health and safety. However, it appears that the Province of Quebec is leaning towards the Health Ministry, by organizing occupational medicine programs in community health centres (Chisholm, 1977a:190).

Recent important developments have been the Saskatchewan Occupational Health Act of 1972, the Alberta Occupational Health and Safety Act of 1976 and the Manitoba Workplace Safety and Health Act of 1977 (Occupational Health in Canada - Current Status, 1977). Newfoundland and the federal government adopted similar legislation shortly after, and Ontario and Quebec are introducing legislation in the near future (Rabinovitch, 1979:22).

It is interesting to note the provision and administration of the Federal Public Service Health Program entails the cooperation of several departments. The Treasury Board develops and provides standards governing the health, safety and physical working conditions of employees. The Department of National Health and Welfare, supported
by their resources throughout Canada and abroad, is responsible for the provision of appropriate technical advice and for the supervision, organization and operation of the Program. The Department of Labour, in addition to its safety inspection services, acts in an advisory and technical capacity (Occupational Health and Safety, 1974:16).

Excluding the Territories, which rely on Ordinances (Occupational Health in Canada - Current Status, 1977:65), the total Canadian occupational health scene emerges with a complex assortment of legislation, regulations and enforcement procedures under a variety of administrations in eleven different jurisdictions.

Further discussion on laws will be presented in succeeding pages, under "Issues."

3.1.3 Programs

Comprehensive occupational health and safety programs in Canada which include safety, industrial hygiene and employee health services, are usually found in large establishments (over 500 employees). Examples of these are the utilities (Bell Canada), petroleum industries (Imperial Oil), chemical processors (Dow Chemical), electronics (General Electric), motor vehicle manufacturers (General Motors), major air and transport companies (Canadian Pacific), large steel processors (Stelco), military services, major mining companies (Inco), some central offices of insurance companies (Metropolitan Life), and governments (Federal,

Employee health services in Canadian firms follow no particular pattern. Policies are as varied as the services they offer. Most large enterprises have some features of an internal employee health service and provide on-site facilities with a company physician, full or part-time. Medium and small firms tend to contract out for physician service, chiefly for medical examinations. It is believed that most medium and small enterprises provide no health service at all. A total of 1,500 nurses and an unknown number of physicians are practising within employee health services (Occupational Health in Canada - Current Status, 1977:46).

Patterned after functioning models in Europe, some Canadian employee health services have been established to cater to a geographic collection of small and medium size businesses. Generally these services are funded by employers and operated privately (Occupational Health in Canada - Current Status, 1977:46). However, the Red Deer Health Unit in Alberta offers a public service to a group of thirty-nine different types of industry, ranging from one employee to 175 employees. The service provides for:

1. pre-placement health assessments on prospective employees;
2. baseline health assessments on current employees;
3. periodic audiometric testing;
4. immunizations for special hazards;
5. referrals to local physicians and community services, as necessary;
6. follow-ups as indicated and/or requested by attending physician;
7. CO₂ monitoring for one industry;

It is surprising that there are so few successful endeavours of this kind in Canada (Occupational Health in Canada - Current Status, 1977:47). What is there to stop other health units following its lead? Is it lack of funds?

There are other diverse types of employee health services set up in response to various needs of select groups. Field first-aid nursing stations operate in remote or underserviced locations in special geographic areas. For years, executive health programs have operated within corporation with the emphasis on periodic health examinations, counselling, immunizations and provision of exercise facilities. More recently, employee fitness and health promotion programs have developed, and treatment of programs for alcohol-related problems, are being successfully implemented through places of work (Occupational Health in Canada - Current Status, 1977:47). Obviously those fragmented approaches reflect a desire to meet specific needs of workers, but appear to be guided by no overall objective for a comprehensive
employee health program - as embodied in the concept of the 4 P's, promotion, prevention, protection and placement (refer to definition, of Occupational Health, page 22).

Notwithstanding, Health and Welfare, Canada's report on Occupational Health in Canada - Current Status (1977:47), notes that workplace programs and activities have increased emphasis on internal responsibility, indicating trends in the development of:

1. employer-employee occupational health and safety committees;
2. industrial safety surveillance;
3. general health promotion (including alcohol and fitness); and
4. employee health services (several modes of operation), and integration of these with other community health services.

One can only speculate why employee health services have not flourished. The fact remains, other seemingly priority issues generally took precedence over occupational health in the past, and health care of employees is a somewhat more recent concern.

In the meantime, the workforce and the public have become cognizant of workplace and environmental hazards. There appears to be, now, a huge receptive workforce that can benefit from a full range of occupational health services:
Although underutilized to date, the occupational setting in Canada provides an opportunity for general health promotion as well as the promotion of health for work-related problems (Occupational health in Canada - Current Status, 1977:47).

This, however, may be easier said than done, mainly because of ideological commitments of the present government in Ottawa (Marchak, 1975; Navarro, 1976), and the fact that there is no overall social policy in occupational health where objectives are identified and in which resources are directed to their pursuit.

In comparing social policy of different ideologies, Joyce Warham (1974:38) expounded, in her paper, on the democratic socialist doctrine as opposed to the liberal philosophy. She says:

In democratic socialism, social services have a positive role and a permanent place, within an overall commitment, to equality of condition as between social classes and income groups.

She continues:

In liberal philosophy on the other hand, they tend to be seen as properly ephemeral, and as desirably diminishing in scope and importance as the increasing affluence of a society is assumed to reduce the numbers of those who are necessarily dependent upon them.

Vincente Navarro (1976:447) of the John Hopkins University School of Hygiene expresses his views on the relationship of capitalism to occupational diseases. He says:

The etiology of those diseases is very much the result of control of the labour process by capital and not by labour, with profit-making taking priority over job safety and worker satisfaction.
He adds:

...One of today's most active state policies at the central governmental level in most Western capitalistic countries is to encourage and stimulate those health programs, such as health education, that are aimed at bringing about changes in the individual but not in the economic or political environment.

Governments do change, however, and new ideologies take over. And the astute planner would consider both personal and environmental factors in any comprehensive occupational health program.

3.2. Issues, Conflicts and Related Problems

3.2.1 Issues

Some of the issues in occupational health and safety have already been discussed on previous pages under "Twentieth Century Concerns". However, to bring them more in line with a Canadian content, it may be worth focussing on those perceived to be priorities in Canada.

The various Canadian authorities on occupational health and safety (Bates 1977, Chisholm 1977, Dennis 1976, Ison 1977, Mastromatteo 1977, Rabinovitch 1979, Somers 1976, Stopps 1976, Watkinson 1976, etcetera) have lent their perspective to the major issues, conflict areas and related problems, in articles, papers and speeches. The recurrent themes hammered out by them in dealing with the issues appear to center around, (1) the need for integrated programs and coordinated policy at the provincial and federal levels,
and (2) the need for a national data base and research/information centre. In order to make headway on these issues, while seeking solutions, it is essential to understand the conflicts that can impede progress and the related concomitant problems and corollaries that compound the issues. Since these three topics, issues, conflicts and related problems impinge on one another, it seemed appropriate to consider them together. The vastness and complexity of the whole subject of occupational health and safety ensures that progress will be slow despite the well meaning efforts of dedicated people.

(1) **The need for integrated programs and a coordinated policy**

at the provincial and federal levels.

The majority of the provinces in Canada has consolidated all occupational health and safety activities in the Labour Ministry, as mentioned under "Laws". For the next step, integration of programs might be considered in the areas of (a) safety and health in the workplace, (b) laws pertaining to hazardous substances and (c) occupational environment versus general environment.

(a) In dealing with safety and health in the workplace, standards for occupational hazards in the workplace environment are established almost exclusively under one category of legislation, the industrial safety, workers' compensation and occupational health statutes. Some relevant provisions are also contained in some Public Health Acts and certain of the special statutes regulating particular
contaminants (Franson et al, 1977:46). However, Somers (1976:49) contends:

There are nearly 200 legislative acts and over 400 sets of regulations and codes applying to occupational health and safety. Most of these acts, regulations and codes are safety orientated.

What seems to be neglected is the occupational health aspect of the workplace environment. Occupational hazards such as continual exposure to light, noise, vibration, heat, computer terminals, long term effects of chemicals, causes of chronic back-pain etcetera, deserve greater attention. No less important are the mental, psycho-social and stress factors that affect people at work.

Integrated comprehensive occupational health and safety programs would consider all factors and should be instituted at the provincial level under whichever ministry has jurisdiction. If this were to become a reality in all provinces, Dr. Somers' (1976:49) remark:

Canada is the only industrialized country in the Western World without a national program of occupational health and safety.

may not have to be taken too seriously. In fact, some would argue that a federal plan might easily become a redundancy. After all, most of the Canadian provinces are each larger than many of the European countries by land mass and some by population. If the workforce is adequately protected in a province-wide comprehensive occupational health program, and assuming the
provinces consider types of industry, and diseases indigenous to their particular regions, is there much left for a federal role? One of the more frequent arguments for a nation-wide set of rules is that it prevents industrial drift to the less regulated areas. Of paramount importance in an integrated program, must needs be that both union and non-union employees are included.

Dr. Mastromatteo (1976:14) states that a high priority is to avoid fragmentation and duplication in occupational health and safety programs, as present programs in Canada afford many examples of fragmentation. He says:

...It would seem best to consider a comprehensive occupational safety and health law which would indicate in general terms what is to be achieved and the responsibilities of employers, workers and governments....

He states further that the legislative and administrative measures should provide the basis for protection of the workers and surrounding residents. The law should be flexible enough to cope with the rapidly developing technology in the field. The details, he feels, should be left to codes and guides. He does not think, however, that a centralized approach as has been adopted in the United Kingdom and Sweden is necessarily best:

...but the system which is used should permit maximum use of the resources available.

Taking a different view of any endeavours relating to the subject, Dr. Boyd Suttie (1976:8) says:
...The construction of an improved definition of and response to occupational and environmental health issues and hazards is clearly of national dimension and cannot be effectively addressed by initiatives of one province or of a group of provinces, unless federal involvement, support and coordinating efforts are strongly and visibly committed....

Whatever the jurisdiction may be, to be effective, preventive measures in occupational health and safety demand a consideration of the worker's total environment both within and outside his or her immediate control.

David Chisholm (1977c:1-2) in the preamble to his paper, "Occupational Health in Canada, Future Directions," places responsibility on workers, management and government, and advocates cooperation, and coordination of occupational health and safety programs. His views are:

...Health and safety activity and policies relating to workers should be an integral part of the total health concept in which:
- individuals accept responsibility for matters relating to their mental and physical health over which they can exert personal control;
- industry, business and governments ensure a high level of protection against health hazards in the workplace; and
- workers who suffer ill health because of their work are cared for and rehabilitated within the framework of social security systems.

And further:

Given the division of powers under the Canadian Constitution, the federal, provincial, territorial and municipal/regional governments should work together and develop integrated and coordinated policies and programs. These should be backed up when necessary by statutory requirements to ensure that all who are gainfully employed are protected by adequate health and safety measures.
Clearly it would appear that the provinces with their vested powers can and should make available integrated comprehensive occupational health and safety programs for all their employed population. The federal government, on the other hand, must deal with matters which by their nature require a single national policy as well as with matters which require an international voice.

(b) In dealing with laws pertaining to hazardous substances, Franson et al (1977:47) have this to say:

There appears to be a good deal of overlap among statutes that deal with contaminants in one form or another. For example, the mercury content of a particular plant's effluent could be regulated under the pollution control legislation of a province, under the federal Fisheries Act, or in appropriate circumstances, under the Canada Water Act. The same problem might be dealt with by controlling manufacturing processes under the Environmental Contaminants Act.

Overlapping jurisdiction is not necessarily bad. It is preferable to gaps in jurisdictions. And statutes all served the specific purpose at the time they were needed. Franson et al (1977:48) state:

...it may be one way of assuring that all interests are consulted before action is taken. In addition, it would be very difficult to draft statutes dealing with different subjects that neither overlap nor leave important areas out altogether....

In order to eliminate possible gaps, supplemental legislation is occasionally required. For instance, Environment Canada officials maintain:
...that the Environmental Contaminants Act is designed for a supplemental role. It is intended to cover problems that cannot be dealt with effectively under other environmental legislation (Franson et al, 1977:48).

It would seem wise if its purpose were clearly stated, however, if only to counter public hostility at its apparent inaction, as indicated by Rabinovitch's (1979:23) remark:

...the existing federal Environmental Contaminants Act is well-known for its weakness and its lack of enforcement.

Because of the numerous acts in the legislative framework with their various regulations and guidelines, it is difficult for the public not to be confused. Without an indepth study it is impossible for the ordinary citizen to comprehend the structure. Therefore, it would be only reasonable to expect regulators to have clear policies and to integrate and streamline existing legislation with a system of cross-indexing, including both provincial and federal statutes.

Before proceeding further, it may be helpful to explain the difference between regulations and guidelines, as used in Canadian legal terminology:

A regulation may be defined as a rule made by a competent authority relating to actions of those under its control. Regulations are specifically authorized by statute, are legally enforceable in the ordinary courts, must usually be passed by Order in Council, and must be published in the official gazette of jurisdiction. A guideline is an informal statement issued by a regulatory agency setting forth the standards of conduct that it expects those under its control to exercise. It is not enforceable in the ordinary courts (Franson et al, 1977:34).
It is interesting to note in the Science Council of Canada's background study, "Canadian Law and The Control of Exposure to Hazards," Franson et al (1977:48) indicated that regulators seem to have a clear preference for issuing guidelines rather than regulations which create many difficulties. Not only are guidelines unenforceable but are hard to locate for researchers and the general public. Their claim to fame is that they can be more quickly changed than regulations:

...but perhaps the loss in enforcement and publicity are too high a price to pay for greater flexibility(Franson et al, 1977:48).

At the same time, if standards entrenched in regulations are more effective, several problems become evident. First, empowering statutes and regulations do not necessarily require regulatory authorities to establish standards for any particular contaminant. This power is nearly always given in discretionary terms which makes it unlikely that courts will order reluctant regulators to promulgate standards. Secondly, even if an agency does establish contaminant standards, it is rarely under enforceable duty to revise or review existing standards in the light of new knowledge. British Columbia has the only Pollution Control Act with a policy of periodic review (Franson et al, 1977:49).

Albeit, the iron-clad nature of the various legislative components lead to frustrations. However, attempting to make changes may often create more problems than they would solve. Nevertheless, there are areas where improvements can be instituted. The Science
Council Report No. 28 (October, 1977:23) investigating hazards, found among other items:

1) ... a lack of uniformity between the provinces in respect of standards. As well, many standards appear to have been selected in an ad hoc and arbitrary fashion.

2) ... a lack of clear definition of responsibilities between different departments within provinces.

3) ... a lack of clear definition of responsibilities between federal and provincial governments, and possibly the most significant finding was:

4) The Canadian regulatory process is characterized by a lack of openness in information gathering, in information access and availability, and in decision-making and determining accountability.

To continue in this unsatisfactory manner can only be regarded as a gargantuan disservice to the Canadian workforce - and to the Canadian companies who might operate in more than one province having to cope with the vagaries of different legislation.

Chisholm (1977c:9) notes in his "Occupational Health in Canada, Future Directions":

Currently the regulatory methods and facilitative resources used within each jurisdiction are highly variable, with only limited interjurisdictional cooperation, coordination, and sharing of resources regarding occupational health and safety.

Therefore, it would appear there is a definite challenge for administrators of occupational health and safety legislation to adopt at least more uniform standards among jurisdictions (Chisholm 1977a:191).
The perennial argument of "enforceable standards" as opposed to "guidelines" is debated hotly by their proponents from labour, industry, government and health administrators on the North American continent. In Canada, government regulatory agencies have largely adhered to the philosophy of self-regulation for industry, claiming that this fosters co-operation between government regulators and businesses subject to regulation. Instead of rigid statutory controls delineating exposure levels, "guidelines" have been established. In the United States, on the other hand, extensive public hearings are held by the Occupational Safety and Health Administration, which establishes legal standards (not guidelines) for occupational exposure to hazardous substances. The adopted standards are legally enforced and have lead to increasing litigation (Tataryn, L., 1979: 162-163). The Science Council of Canada (1977:45) assessing the two countries' approaches, concluded:

We have been impressed by the testimony of the individuals most affected by the major occupational hazards we have studied, to the effect that there is no reason why they should have any confidence in a system of "guidelines" or of "non-enforceable standards." It seems clear that for some major hazards, for example, asbestos, lead, vinyl chloride, and radiation, the level of exposure measured as precisely as possible with modern technology, must be controlled by enforceable regulations.
(c) In dealing with occupational health and environmental health, the Canadian Public Health Association, in a policy statement issued these words:

> Man's health and environment are inseparable... Therefore environmental health standards, which can be understood by the public, should be adopted on the scientific evidence, professional judgment and public health knowledge of the protection of human health... Health supervision at places of work should be linked with environmental agencies... (Watkinson, 1976:7).

The statement goes further. It says that human enterprises affect the environment, by the waste products of their processes, by the effects of the final products themselves and by the effects of the disposal of the products. Moreover, the information about the workplace environment which is gathered to protect the worker's health should be extended to protect the general public.

In a similar vein, Dr. Somers (1976:50) presents the concept that occupational health is part of the greater totality of environmental health. He notes:

> ...because of the intense exposure suffered occupationally, knowledge of environmental effects is best developed from occupational data.

Many other occupational health authorities (Chisholm, 1977; Dennis, 1976; Stopps, 1976; Karr, 1976;) view occupational health as an integral and inseparable part of environmental health which broadly includes interactions of the human environment and
health, injury and disease. For this reason, there is a great need for closer cooperation and integration of departments in dealing with the health of Canadians. As William Karr (1976:72), Secretary, Canadian Council on Occupational Medicine, puts it:

If the problem of occupational health in general and environmental hazards in particular are to be solved, we must work together, and take guidance from cohesive, coordinated, central sources, headed by properly trained people....

(2) The need for a national data base and research/information centre.

With the acceleration of technological changes in industry and the increasing complexities of the work and living environments, the Canadian workforce requires an instrument for quick exchange of information and documentation on a national and international level. As it is:

...no focal point exists in Canada for information collection or exchange. Data on health hazards, effects, and health states of workers are not adequately monitored nationally, and thus remain fragmented and incomplete. National standards for safety of the workplace do not exist, which leads to provincial variations and inequalities... (Chisholm, 1977a:189).

The two main areas for discussion in this section will be; (a) monitoring occupational disease and injury and (b) control of hazardous substances.
(a) Occupational disease and injury are costing the
Canadian government billions of dollars and incalculable cost in
human suffering to Canadian workers. Yet, Ison (1977:1), notes in
his paper, "The Dimension of Industrial Disease":

There does not exist any administrative structure
for ascertaining and recording the total incidence
of industrial disease (however defined). How far
disablement from industrial disease has been brought
under control is, therefore, not determinable...

Somers (1976:49) also says:

Our present statistical reporting systems and
workers' compensation are unable adequately to
present the effect of occupational diseases....

Without a uniform data base on which the extent of occupational
disease and injury can be assessed and or from which the
effectiveness of existing, or new programs can be measured,
occupational health and safety will be unable to move forward.

Unless there are figures to prove that a national problem
exists, neither industry nor government will give preventive
action the same priority as would be assigned to it if the
dimension of the problem were fully known. Then too, lack of usable
statistical data impedes the process of risk assessment for
both communities and individuals. It prevents them from making
informed decisions on what are acceptable risks:
Uncertainty about the dimensions of industrial disease can be an impediment to the rational making of individual choices as well as community decisions (Ison, 1977:35).

Chisholm (1977c:1) adds:

Scientific and technical knowledge should be gathered, disseminated and discussed, not only to monitor the trends of problems and successes, but to provide a sound basis for future action.

It is clear, then, that a national data base is essential to determine the extent of occupational disease and injury which answers all the questions of "what", "who", "where", "how much" and "why". This in turn facilitates decisions on priority and fund allocation. Finally, it is fundamental to program evaluation and program planning.

Mastromatteo (1976:15) suggests further that:

A good system of reporting and recording occupational diseases and linking existing health records to exposure to environmental agents on the job is needed.

In this connection, Dr. V. Cecilione (1976:60), in a keynote address to the Canadian Public Health Association at the first National Conference on Occupational Health, said that the medical profession should play a more active part in community health and provide more assistance to their patients who work in industry. He mentioned the possibility of occupational cancer and other diseases arising from the use or exposure to chemical compounds
or materials in the workplace - hence, the necessity for keeping complete records. These records should be made available to all employees and their family physicians, not only during their working years but after their retirement as well:

only in this way can many occupational diseases and cancer be studied more thoroughly and prevented in the future (Cecilione, 1976:60).

The Radiation Protection Bureau is carrying out a commendable service to Canadian workers dealing with radioactive substances by monitoring their exposure to radiation:

Occupational Radiation Hazards Division provides specialized dosimetry services to over 70,000 workers throughout Canada on a regular basis. This information is used by Provincial and Federal agencies in implementing regulatory control. Each worker's exposure history is maintained in a national records system which is used to obtain statistical information on health risks (Environmental Health Directorate, 1978:7).

(b) The increasing number of chemicals in widespread use on the Canadian scene today is a major concern to the general public, the workers and health professionals (Ison, 1977; Mastromatteo, 1976; Somers, 1976):

Although some 10,000 new chemicals are launched on the market each year, only a few can be fully investigated with our present time-consuming methods...New standards are needed for the thousands of known or potentially dangerous substances already in use in industry today...(Cecilioni, 1976:59-60).
However, to put this into perspective, other authorities claim that most of these chemicals are new formulations of those already on the market. Still, a sizable number are new compounds. In 1973 vinyl chloride, which had been in industrial use for over 30 years was found to produce a rare tumour of the liver. This episode has served to arouse national and international concern over the hidden health hazards of the workplace (Mastromatteo, 1976:9). However, the control of the vinyl chloride hazard illustrates the importance of a quick exchange of information at the national level:

In respect of vinyl chloride, information exchange between industry and academic scientists worked well, possibly because industry commissioned significant scientific research (Science Council of Canada. Report No. 28. 1977:22).

Several recent Canadian government reports and policy papers on health and safety, notably in Saskatchewan, Alberta, Ontario, Manitoba and Quebec have included in their recommendations, among other items:

...the expansion of research and testing facilities throughout the country in order to detect toxic substances in the atmosphere and to pre-test chemicals before they are introduced into industrial usage... (Rabinovitch, 1979:22).

It is interesting to note at this point that Sweden has national legislation which pre-screens chemicals before they are
permitted for use in industry. Furthermore, Sweden also passed a new law in 1974, which places the onus on each importer or distributor for every new product introduced, to ensure that it can be used without hazard to workers or to the environment (Cecilioni, 1976:59).

Proposals for registration and pre-screening of chemicals are being actively studied in the United States, by the European Economic Community, and in other countries (Mastromatteo, 1976:14).

The list of hazardous substances, including physical agents, materials and chemicals that threaten the worker in industry is long and growing longer each year. Thus, there is a need to set up a system of priorities for evaluating the health and environmental effects of chemicals for which there is no information. Dr. Mastromatteo (1976:14) feels:

Priority should be given to those chemicals which bear a structural similarity to those chemicals with known hazards. Priority should also be given to those chemicals which are in widespread use and to which many workers are exposed.

Of all the poisonous effects of hazardous substances in the occupational and general environments, carcinogenesis seems to be of most universal concern. The truth of the matter is the vast majority of industrial and commercial substances
are not carcinogenic. Lloyd Tataryn (1979:55) in his well documented book, "Dying for a Living", writes:

There is little doubt that many widely used industrial and commercial substances are carcinogenic. It is certainly true that many industry wastes can cause cancer and other diseases. But is it also true that most industrial processes, products and by-products are relatively harmless.

An article in Occupational Health Nursing (Rubenstein and Bellin, 1976:17) referring to the chronic effects of chemicals, mentions:

An advance has been made in evaluation of carcinogenesis: with only a few exceptions most carcinogens are bacterial mutagens. This is the basis for a relatively inexpensive pre-screening test for carcinogenicity....

Lloyd Tataryn (1979:155) adds:

...Indeed epidemiological surveys and animal experiments have already uncovered many of the materials which give birth to the dread disease.

Therefore it would appear that the use of bacterial cultures (Ames Test) alone or in combination with other measures may offer some hope as a prescreening method for carcinogenic and mutagenic substances (Mastromatteo, 1976:14). However, it would be prudent to avoid placing excessive reliance on this procedure because in many cases, chemicals that are bacterial mutagens have not been associated with cancer.
Preventive and control measures should be practiced on those materials found to be carcinogenic. Even though cancer-causing substances may be identifiable, it is not always easy to prohibit their industrial use without wide-spread economic and technical difficulties - for example, asbestos and vinyl chloride. The task, then, confronting governments, and public health officials is to enforce the strictest measures possible to prevent human exposure to them or to adequately protect workers who come in contact with them. Moreover:

The discovery of alternatives to occupational carcinogens is greatly to be encouraged and should permit the abandonment of the manufacture and use of these substances without economic hardship (Clayson, David, 1976:241).

This alternative method of control, the licencing and regulation of the manufacture and use of occupational carcinogens is supported by the International Labour Organization (I.L.O. June 24, 1974: NO.147).

...Nevertheless, in replacing these compounds, adequate experimental investigations must be carried out to ensure that one hazard is not replaced by another (Clayson, D., 1976:242).

In Sweden the occupational carcinogens are divided into three categories:

1. Those which are banned without specific authorization (outright).

2. Those which are permitted for use but subject to specific use prescriptions.
3. Those which are permitted for use with an assigned T.L.V.

(Mastromatteo, 1976:13).

Competent Canadian authorities must develop similar approaches to categorization and control of occupational carcinogens and vigorously pursue prevention as a national cancer policy.

Recognizing that grave problems do exist in the lack of and dissemination of information, the federal government, in 1978, established the Canadian Centre for Occupational Health and Safety. The serious gap in worker protection will hopefully be eliminated. The Honourable Monique Begin, in a keynote address to the Second International Congress of the World Education of Public Health Associations at Halifax in May, 1978 had this to say:

An immediate activity of the Centre will be the development of a national information system on the whole spectrum of occupational health and safety. The Centre will then begin by providing Canada and Canadians with a coordinated and integrated source that up to now has been lacking in this field. The Centre will attempt through information to promote healthy lifestyles for all workers and to prompt the individual's own responsibility in this area (Begin, M., August, 1978:272).

3.2.2 Conflicts

In dealing with the major issues in occupational health and safety, consideration must be given to the various conflicts that can occur. It is interesting to note the apparently similar
situation faced in the United States. Speaking of the difficulties encountered when the law is used as the predominant mechanism for the social control of science and technology, Ashford (1976:4-8) postulates:

...the law, and especially the Occupational Safety and Health Act, cannot be successfully implemented if we continue to ignore the fundamental conflicts and tensions which exist between various groups of people and between various institutions in our society.

He identifies at least four broad categories of conflicts that characterize health and safety in the workplace, namely:

(1) management-labour, (2) inadequate knowledge, (3) perceptual differences and (4) institutional divergence. It would be prudent to examine these conflict areas if progress is to be made in integrating programs and coordinating policy in Canada.

(1) The first type of conflict is the clashing of different self interests that is characteristic of management-labour relations. In unionized situations, the traditional adversarial climate creates overt conflict. This basic conflict of self interests stems from management's desire to keep costs down and to maintain control of the workplace versus the workers' desire to gain the largest package of wages and benefits, job security and control (Ashford, 1976:5). In connection with management-labour issues, developments in occupational health and safety in Canada closely
parallel events occurring south of the border. Nicholas Ashford (1976:30) speaking of the United States, says:

Historically, organized labour has not emphasized health and safety in collective bargaining for several reasons. Worker concern with inflation and economic problems has often pre-empted health and safety considerations.... Most importantly, the fear that jobs would be lost if strict safety and health standards were introduced, or if a worker filed a complaint with the state authorities, has often deterred workers or unions from raising this issue except in extremely serious situations. Further, it was not until 1966 that the National Labour Relations Board established the principle that health and safety issues are mandatory subjects for bargaining...

After a history of hard won rights for workers on the North American continent, it appears collective bargaining will continue to be the most effective way of arriving at settlements between labour and management. Among other important issues on the labour scene in Canada today, the right to work in a safe environment will increasingly focus on occupational health and safety measures.

The negotiating process in this connection has great potential. It enables different local and industry-wide needs to be met, particularly where hazards are extensive. As well, it moves the responsibility for occupational health and safety out of the sole hands of management and thus encourages the participation of workers in the process of controlling technology
in the workplace (Ashford, 1976:31). However, during a climate of change, conflicts will arise as the adversarial approach dies hard.

On the one hand, there will be some reluctance on the part of labour to completely trust management. In the past, workers have felt they were exploited for profit. And the "industrial-medical complex", referred to in another section, is still pervasive. The Science Council of Canada (1977:47-48) notes:

...Many people believe that the reason for this is that physicians are wholly employed by company management and that independent medical advice is therefore not available within the workplace.

The result of which, induces workers in major industries to seek medical opinion outside the plant, and often as not, outside Canada, in order to confirm their suspicions of occupational diseases (Tataryn, 1979).

The record of medical performance in Canada, in truth, has been less than distinguished. Dr. David Bates, addressing the Canadian Medical Association convention in June of 1977, referring specifically to the hazards Canadians have experienced as a result of exposure to asbestos, radiation, lead and mercury, said:

...There has been a "major deficiency" in the role played by the medical profession in the field of occupational health.
The belief by some is that much of this situation can be laid at the door of the exploitative capitalist system. Navarro (1976:446) says that state intervention replicates, the ideology of medicine which complements rather than conflicts, with the ideology of capitalism. In his view, the state sees the "fault" of disease as lying with the individual and absolves the economic and political environment from responsibility for disease.

Occupational health nurses, as salaried medical personnel are also suspect, as evidenced by a suit launched against Pacific Press Limited in March 1977, in Vancouver over visits by nurses to sick employees:

The Guild threatened earlier this week to lay criminal charges if Pacific Press, which publishes the Province and the Sun, did not stop sending nurses out to visit ill employees, a practice the Guild claimed amounted to harassment... (The Province, Vancouver, 18 March, 1977:10).

The negative attitudes by labour, built up over the years, have contributed to the poor relationship that now exists between labour and management.

On the other hand, management personnel who have long been responsible for making decisions in all aspects of the workplace will feel threatened that occupational health and safety needs are no longer its prerogative. The process of relinquishing part of this status may even be painful. Clive Dennis, former
head of the health and safety program in Saskatchewan is critical of the way professionals have been relegated to the sidelines. He feels that one important side effect of an occupational health program oriented towards the promotion of worker power is:

...that professionals employed in the workplace... promoting health and safety are automatically crucified as stooges of management for the purpose of exploiting the workers, be they physician, nurse, safety director, first-aid worker, occupational hygienist, safety engineer, or rehabilitation counsellor (Dennis, 1976:62).

It is clear that an atmosphere of mutual trust and consideration must be encouraged. As long as the bases for conflicts are recognized they should be acknowledged and dealt with. The positive potential for conflict in strengthening decisions and improving relations may be a concept worth studying.

The major occupational health and safety laws enacted in Canada by provincial governments since 1975 have laid the emphasis on prevention, without diminishing the traditional commitment to compensating victims of industrial accidents and disease. With this added stress on the need for better prevention, management and labour now argue about the nature of safe and healthful work conditions:

These new conflicts thus center around issues that, if resolved, are more likely to improve workers' health and safety (and productivity in the long run) than the resolution of conflicts over who will pay for the harm (Ashford, 1976:5).
The Saskatchewan Occupational Health Act of 1972 (substantially revised in 1977) has been of prime importance in terms of originality and innovation (Rabinovitch, 1979:22). Bob Sass, director of the Saskatchewan government's Health and Safety Service, Labour Department, acknowledges that the law and the way it is administered clearly favours workers. The keystone of the Saskatchewan program comprises the employer-employee safety committees which are established in all companies with 10 or more workers regardless of union or non-union shops. These committees have access to all information gathered by government inspectors and have the power to investigate conditions in a given plant or office. Another key in the Act is the worker's right to refuse unsafe or unhealthy work. The Act is one of the most far-reaching health and safety legislations in the country, and other provinces, namely, Newfoundland and Ontario have patterned their occupational health laws after it (Financial Times, 15 October, 1979:14).

The 1975 Alberta Industrial Health and Safety Commission views occupational safety and health concerns as being the joint responsibility of labour, management and government. It is attempting to eliminate the "adversary" method of handling these concerns with the development of tri-partite involvement whenever and wherever possible (Stopps, J., 1976:66).

The implementation of these Canadian Acts is slowly serving to raise the consciousness of both management and labour.
Moreover, it is requiring a high degree of worker-employer co-operation to identify, control and reduce hazards to the health and safety of workers. In addition, the terms of reference in these Acts which accept the workers assuming more responsibility for decisions made about his or her own protection is pointing to the need for long range policy planning whereby the welfare of the worker has equal priority with that exercised by management.

With the assumption that collective bargaining will continue to be the foundation of the Canadian industrial relations system, it can be expected that occupational health and safety concerns will be constantly redefined as workers become more active on environmental issues.

Finally, in as much as collective bargaining provides the mechanism for change in attitude and behaviour, indirect benefits may accrue to unorganized workers and small firms:

National policy must ultimately address their problems and provide them with information, educational services, legal aid, and technical assistance that they both badly need (Ashford, 1976:31).

(2) The second type of conflict is that which is caused by lack of knowledge.

(i) In the case of cancer-causing substances in the workplace, for example, there is continuing debate over "safe levels" or "zero thresholds" regarding exposure. Although some carcinogens are now identifiable, is there a permissible safe level, would be
the significant question.

It should be noted, at this point, that carcinogens stop damaging cells when exposure is ended. The problem remains that the already damaged cells give trouble. Carcinogens in large doses can kill human cells much like poisons, but in smaller doses they cause cells to mutate. It is realized now that cancerous growths can appear years after a person has been exposed to an initial sub-poisonous contact by a cancer-causing agent. But what is that minimum amount? And to what degree are individuals susceptible? The zero threshold advocates find, under scrutiny, that it is not practical as only 20 percent of the population gets cancer. Moreover, establishing a threshold - a lower limit of exposure that is not dangerous - is nigh on impossible. To quote Dr. Ronald Glasser (1976:113-14):

...over fifty years of continuing experimentation has proven that the amount of carcinogen necessary to produce cancer can be minute and still be deadly... that it is scientifically possible that a molecule of a carcinogen getting into a cell could damage any DNA molecule (the part of every cell which determines what we are) enough to change it, to cause the cell to lose control and become malignant...

Complicating the threshold approach, is that thresholds are usually established as though the substance in question is the only cancer-causing agent a person ever encounters. The U.S. Department of Health, Education and Welfare publication on "Chemical Carcinogenesis" speaks to this point:
We have currently no established scientific method to determine threshold levels for chemical carcinogens... in the industrial environment, workers may be exposed to multiple carcinogenic agents which may compete for the same target site.

It states further:

Multiple exposures can occur on the job, in the diet, and in the ambient and home environments. Under these circumstances, some people may have already received doses from multiple exposures in excess of any presumed threshold for any single carcinogenic chemical. Consequently, any incremental increased exposure to chemical carcinogens could then result in an increased risk of cancer....(Bridbord et al, 1977:181).

Because of the risks involved in dealing with carcinogens, which may not be entirely eliminated in an industrial society, it has been suggested that the concept of "safe" levels be replaced by that of "socially acceptable level of risk". This, however, raises the question, acceptable to whom (Tataryn, 1979: 179)? Obviously, there are many unanswered questions. Nevertheless, in the meantime, some action is imperative:

As the debate over threshold levels indicate, the regulation of industrial health hazards remains essentially a social, economic and political question, rather than a scientific one. At issue is the price tag to be placed on a human life (Tataryn, 1979:181)

The United States federal health agencies have adopted the approach that there is no threshold to carcinogenic exposures (Tataryn 1979:178). The Canadian occupational and environmental regulatory agencies have as yet developed no consistent policy on thresholds to chemical carcinogens.
The reason for the different stances is, in part, political. The Canadian governmental system allows for more discussion among agencies, while its U.S. counterpart does not. The outcomes, therefore, are either; the risk of some dangerous practices, or perhaps unwarranted heavy state expenditures. Which is the worse of the two evils?

(ii) Another example of lack of knowledge or insufficient research that causes conflicts is the subject of nuclear safety.

In Canada, the Science Council reporting on "Policies and Poisons" (1977:21), warns of the hazards of low-level radiation:

- Radiation exposure at low levels may produce lung tumours histologically identical to those that are not a consequence of radiation exposure.
- The present radiation doses from diagnostic medical x-rays constitute a major source of population exposure and one that is poorly controlled.

Some scientists disclaim that there is any risk from low-level radiation. They point to studies of sizeable populations with control groups, which revealed no significant difference.

Many scientists say that today we still do not know what level of radiation is dangerous and many believe we will never know. The effects of longterm exposure to low levels of radiation are far more difficult to document than exposure to high levels (studies on survivors of Hiroshima and Nagasaki bombings).

Since human experiments with low level radiation are unethical, reliance must needs be placed on animal experiments and other available data of human exposure. There are further problems, such
as the absence of symptomology at low level exposure, and a long developmental period for cancer: Added to this, researchers must have precise information on the amount of radiation received by the population studied, in order to determine a relationship between radiation and disease.

Here again, how much radiation is socially acceptable? The fact remains, the best available knowledge on radiation protection should be used. At the same time, the benefits of the nuclear age must also be recognized. Nuclear radiation can detect pollution, cure cancer and diagnose illness with precision.

The Science Council of Canada (Policies and Poisons, 1977:21) states:

- The risk of injury from ionizing radiation was recognized shortly after its discovery in 1895. A continued growing awareness of radiation hazard and its association with cancers, leukemia and genetic changes resulted in the creation of the International Committee on Radiological Protection (ICRP)....
- Since the 1940's the ICRP has issued guidelines on the "maximum permissible" radiation exposure to the body.... Most countries have adopted standards at least as stringent as those proposed by the ICRP....

Conflicting viewpoints continue to be aired in the nation's dailies and periodicals as the forces of health battle with the forces of economics.

In the field of radiation research, progress has been substantial. However, there is obviously much more to learn.
(iii) Still another example of inadequate knowledge causing conflicts can be seen in the area of possible work-related conditions such as heart disease. This is the leading cause of death in the United States and Canada. Executives and workers alike are affected. It has been general knowledge in recent years, that the incidence of heart disease has risen in blue collar workers, in tandem with their wages increasing and physical work declining. Nonetheless, there has been very little research on this condition linking it to the work environment. A report by the U.S. Health, Education and Welfare Department, entitled, "Work in America" (1973:79) says:

research findings suggest that diet, exercise, medical care, and genetic inheritance, may account for only 25% of the risk factors in heart disease... Although research on this problem has not led to conclusive answers, it appears that the work role, work conditions and other social factors may contribute heavily to this "unexplained" 75% of risk factors.

Efforts to have heart disease recognized as a work-related compensable disease would obviously fail, because they would conflict with policies which are more safety oriented than disease oriented. However, if there were more data demonstrating to what extent heart disease is caused directly by the work environment, the outcomes may be different (Ashford, 1976:42).

Pomerleau et al (1975:3), in The New England Journal of Medicine, regarding causes of the major diseases in Canada, state:
An analysis of the principle causes of morbidity and mortality, revealed that environmental factors and lifestyle contributed so greatly as to constitute the key to effective control.

As programs in occupational health and safety become more integrated and comprehensive, the question of coronary-artery disease will need to be addressed.

(3) The third type of conflict occurs when there are differences in perception which cause real problems in policy development. For instance, the proverbial argument over whether to permit use of a certain substance until proven harmful, or prohibit use until proven safe, can pose great difficulties. What is just and fair? Either course involves costs and risks to someone.

In another instance, the question of policy-making with regard to the general environment as compared to the work environment is complicated by the differences in the degree and selectivity of the risk posed. A case in point, certain chemical pesticides used in diluted form may present low risks to the general population and confer important benefits, but they can create severe risks to workers handling the material. There would be strong assertions that these situations are not equitable (Ashford, 1976:6-7):

whether it is fair for the lives of selected employees to be sacrificed for the betterment of society and whether employees can rationally assume the risk of hazardous employment are questions that need to be addressed (Ashford, 1976:43).
A final instance where honest men can differ is in how much control a government should exercise in protecting its citizens. Here the question of "guidelines" versus "regulations", illustrates the point. Some occupational and safety experts, like Dr. Victor Rabinovitch, director of health and safety at the Canadian Labour Congress Centre for Labour Education and Studies, feels strongly that government must enforce the rules of behaviour at the workplace (Davies, Financial Times, 15 October, 1979:14). In agreement with strict government enforcement, Ken Valentine, safety director for the Canadian district of the United Steelworkers of America says:

Unless occupational safety and health codes and legislation are policed and enforced, they will have little effect on workplace safety and health (Davies, G., Financial Times, 15 October, 1979:14).

However, other experts are inclined to disagree. James McLellan, director, occupational health and safety, Federal Department of Labour, doesn't believe health and safety regulations should be enforced. Likewise, Jim McNair, director of occupational health and safety, industrial branch, province of Ontario, does not see his main function as a policeman (Davies, G., Financial Times, 15 October, 1979:14). Dr. G.J. Stopps (1976:66) associate professor, Division of Community Medicine, University of Toronto, with an extensive background of environmental effects on workers, quotes the Alberta Industrial Health and Safety Commission as saying:
We feel there are real limits to which improved occupational safety and health conditions can be brought about through the regulatory efforts of government. If the system is to be effective it has to be largely self-regulating.

It would appear that a successful self-regulating system must need to depend upon two factors. The first, from management's point of view; legislation in the field of occupational health and safety must be clear, reasonable and enforceable (Stopps, G.J., 1976:66). The second, from the worker's point of view; to effect attitude and behaviour change, information, explanation, participation and necessary role models must be offered. Added to these two factors it is essential that both employer and employee are beholden to assume personal responsibility and accountability.

From all accounts, it seems the recently enacted provincial occupational health and safety acts in Canada are promoting fundamental changes in the workplace atmosphere, in an attempt to reduce injuries and illness in the working population. Acknowledging how these changes take place, is crucial to their implementation. Chin and Benne (1976:23) outline three approaches that are commonly used:

(1) Empirical - rational strategies, in which rational self interest is the operative element. Change is promoted when some group or person can demonstrate to others that the proposed action will result in gain for those affected by the change.

(2) Normative - re-educative strategies, where in order for change to take place, people have to change their old values and adopt new ones.
(3) Power-coercive strategies, which use economic and political power in order to achieve goals that are viewed as desirable by the change agents.

In the past, governments, administrators and the health care system have leaned heavily on the empirical-rational and power-coercive strategies. A judicious use of the three strategies will likely continue to be used. However, if employees are to assume some responsibility for their own safety, change will need to take place within the framework of the normative-re-educative strategy, emphasizing the inherent dignity and intelligence of the individual:

The use of the normative-re-educative framework for change requires a philosophical stance which recognizes the consumer (worker) as an individual with a store of untapped personal resources at his disposal (Green, G., 1978:16).

Therefore, it would seem in a democratic country, other alternatives to too much government control are feasible. Perhaps in the final analysis, workers would find a government that enforces workplace conduct according to the strict letter of the law, just as unpalatable as an all powerful management doing the same.

(4) The fourth type of conflict deals with the lack of coordination among institutions and agencies within the whole spectrum of occupational health and safety. For example, the type of conflict that arises when public and plant environmentalists work in isolation, has been discussed in the previous section, under "differences in perception". Cleaning up the factory may result in polluting the general environment, and conversely, containing the pollution may mean increased pollution within the
Joint problem-solving or improved communication between agencies, if not amalgamation, could, perhaps, avoid the inevitable conflicts.

Within the medical profession, itself, often different languages are spoken:

In fact, many professionals concerned with medical care delivery systems will define preventive medicine as merely early detection of disease, rather than an elimination of those hazards that can ultimately cause disease (Ashford, 1976:7-8).

The distinction is vitally important, especially with diseases such as cancer whose progress is difficult to reverse (Ashford, 1976:8). Preventive medicine needs to be more fully understood and pursued. The Canadian Medical Association realizes that occupational health services are designed and implemented to maintain or improve the total health of employees, so that each individual can function as a self-respecting, productive person throughout his working career. Further, in its booklet, "Guiding Principles for the Provision of Occupational Health Services", it states:

...As one aspect of the overall preventive or public health program in the community, it is important that occupational health professionals consider each worker not just in respect to his working environment but, also in relation to his home and community (Canadian Medical Association, no date:1).

The ethics of occupational medicine decree that it does not encroach on the field of private medicine. The work of the occupational health physician supplements that of the family
physician who is ultimately responsible for the employee's treatment. As well, occupational medicine must be practiced in accordance with existing local, provincial and federal legislation, such as the Workers' Compensation and Public Health Acts (Canadian Medical Association, no date: 2). Thus it seems that in an atmosphere of cooperation and collaboration, with each segment respecting the others' specialties, conflicts can be reduced to a minimum between the treatment establishment and the preventive field.

3.2.3. Related Problems

Most of the problems related to occupational health and safety issues have already been mentioned. However, there are a few that need to be addressed more fully, namely; economic considerations, manpower implications and the Workmen's (Workers') Compensation in Canada.

(1) Economic Considerations

It has been observed that occupational disease and injury are considered part of the total human and social costs of production:

...As such, the level of workplace-related injury and disease is influenced by the economic forces that come to bear on firms and their employees (Ashford, 1976:18).

On the one hand, companies need to produce an adequate rate of return in order to remain economically viable, hence are under great pressure to keep costs down in order to be competitive in
the market place. On the other hand, the many ways of reducing costs may increase workplace hazards for the employees. Rabinovitch (1979:23) says:

Employers have a legal duty to provide safe and healthy workplaces. In practice, the immediate pressures of production targets and cost reduction efforts during an economic squeeze generally take precedence over health and safety protection.

If employers were required to include health and safety in their total costs of production, it might motivate them to make improvements in the workplace. This approach advocated by some, suggests that public policy should be geared toward intervention in the market system to make it function in such a way that all prices reflect true social costs and all "externalities" are "internalized" (Ashford, 1976:18).

It is often the case, however, safe conditions are more expensive to achieve for smaller firms than for larger ones. Typically, the larger companies have the advantages of attracting better management, longer time span for evaluating investment in good safety equipment and practices and better access to information and expertise. As it happens, many of the most profitable firms are also the safest (Ashford, 1976:20). In an article in the Financial Times, entitled, "Safety First at Dupont," Graham Davies, (1979:4), writes:

Dupont of Canada has one of the best industrial safety records in North America. Last year, only two of its workers of 5,400 suffered lost-time injuries at the chemical company's 22 plants, warehouses and offices - the same as in 1977.
He quotes management as saying:

We are charged with giving safety a priority at least equal that of production, quality of products, cash flow and cost....

Davies in praising Du Pont, also notes:

Du Pont is one of the few companies that have shown that individual corporations can reduce workplace accidents to a minimum without government regulation and interference....

By the same token, it is possible for the smaller or marginal operations to provide safe workplaces and still stay in business. They can offset the economies of scale and high priced managers by other methods to promote health and safety in the work environment. Safe operations are usually well managed operations. And good management promotes safe conditions by ranking job safety as top priority along with other vital company activities. Good management also fosters a close employer-employee relationship, with each individual responsible for safety of equipment and procedure. As Ashford (1976:20) puts it:

...in many cases, the workplace can be made safer and healthier by education and management - labour co-operation, with little capital expenditure for new equipment or expensive substitute material. In such cases, the size or marginal nature of the firm need not be a reason for ignoring workplace hazards.

Will companies make job safety a top priority, or will they leave provincial governments no choice but to increase its involvement with the accompanying costs and decreased freedom of action (Davies, G., 1979:4)?
Manpower Implications

The manpower problem with all its ramifications is far too extensive as a subject to do it justice in an overview of occupational health and safety in Canada. An indepth study is essential in understanding the total manpower needs for developing a coordinated national policy.

Roll Call 75 (1975:18), a University of British Columbia publication, stated that the Federal/Provincial Health Manpower Committee had established fields which require attention and study in 1975. Of the five most urgent concerns in Canada, it listed occupational health as third priority after dental health and mental health. Roll Call suggested further research into the fields and realities of occupational manpower, in order to rationalize the production and the distribution of health workers which can be translated into policy for future programs.

To highlight some of the main concerns, this topic will be examined under three headings; current shortage, types of manpower required and training facilities.

(a) Current shortage

With the focus now on prevention in health care and concern about the health hazards in the workplace and general environment, demand for trained personnel to work in the occupational health and safety fields has increased. Dr. G.J. Stopps (1976:67) says:
...with the passing of the Occupational Safety and Health Act in the United States in 1970 a huge demand has been created for occupational health professionals in that country. Canada is having to compete against this demand with totally inadequate resources.

Other Canadian authorities, such as Dr. Mastromatteo (1976:15) realize the need for qualified personnel:

Education and training of the professional specialists, technicians, and others needed in the occupational safety and health field will be required to provide the skills and resources needed. Undergraduate and post graduate training of physicians in occupational health should be stressed. The integration of occupational and environmental health topics throughout other undergraduate teaching programs is also needed.

The chronic shortage of qualified personnel has become apparent in the last decade as interest mounted in occupational health and safety concerns. Possible reasons for this dearth of occupational health workers are given by David Chisholm (1977b:2):

1. Lack of clarity about the field itself and bonafide role of professionals and technicians in it; and
2. "Market mechanism" re-supply and demand.

He further postulates that the supply portion of the equation has received insufficient attention and support, largely due to a weak demand for well trained personnel.

The manpower dilemma can best be illustrated by a simple figure i.e. Need Availability. If there is a need which cannot be met by available manpower, the need tends to be
by-passed. If there is manpower but no need, a need is often created. At the present time, there is a need but not much demand.

Besides the aforementioned reasons, a third may be added, the disinclination of professionals to enter the field because; not only are roles not clearly defined but there is lack of recognition and support from their peers, especially in medicine and nursing; and the antagonism from labour as seen in the "medical-industrial complex."

In order to develop a manpower planning policy, it is necessary to analyze the needed expertise in each area to project the numbers required. This is a difficult task, however. As pointed out by Dr. Chisholm (1977b:2):

(a) no classification scheme exists as to what are professional and technical disciplines involved in this field (primary and secondary).

(b) No national survey or inventory exists for all disciplines, nor for any single discipline.

(c) No estimations of future requirements have been undertaken for all disciplines, although very rough estimates have been projected for a few.

Until the serious shortage of manpower is recognized in the market-place and by governments, there will be insufficient resources for training the people required to do what needs to be done.

(b) **Types of manpower required**

The types of manpower required can be viewed from the aspect of role prescriptions, basically to supply the three broad
fronts of governments, management and labour. Nicholas Ashford (1976:22-25), in his study for the Ford Foundation, "Crisis in the Workplace", found at least four categories of health workers should be considered:

1. Enforcement personnel which includes health and safety inspectors.

2. Qualified researchers including chemists, physicians, environmental physiologists, epidemiologists, toxicologists, industrial hygienists, and engineers are required to identify potential occupational health and safety hazards, to assess their effects and to determine the requirements for assuring a safe and healthful working environment.

3. Personnel who provide health and environmental services are needed to aid in developing and implementing techniques, methods and programs for the prevention and treatment of occupational disease and injury. This group includes: occupational physicians, industrial nurses, safety professionals, industrial hygienists, and technicians, as well as executives and managers in business, labour unions, and governments.

4. Personnel are needed to teach the skills necessary for performing the tasks within each of the above mentioned groups.

One of the least studied categories of health manpower in Canada is the health administrator. While progressive changes
have evolved from the hostile administrative climate of the "dual-line-of-authority" era (Smith, H., 1955), the upgrading of health administrators has lagged far behind the modern concept of health care. As Hastings, J.E.F. (1976:1) states:

At this time, however, there is considerable evidence emerging in the form of government statements, actions and commissioned reports, that changes are taking place in the health care field now and during the next decade, that will both affect the health administrator and be affected by his/her performance in the profession. In general, these changes fall into three broad categories: (1) the structure of the health care field; (2) the philosophy of health care provision; and (3) changes due to increased technology. Changes such as these suggest that health administrators will increasingly be concerned with a range of new problems and issues rather different from those of the present and recent past. Irrespective of the specific nature, extent and direction of such changes, the role and knowledge and skill requirements of health administrators (and in all probability their numbers and deployments as well) will be influenced.

Many health administrators are doing an admirable job in spite of fiscal constraints and cutbacks in services offered the public. But many others need to upgrade their basic managerial skills and be more informed about prevention in health care - especially in relation to occupational health and safety.

An interesting study was done in British Columbia (Mackenzie, S., 1977:2) in which she noted the changing character of occupational health manpower personnel. She states:

Environmental hazards have three effects on man; biological, psychological and physical. In the past, the worker, management, health providers
and legislation have focused on the physical effects of environmental hazards, then safety personnel emerged, compensation acts expanded and safety committees became established in industry. Now the emerging emphasis of occupational strategies in the 1970's is on the biological effects of environmental hazards. This has resulted in changes of manpower categories of occupational health workers. These changes are:

1. The emerging new categories; eg: audiometrician.
2. Developmental changes of established categories; eg: nurses and physicians.
3. Increased emphasis of categories; e.g. industrial hygienist, psychologist.

More recently, a study on occupational vision care (Schmidt, B., 1978:66) emphasized the fact that eye safety is an important component of health and safety programming, and encouraged optometrists as primary providers of vision care to take more initiative to become involved in occupational health activities both in government and industry.

As occupational health and safety programs become more integrated and comprehensive, the psycho-social environment of the working population should be considered. Close cooperation with other specialists such as social workers, sociologists, behavioural scientists, physical fitness experts, may be necessary, as the "team" concept develops.
(c) Training facilities

There are very few post-graduate training programs for occupational health and safety manpower in Canada at the college level. Consequently, there is a continuing reliance on courses either in the United States or the United Kingdom. In a Discussion Paper on "Professional and Technical Personnel Resources for Occupational Health and Safety in Canada," David Chisholm (1977b:4) states that the University of Toronto, and Humber, Algonquin and Grant MacEwan Colleges do have training programs for these disciplines. He said several more are being proposed, developed or expanded at the following universities; McMaster, Toronto, British Columbia, Laval, Montreal, and McGill, and several community colleges. However he says:

(a) There is little collaboration among these institutions.
(b) Curricular guidelines are being developed independently and hence are highly variable even within the same disciplines.
(c) Disciplines created have no common standards, titles, etc. between provinces as well as within provinces.
(d) No agency is maintaining an on-going inventory of training institutions, programs, certificates/diplomas/degrees offered, curricula, future plans....(Chisholm,D., 1977b:4).

During the 1970's there have been a number of attempts by the Medical Association, the Nursing Association, the Canadian Public
Health Association, Science Council of Canada, other organizations and interested individuals to stimulate interest in training in the general discipline of occupational health (Chisholm, D., 1977b: 5-6).

(3) Workmen's (Workers') Compensation in Canada

A comprehensive coverage of "Workers' Compensation in Canada" is not possible within the scope of this paper, but the author would be remiss if some reference is not made to the principles underlying the system, and to the legislative jurisdictions.

The Canadian workers' compensation system is based on two main principles: collective liability on the part of employers and compulsory insurance in a state fund, known as the Accident Fund. It is, in effect, a mutual insurance scheme in which the employers in a class of industry are jointly or collectively liable for the cost of all accidents occurring in that class.

In each province, coverage is compulsory for all employment within the scope of the law. Neither the employee nor the government makes any contribution to the Accident Fund. The costs of compensation are regarded by employers as a direct cost of production and passed on to the consumer. The workers' compensation system is an example of an attempt to "internalize" cost - but after the harm has been done.

A significant feature of the Canadian workers' compensation system is that each law is administered by a virtually autonomous
board, with full and final authority to determine all matters arising in the administration of the Act. However, in British Columbia a worker whose claim has been rejected by the claims department of the Board, may appeal the decision to a Board of Review.

Accident prevention is an integral part of the Workers' Compensation system of all Canadian provinces, though the responsibilities may be assumed by the Board, or in some instances, employers' associations. Regulations governing safety committees vary from province to province.

In the provinces where the Board has direct responsibility for accident prevention, (Alberta, British Columbia, Newfoundland, Prince Edward Island and Saskatchewan) it has wide statutory powers. It is empowered to make and enforce regulations, to require the installation of necessary safety devices, to carry out an extensive educational program and to take other measures to protect the workforce against injury in the course of its employment (Workers' Compensation in Canada, 1969).

There are some problems in the system that are gradually being worked out. The safety aspect is excellent, but as yet the system does not adequately deal with occupational problems such as chronic conditions and environmental hazards. Ashford (1976:19) comments:

Workers' compensation, in paying for treatment, rehabilitation, or harm, is probably not nearly as cost-effective as prevention. However, since prevention costs must be faced immediately, whereas treatment and compensation costs may be deferred -
or even avoided entirely - the higher dollar costs of delayed action may be discounted to a relatively lower present value than prevention costs.

Further problems are surfacing as unions become more vocal in their demands for the workers' health and safety. For example, the B.C. Workers' Compensation Board commissioners came under attack, recently at the International Wood Workers of America Convention in Vancouver, B.C., as reported by Peter Comparelli (Vancouver Sun, 12 September, 1979: A11). They were accused of meddling with decisions made by Workers' Compensation Board boards of review. Apparently other unions have previously made similar public statements condemning Workers' Compensation Board Commissioners for overturning successful union appeals granted by boards of review.

Among the resolutions passed at this convention criticizing WCB policies, the following are indicative of labour's growing concern for their own health and welfare, such as:

1. An increase in WCB assessments against employers to counteract a "fierce cutback in coverage for injured workers."

2. That the board increase its inspections of unsafe working conditions and impose harsher penalties against employers for industrial health and safety infractions.

3. A change in WCB regulations to enable training of safety committees.

4. Full access to all WCB files by claimants or the union.

5. That a WCB representative look at a job with an injured employee instead of rejecting his or her claim on the basis of management's description.
6. Changes to WCB legislation to guarantee that time loss benefits continue until the injured worker is fully retrained or back working at the same or better wages.

One important resolution concerning health rather than safety was also passed. This was for specific regulations covering dust control and air quality for cedar and plywood mills.

On the other hand, Workers' Compensation Board has had occasion to implicate both management and union members in industrial fatalities. A case in point, as reported by Keith McQuiggan in the Trail Times (29 November, 1978:3) was negligence of both Cominco and Local 480 leading to the deaths of three young men.

It appears then, that the Workers' Compensation system together with labour ought to cooperate in good faith, moving away from the "adversarial" atmosphere to a truly "clinical" approach. This would necessitate employers putting workers' health before products, and workers assuming more responsibility for their own health and for the health of their fellow workers.

Workers' Compensation Board of B.C.

The British Columbia Workers' Compensation Act was formulated in 1916 and came into effect on January 1, 1917. Under this act, the Board is the sole judge of all questions of law and fact which arise out of the Act (Berry, J.P. lecture, no date: 1-9).
The Board basically has 3 functions, to provide:

(a) a program of compensation for disability,
(b) a program for income maintenance and the protection of economic loss due to disability,
(c) rehabilitation programs aimed at restoring the disabled to optimum levels of functioning.

The B.C. Workers' Compensation Board is one of the largest on the continent and has 1,000 patients (W.C.B. Interviews, Nov. 1976). It has divisions concerned with accident prevention; industrial hygiene, safety research and training; medical care to employees; rehabilitation clinics; claims and claims processing; organizations to inspect and advise on methods of improving working conditions.

Writing in the Labour Gazette, Ralph M. Wirls (September 1977:407), former editor of the Oregon Workers' Compensation Board Magazine said that B.C.'s Workers' Compensation Board has been accepted for most of the province's industrial history as the proper authority over the physical well-being of its workers, and:

British Columbia's occupational safety and health program contains many advances U.S. and other Canadian agencies would do well to study...
3.3 DESIGN OF POLICY

The Canadian experience clearly demonstrates that occupational health and safety problems are not only diverse but inordinately complex. Therefore, it is unlikely that solutions will evolve from simplistic strategies based on single approaches. The foregoing pages dealt at length with the many issues, conflicts and problems of occupational health and safety. It appears that legislation and enforcement will not suffice: neither will research alone, to generate knowledge and determine standards. On the other hand, self-regulation has its critics, and would probably create more problems than it would solve.

Ashford (1976:34) suggests four sets of policy instruments:

1. The law.
3. The generation, dissemination and utilization of knowledge.
4. The development of personnel in the various professions, in the labour unions, in management, and in government with the requisite knowledge of the issues.

In summation; even while these instruments are aggressively developed and pursued, they also will not be sufficient without the active involvement of both employers and employees. Workers must assume a greater role in monitoring the quality of their own work environment as well as checking on management's responsibilities. This does not mean, however, that employers can relinquish any of their
responsibility, as there are circumstances which are beyond the control of the workers.

The issues that arise, whether they be safety or health hazards, worker dissatisfaction or production delays, supervision and training methods or ergonomic factors, they can all be addressed in the daily interaction of informed and concerned employees and employers. The placing of a higher priority on job environment issues in the collective bargaining process would go a long way towards resolving problems. The focus of occupational health must be prevention, and the goal should be optimum physical, mental and social well-being of the worker. The goal is the essence of policy.
4.1. INTRODUCTION

Following in the wake of the scientific and technological revolution—a continuation of the industrial revolution—many new hazards were created and are still being created. The existence of these are of grave concern to individuals and communities, at work, in homes, in transportation and recreation. Moreover, the real tragedy appears to be the needlessness of a great many of the hazards which lead to the accidents that plague the public. Gabor (1970:9), in his book "Innovations", expresses this sentiment succinctly:

The most important and urgent problems of technology today are no longer the satisfactions of primary needs or archetypal wishes, but the reparation of the evils and damages wrought by the technology or yesterday.

For more than half of their lives, the people of the United States and many other Western countries are more likely to die from accidents than from any other cause (Haddon et al, 1964:2). Accidents, as a cause of death, on a global scale are now out-ranked only by cancer and cardiovascular disease (Candau, 1961). Thus:

It seems essential, therefore, that as much attention be directed towards the prevention of accidental death and injury as is devoted to the control of infections and degenerative diseases (McFarland 1964).
Nevertheless, it is wise to view accidents as a cause of death with some sort of perspective. It is suggested that accident mortality, at least in the Western countries, has "risen" by virtue of remaining unchanged while dramatic reductions have occurred in the incidence of fatal diseases of mankind. With improved sanitation, pasteurization of milk and other environmental controls, antibiotics, vaccines, advances in surgery, and a general rise in standards of living and medical care, mortality from other causes have markedly declined (Haddon et al, 1964:2; Hale and Hale, 1972:18).

However:

Accident fatalities taken as a whole have shown no such decrease. Changes in culture and technology change the incidence of specific kinds of accidents (railroad fatalities decrease and motor vehicle fatalities increase), but the substantially unchanging over-all totals tend to lend credibility to the widespread popular belief that, accidents, like the poor, we shall always have with us (Haddon et al, 1964:2).

Dr. Mastromatteo (1976:11) warns:

There is need, however, for a fresh approach in accident prevention because occupational accidents in general have levelled off and the trend seems to show increasing accidents in some industrial sectors.

Due to the fact that accidents occur in all walks of life, it has become a subject of interest to a number of disciplines including psychology, sociology, ergonomics, engineering, design, statistics, medicine, industrial hygiene, safety, etcetera. As a consequence, many different aspects of accidents have been studied and various methods of study have been employed. A search of the
literature confirms the multiplicity of possible approaches to the subject (Haddon et al, 1964: Hale and Hale, 1972). The awesome task facing the researcher has been aptly described:

> Accident research is highly heterogeneous in content and emphasis. It ranges from intensive studies of the role of specific variables to broad scale investigations of accident incidence. There are many types of accidents, and many factors, often inter-related, that may be significant. This complexity is soon apparent to those approaching the subject for the first time, and it remains a source of concern to established investigators (Haddon et al, 1964:14).

Bearing in mind the complexity of the field and the multiplicity of methodology, a researcher also needs to guard against overemphasizing the importance of some variables, to quote:

> Each one naturally tends to look at accidents from his own point of view and to concentrate on those variables and those methods of study which are familiar to him (Hale and Hale, 1972:9).

Notwithstanding the pitfalls and problems encountered in accident research, it is possible to extract some general concepts which have been proven useful in the recent past, and to apply them towards a balanced approach to the study of accident prevention.

### 4.2. SOME OBSTACLES TO ACCIDENT RESEARCH

In viewing some areas for an explanation of the difficulties encountered in accident research, a few factors can be
isolated that may have contributed to this situation. It seems the way in which accidents are perceived by contemporary society has had a great bearing on the lack of sophistication in this field.

4.2.1. Myths

Well established myths on the causes of accidents and prevention methods are still propagated in many quarters. Various publications and articles on safety blame human carelessness as the major cause of safety problems. To counter this, Rabinovitch (1979:22) states:

In fact, many reputable studies have demonstrated conclusively that "carelessness" is a minimal factor.

Other myths, in occupational settings, tend to present the picture of worker ignorance and "bad worker attitudes" as requiring counter-measures in the form of strict management controls and simplistic educational programs. Such myths ignore the physical and social elements in work situations, and actively deter the development of positive programs and the search for accident causation (Rabinovitch 1979:22).

Another impediment to accident knowledge is what appears to be a universally held concept embodied in the oft-quoted phrases, "Act of God", "luck", "chance", implying that which is beyond human control. In the words of Haddon et al (1964:2):

As a reflection of this, accidents remain the only major source of morbidity and mortality which many continue to view in extra-rational terms.
This culturally acceptable explanation continues to be applied to such "natural" disasters as floods and earthquakes, and often-times as not, goes unchallenged. But if the assumption is that most accidents are not causally unique then the entire accident field must come under more concerted scrutiny.

4.2.2 Social Value of Safety

Safety per se has never graced the top rung of social values. Safety measures often involve the restriction or prohibition of behaviour that the individual enjoys or that the culture esteems. Hence, personal freedom becomes threatened and gratification from risk-taking is thwarted:

The American culture, if not Western culture as a whole, has always prized and rewarded the taking of risks. The risk-taker - the explorer, the voyager, the medical researcher, the entrepreneur, the prize-fighter and bull-fighter, the sports car racer, the test pilot - has always been endowed by society with heroic qualities, even when his risk-taking is unsuccessful and he is maimed or killed (Haddon et al, 1964:7).

4.2.3 Costs

Safety measures involve understandable threats to specific industries or to the public as a whole. Safety features that are found to be effective can be costly to the manufacturer and to the consumer. The slogan "it is better to be safe than sorry" is not always heeded. It is only fair to say, however, that many industries and firms have improved the safety of their products
and operations without organized public pressure or legal sanctions.

As mentioned in the preceding chapter, the Du Pont company illustrated what can happen by showing that individual corporations can reduce workplace accidents to a minimum without government regulation and interference. On the other hand, the history of safety legislation has demonstrated that often action takes place only because of high level pressure from an outraged public. By and large, in the absence of such disasters as the Titanic's sinking, or the multiple refrigerator deaths of small children, society has been insensitive to assuming the costs of effective counter-measures to prevent accidents.

4.2.4 Inertia to Change

Inertia to change is an additional problem which is detrimental to vigorous research study and implementation of its results:

Even such organizations as those responsible for the provisions of medical care, insurance, vehicle repair and disability benefits have characteristics which are but slowly susceptible to change (Haddon et al, 1964:8).

Although there is nothing to suggest that particular interests are threatened nor accident research in general is opposed, Haddon et al (1964:8), continue:

It does mean, however, that the application of any new finding may be hampered by the inertia so often associated, in any setting, with change in functioning.
Citing an instance, a substantial change in attitude towards the culpability of individuals involved in accidents might require enormous revisions of legislative statutes with corresponding expenditures at various levels, of time, money and effort. The bureaucratic delays, to say the least, would be most disheartening knowing that accident research does not seem to qualify for high priority status.

Conflicting views held on the adequacy of existing accident prevention programs also obstruct progress and delay change. Some persons may be reassured that they are protected regardless of the efficacy of a given program. Others may question certain procedures and feel insufficient knowledge is being communicated. These different beliefs tend to delay an objective evaluation of any accident reduction measures.

4.2.5 Psychological Factors

Some psychological obstacles to accident research also need to be considered. Human behaviour seems to be greatly influenced by the "remoteness" factor with respect to accidents. To illustrate with three examples; first, Haddon et al (1964:9) noted:

Public response to a social problem often seems to require a stimulus that is immediate, close at hand, and dramatic.

Hence, the public may demand immediate flight safety legislation after a hundred passengers die in an airline crash. But it accepts the same statistics in traffic or occupational facilities
with apparent indifference simply because the cumulative result may be spread widely over time and space. Secondly, there is the commonly held belief that accidents, like cancer or the aging process only happen to the "other person" (Lalonde, M. 1974:8). Unless there is the ability to identify with accident victims, there seems to be no great urgency for people to establish preventive measures. Thirdly, the difficulty in connecting cause and effect also makes immediate preventive action less likely. For instance, the long term effect of ionizing radiation may be noted years after exposure. Thus:

If scientific investigators often have difficulty in establishing the role of pathogenic agents and quantifying their effects, it is not surprising that social concern and action may be difficult to stimulate (Haddon et al, 1964:10).

4.2.6 Inherent Violence Factor

One other aspect of the public's apparent tolerance to accidents, is the preoccupation of society in the various forms of violence related to human sacrifice. To cite a few examples from ancient history to the present day are such experiences as public executions, bull fighting, contact sports, sadistic motion pictures:

It is possible that accident research and prevention will not obtain the public support and approbation accorded to medical research until those aspects of accidents and the role of violence in human behaviour are understood... (Haddon et al, 1964:10).
4.3 PRESENT STATUS OF ACCIDENT RESEARCH

The aforementioned obstacles to the establishment of accident research as an independent discipline may account to some extent for the status of the field of accident research today. Whereas research on diseases have enjoyed government and public support over the years, accident research in sharp contrast has not had this attention:

Except in a scattering of laboratory and field programs in the United States and other countries devoted chiefly to the development and evaluation of "hardware" - seat belts, industrial safety equipment, and aircraft, for example - there are few well trained groups of investigators working in recognized and adequately supported research centres and universities...

(Haddon et al, 1964:4).

Thus, despite the enormous amount of literature on accidents there has been a scarcity of organized quality accident research (Hale and Hale 1972:80; Haddon et al, 1964:280).

What accident research has been done has been conducted largely by interested individual professionals either in the course of their work, or to test a theory or a technique:

...But an adequate accident-research program, like broad research programs in areas of more traditional medical concern may require, depending on its focus, professionals trained in many disciplines...

(Haddon et al, 1964:4).

Nevertheless, science is growing at an exponential rate. New concepts in medicine, psychology, sociology and statistics, together with the expertise in these fields, are providing the
needed impetus for a more comprehensive study of accidents. And with
the widespread interest in occupational health and safety today,
accident prevention is becoming high priority with more governments
in Canada.

Added to this, the public is gradually becoming aware
that "modern" accidents appear to be increasing in developed
countries, as well as in developing countries currently undergoing
westernization (Haddon et al, 1964:11). This concern is being
reflected in organizations such as the Workers' Compensation
Boards using the media for safety education, and labour/management
teams including safety clauses in their collective agreements.

Thus the climate in the closing years of the twentieth
century appears to be favourably disposed to a new emphasis on and
a new direction for accident research and safety programs.

4.4 MAIN THEORIES IN ACCIDENT RESEARCH

Most serious students of accident research, over the
years, have postulated various theories. Some of these theories
have since fallen into disrepute, while others have been built on
previous ones or modified. Still others have taken on entirely new
approaches to the subject. Hale and Hale (1972:14-17), divides them
into two groups, non situational and situational theories.

First, the ones that concentrate on the person to the
exclusion of the situation, are listed as; pure chance, biased
liability, unequal initial liability - more commonly known as the accident prone theory, adjustment/stress theory, goals/freedom/alertness theory, and unconscious motivation. Perhaps the most influential of these in accident research has been the accident prone theory.

Basically, this theory states that some people are more liable to accidents than others due to innate personal characteristics:

The basic hypothesis requires that all people in the same sample considered are exposed to the same risk, so that the differences in liability are entirely due to personality characteristics. A logical deduction from this hypothesis is that it should be possible to identify the characteristics responsible for a high level of liability (Hale and Hale, 1972:15).

Earlier works on accident proneness dealt mainly with sensorimotor variables, but from the 1940's onwards the studies changed their emphasis to personality variables (Hale and Hale, 1972:15). Today, accident proneness is taken as susceptibility to accidents due to human factors. It is considered that all persons are subject to this susceptibility at different times and in different circumstances, save that the degree varies with individuals (Encyclopedia of Occupational Health and Safety, 1971:18).

The second group of theories mentioned by Hale and Hale (1972), concerns the accident liability of situations. Faverge
is reported as analyzing the situations leading to unreliability and accidents, stressing particularly the concepts of breakdown and degradation of the normal work routine. Winsemius, another researcher, produced a detailed theory of task structures, considering an accident to be a disturbance in the task activity which may or may not result in injury.

The Domino theory, due to Heinrich, encompasses both personal and situational factors. It describes the sequence of events leading up to an injury in five stages: (a) ancestry and social environment, leading to (b) fault of a person, constituting the proximate reason for (c) an unsafe act and/or mechanical hazard, which results in (d) the accident, defined as being struck by, falling, being burnt by, etcetera, which leads to (e) the injury. It is this theory that gave rise to the consideration of accidents by unsafe acts and unsafe conditions, which is used widely in industry today (Hale and Hale, 1972:16).

The epidemiologic theories owe much to the influence of ideas formalized in the study of epidemics in the public health field. This approach has introduced three terms into the language of accident research first postulated by Gordon (1948); the host (victim) to whom the accident happens, the agent according to Haddon et al should refer to the "abnormal exchange of energy" which causes the injury (defined as mechanical, chemical, electrical, thermal, ionizing etcetera), and the environment refers to the
circumstances surrounding the accident, subdivided into physical, biological and socio-economic. The accident is regarded as being caused by the conjunction of factors from all three areas (Hale and Hale, 1972:17).

4.5 PROBLEMS IN ACCIDENT RESEARCH

The study of accidents presents many basic problems which need to be reviewed. Some of the more obvious ones will be examined.

4.5.1 Definition

In order to study a subject scientifically, it must first be defined. Therein lies the first problem.

The Encyclopedia of Occupational Health and Safety (1971:10) says:

An accident may be defined as an unexpected, unplanned occurrence which may involve injury....

Webster's New World Dictionary uses terms such as:

1. an unexpected happening
2. an unfortunate occurrence; mishap
3. chance

Yet any hint of causelessness is diametrically opposed to the spirit of scientific enquiry. Thus, researchers have had to provide their own definitions tailored to suit the research questions under investigation. A few examples are put forth by Hale and Hale (1972:11):
"In a chain of events, each of which is planned or controlled, there occurs an unplanned event, being the result of some non-adjustive act on the part of the individual (variously caused), may or may not result in injury. This is an accident" (Arbous and Kerich).

"An accident with or without injury, is in the main a morbid phenomenon resulting from the integration of a dynamic variable constellation of forces and occurs as a sudden, unplanned and uncontrolled event" (Schulzinger).

Suchman discusses the problem of definition at length and concludes that "It is doubtful that any single definition will cover all types of events of interest to the student of accidents." He goes on to produce a list of indicators of the accidental nature of an event. The more indicators that are present, the more likely the event is to be called an accident: low degree of expectedness, low degree of avoidability and low degree of intention.

Haddon et al (1964:3) say:

Accidents are almost invariably defined - in tabulations, in control programs, and in research - as the occurrence of unexpected physical or chemical damage to living or non-living structures.

The Encyclopedia Americana, Canadian edition (1963:70) states:

...The word sometimes carries implications of the absence of human fault or negligence; and in this sense an accident is an occurrence which could not have been prevented by the exercise of ordinary care....In many cases, however, the term has been interpreted by the courts as meaning simply an event occurring without one's foresight or expectation, and thus including happenings which involve negligence.

Hale and Hale (1972:11-14) and Haddon et al (1964:140), who have compiled useful reviews on accident research literature, found that in the majority of research papers, the words accident and injury are almost synonymous. They also came to the same conclusion, that the choice of definition and behaviour to be studied should be
decided by the use to which the research findings are to be put.

Practical considerations of data collection have ensured that most researchers have used injuries as their subject of study (Hale and Hale, 1972:12). To lessen the confusion, it would seem reasonable to expect researchers studying actual injuries, to refer to them as such, and not "accidents".

What seems to be required is the differentiation between a conceptual definition and an operational definition of accidents, so as to permit comparative and cumulative research (Suchman, E., in Haddon et al, 1964:281).

4.5.2 Concept of Cause

Unlike diseases in human beings, accidents are commonly regarded as somewhat different when establishing causation. Since there are many unknown factors in the cause of accidents, researchers have been suitably vague and have hedged about in pin-pointing direct cause. Crucial to understanding of accident causation is first, an understanding of what is usually meant by the term "accident" and secondly a comparision between accident causation and that of other sources of morbidity and mortality for which accidents are often believed to differ (Haddon et al, 1964:2).

In the absence of specific causes such as bacteria, viruses or other signs of pathology which are responsible for disease,
researchers from the various disciplines focus on other factors, according to their particular field of investigation. Haddon et al. (1964:17) observed that the terms "cause" and "causation" are often used in descriptive papers, emphasizing the qualitative and quantitative definition in statistical terms of parameters, and their relationships, associated with high rates of occurrence.

It is largely accepted by most researchers, now, that in an accident situation, there is a causal chain of events and the occurrence of "trigger" events that touch off the accident (Suchman, E.A., in Haddon et al, 1964:281). Therefore, emphasis is placed on the identification of the major stages or steps in the accident sequence. Terms such as "predisposing" relating to human factors, and "contributing" in the environment factors are often used.

This multifactorial nature of accident causation is evidenced by the comment of the Encyclopedia of Occupational Health and Safety (1971:11):

Accident causation is a complex subject but in essence most injuries are caused by a combination of physical circumstances and human acts in varying proportions....

John E. Gordon (in Haddon et al, 1964:21-22), whose study was done in 1948, defined agents concerned with injuries and accidents as of physical, chemical and biological in nature. He maintained that the causative factors in accidents have been seen to reside in the agent, in the host and in the environment. The mechanism of
the accident production, he stated, is the process by which the three components interact to produce a result, the accident — but it is not the cause. Various kinds of mechanism, however, serve to advantage in classifying accidents by type, with particular events ascribed to cutting, to collision or to crushing, yet the agent in all three instances may be a glass panelled door. Conversely, he argues, a fall may be related to such dissimilar agents as a faulty ladder or a playful pup.

Haddon et al (1964:27) commenting on Gordon's analysis say:

...although it is a landmark in the shift of medical attention to accidents, it fails to identify the agents required by the host-agent-environment model...

They felt that describing parts of the environment, for example, a glass panelled door as the agent, was not specific, since such injuries as lacerations can be produced by other means. They speak of the "abnormal energy exchanges" which are necessary and are the specific causes of accidents (Haddon et al, 1964:140).

Haddon et al contend that the abnormal energy exchange is the common factor in accidents, without which unexpected injuries to living or inanimate structures cannot occur. When this question is considered, it appears all such types of damage fall causally into a relatively small number of groups. It follows then, each type of damage is the result of a specific type of energy exchange and it can usually be produced in no other way. They cite for example, the crushing, tearing and breaking of structure, whether a
fender or a leg, can only be produced by the transfer to that structure of a sufficient quantity of mechanical energy. Thus, they suggest the several forms of energy, thermal, electrical, mechanical and ionizing meet all the criteria of agents in the host-agent-environment model. The fundamental problem in accident prevention, then, is seen to be the prevention of these abnormal energy exchanges (Haddon et al, 1964:28).

Once the essential role of abnormal energy exchange is recognized in accident causation, two important points can be made. First, it makes clear the nature of the basic events that motivate and define the field. Secondly, it demonstrates the close parallelism between this area and others - specifically infections and other insults to the body which have long been the concern of preventive medicine (Haddon et al, 1964:29).

4.5.3 Methods of Study

A subject as heterogeneous as accident research calls for a multiplicity of methodologies. Indeed, investigators from the various disciplines have had a wide field in choosing research questions and methods of study. Most of these works can be grouped into two major subdivisions; those papers which look at one group of people or events and those which compare two groups of people or events. Within these two divisions, there are studies which use past accident history as a criterion for choosing a group or groups,
and there are those which choose the group on other grounds and look at distribution of accidents within them (Hale and Hale, 1972:18).

A number of problems become apparent when these studies are reviewed. One of the pitfalls in case studies of accident victims and accident situations, has been the common error of assuming a causal relationship between certain characteristics and accidents without studying the extent of such characteristics in the general population. Hale and Hale (1972:18) point to Selling's study which found some visual impairment in all those over 65 years in 35 accident prone drivers. But he did not examine how many others in this age group also had some visual imperfections.

With the case study method, there is also danger of generalizing the results too widely beyond what is supported by the evidence leading to unjustified conclusions. This problem arises when a sample population is too small or represents a specialized segment of society (Hale and Hale, 1972: 19) or if based on data known by informed researchers to be faulty (Haddon et al, 1964:36).

Nonetheless, it can be said the case studies have much of value in them provided they look at all aspects of the accident, both personal and situational, and provided that the detailed information which they produce is objectively analyzed.

Comparing two groups on the basis of their past accident history, for example, accident prone people with the non-accident prone, gives rise to a number of problems. Even when investigators
accept the theory of accident proneness, they find the term "accident prone" can be applied only to a very small proportion of any population. Added to this difficulty, they find operational definitions of accident prone and non-accident prone need to be stipulated. Davis and Coily used drivers with more than three accidents per 100,000 miles of driving, as their accident prone group and those with less than three accidents per 100,000 miles as their safe group. Marcus et al used the same criterion for their accident prone group, and those with one accident or less as their accident free group. Others have used four accidents or more as opposed to no accidents during 100,000 miles of driving (Hale and Hale, 1972:28). It appears the variations of definitions are multifarious making corroborative studies impossible, unless the same criteria are used.

Other pitfalls, mentioned in their "Review of Industrial Accident Research Literature" (Hale and Hale, 1972:30-31), are: (1) not acknowledging the differences in risk in their populations. For example, all people with the same job title are not necessarily exposed to identical risks. (2) Failure to recognize that accidents are not a homogeneous entity. What little work has been done on comparing factors associated with various kinds of accidents has indicated important differences. (3) A besetting sin of accident research, is the interpretation of correlation as causal when the evidence does not support this. A greater clarification of the factors central to causation must be considered in any accident
research. (4) There is a tendency to interpret results of research according to personal or professional bias ignoring other equally plausible explanations. (5) Reliance on records as a source of accident data often precludes the realities of the industrial situations, such as skills required for specific jobs, the multiplicity of machines and various task components of a job. Researchers are often unaware of the intricacies of the industrial situation and generally do not acknowledge them.

4.5.4 Classification Systems

There are many ways of classifying accidents. These can be according to cause, degree of severity of injury, time loss and no time loss, nature of the injury, parts of the body involved and according to place of accident (at work, in public places, at home and in motor vehicles), etcetera. The classification according to cause appears to be the least straightforward and creates much confusion.

The various methods of classifying accidents according to causes take the form of simple classification systems and multiple classification systems, and as often as not, "cause" and "type" are used interchangeably. Sometimes the lists refer to the motion that precipitates the action, for example, falling or struck by, as the cause. Other times, the external agent such as machinery is considered the cause (Encyclopaedia of Occupational Health and Safety, 1971:10,20).
Many countries keep accident statistics of work, travel and home accidents, but the basis for compilation varies between countries and between activities so that valid international comparisons are difficult (Encyclopaedia of Occupational Health and Safety, 1971:10).

The traditional means of classifying accidents by cause has been the External Cause section of the International Statistical Classification of Diseases, Injuries and Causes of Death (ISC). This system has been used over the years by the vital records section of many health departments to code cause of death on death certificates. However, the International Statistical Classification does not describe non-fatal accidents with sufficient detail to permit practical application for planning prevention programs (Haddon et al 1964:141).

The problem with this type of classification is that it has definite limits when applying it to an accident study, because accidents do not exist within clearly defined categories. Furthermore, the conditions prevalent in a particular study population may make a rigid classification system irrelevant, for example, skiing accidents or computer personnel accidents.

It follows then, that each researcher must develop his own classification system according to the data collected.
4.6. SOME FINDINGS IN INDUSTRIAL ACCIDENT RESEARCH

It may be said that the incidence and type of accident varies with the occupation: the frequency rate in the heavy industries, such as shipbuilding, is higher than in the light trades such as the clothing industry; falls from a height are more prevalent in the building industry than in most other occupations; trades with a high ratio of machinery to men will have a higher proportion of machinery accidents than trades where there are many non-mechanical operations. Therefore, it would appear that each industry has its own characteristic type of accident, but the general overall pattern of industrial accidents remains the same.

As an example of this pattern, the main causes of industrial accidents in Great Britain for the year 1968 as shown in the Encyclopaedia of Occupational Health and Safety (1971:10) were as follows:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling</td>
<td>29.5%</td>
</tr>
<tr>
<td>Persons falling</td>
<td>16.6%</td>
</tr>
<tr>
<td>Machinery</td>
<td>15.0%</td>
</tr>
<tr>
<td>Striking against object</td>
<td>9.4%</td>
</tr>
<tr>
<td>Transport</td>
<td>8.0%</td>
</tr>
<tr>
<td>Struck by falling object</td>
<td>6.7%</td>
</tr>
<tr>
<td>Hand tools</td>
<td>7.3%</td>
</tr>
<tr>
<td>Others</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

Comparison with other years shows that percentages vary little and there is no reason to suppose that there is any essential difference in the relative percentages from other industrialized countries (Encyclopaedia of Occupational Health and Safety, 1971:10).
In other findings on industrial accidents, researchers in different disciplines have produced some interesting information. In "A Review of the Industrial Accident Research Literature" (Hale and Hale, 1972), a list of findings from the published papers on industrial accidents have been compiled and commented upon. These studies have examined many independent variables from the biographical, physical, psychological, personality, social and environmental spheres. For the purpose of the present study, however, it was thought advisable to limit the discussion to the biographical data.

Sex

A few researchers have attempted to discover whether men or women are more liable to accidents. In industry, men and women are rarely employed in the same work, because of tradition and differential pay rates and in order to make a valid comparison they must all be working in identical jobs. Consequently, few studies have been conducted in industry to test for sex. Vernon studied the difference indirectly in a munitions factory and found that, when a working day was increased from 10 to 12 hours, the accident rates of the women increased more than those of the men. He attributed this to a difference in fatiguability adding that the energy expenditure outside working hours might be playing a part (Hale and Hale, 1972:32).

It appears that much research is required to clarify
differences in accident rates between the sexes, especially since men and women in industry seldom do the same work.

**Age**

This factor is one of the more frequent variables considered in accident research:

Overall findings seem to be in agreement. During the teens and early twenties the number of accidents is high; it then drops sharply, levelling out in the mid-twenties. After this there is a slight decline until the middle or late forties when the numbers start to rise again till the end of the working life... (Hale and Hale, 1972:11).

The younger workers are usually more inexperienced and thus the effects of age and experience are easily confused. A few studies matched groups for experience but still found younger people had more accidents. Yet other studies found the same in one department but in another the older workers had more accidents. A number of researchers have suggested younger workers have accidents for reasons other than inexperience, namely; inattention, lack of discipline, impulsiveness, recklessness, misjudgement, overestimation of capacity and pride. It is possible that these are correct in certain circumstances, but appears to be mainly based on the researchers' subjective impressions. Whitfield suggested that perception and cognition were a fault in accidents involving youthful workers (Hale and Hale, 1972:34).

Possible reasons for accidents in older workers were found to be poor motor coordination, less mental agility, sensory
deficiencies, slowness in adapting to new situations. All these explanations could be correct in certain circumstances, but there is no evidence to clarify how important each is in any given situation (Hale and Hale, 1972:34).

Whatever the reasons are for the strong relationship between age and accidents, it seems a wise move to concentrate on the two ends of the distribution scale in any attempt to reduce the number of accidents in industrial settings.

Experience

Researchers have examined the effects of experience since the earliest accident studies. How much a worker learns and remembers about hazards in the workplace will obviously affect his ability to avoid unnecessary work accidents. And as the person gains experience so his perception of his surroundings change. Hale and Hale (1972:35) lists five kinds of experience which could be pertinent to accidents:

1. Experience of industry in general. This provides knowledge of general industrial hazards.

2. Experience in the firm. This gives knowledge of specific danger points in the factory, e.g. the places where the fork trucks can be encountered.

3. Experience in a section. This affords specific information about local hazards, e.g. uneven flooring.

4. Experience on a type of work, e.g. press work.

5. Experience on specific tasks which familiarizes people with the hazards of individual machines and components.
Many authors have failed to make these vital distinctions and this has caused great confusion in interpreting the literature on accidents (Hale and Hale, 1972:36).

In new recruits, the general finding has been that experience is the critical factor in accident causation. There seems to be strong evidence that length of service has an effect on accident rate over the first one to two years of employment in a company - but this experience effect does not account for all of the peak of accidents in young workers (Hale and Hale, 1972:37).

As inexperience appears to be an important contribution to accident causation it would be expected that training should make a considerable difference to accident rates. However, in studies of the effectiveness of formal job training and specific safety training programs, the conclusions were:

1. Some training programs had no effect on accidents because the material included in them was not relevant to the normal work situation.

2. Inadequate training methods and instructors were responsible for other training failures.

3. Some training programs were successful enough to indicate that most job training had not realized its full potential in accident prevention (Hale and Hale, 1972:37).

The published evidence suggests that the potential of safety training has not been fully exploited (Hale and Hale, 1972:37). Perhaps this is an area that vigorous research must direct itself.
4.7. SAFETY RESEARCH IN INDUSTRY

Accident research in industry has mainly focused on examining human factors and situational variables in an attempt to determine causation. Industry, then, having gained some insight into the causes of accidents proceeded to implement preventive strategies in order to reduce the accident rates. But good evaluation studies of safety measures have been scarce, as little effort has been made to validate the preventive measures in the work situation (Hale and Hale, 1972:68):

The advantages of validation are not widely enough realized, but advances in the efficiency of the measures cannot be expected without a solid base of proven evidence (Hale and Hale, 1972:78).

Perhaps verifying the effectiveness of safety procedures has had little success because of the lack of expertise on the part of most investigators. As well, the conduct of evaluative studies is of fairly recent origin. However, today's emphasis on accountability and responsibility puts the onus on management to prove the efficiency and effectiveness of preventive techniques. Therefore, program evaluation regarding safety at work may be more actively pursued in the future.

4.7.1 Problems in Evaluation

It was found in most published attempts to validate safety measures that they take the form of comparing accident rates before and after a safety program has been installed. At
the outset, there would be two problems. First, the question has to be asked, what criteria will be used as a measurement of success? Secondly, what other factors in the situation will have to be distinguished from the effect of the safety measure?

The recorded accident rate is not sufficient as a criterion of success because there is danger of reliance on the reporting of accidents rather than the actual occurrence of accidents. Thus, even though the reported accidents show a reduction, the program may not have prevented accidents at all (Hale and Hale, 1972:69). On the contrary, if reported injuries show an increase - for various reasons - it does not hold that the program is ineffective or that there have been any more accidents.

Because of the false picture that recorded accident rates can give, some researchers have used other criteria such as "dangerous behaviour" improvement and "changed attitude" to safety as criteria of the success of safety training. In the former human characteristic, there is a problem in extrapolating dangerous behaviour to accidents. In the latter, there is a program of determining what initial attitudes people have had. Besides, changes in attitude do not necessarily effect changes in behaviour. Both characteristics are difficult to measure. The most satisfactory procedure would seem to be the use of as many criteria as possible in evaluating the success of a safety program (Hale and Hale, 1972:69).
Evaluation projects must also discount the effect of other factors in operation that may change the accident rate, and hence, as many potentially "contaminating" variables as possible will have to be monitored, so that changes in accident rates can be attributed to the safety measures and not to changes in other circumstances (Hale and Hale; 69).

4.7.2 Preventive Measures Used in Industry

There are four basic methods of preventing accidents. The effectiveness of these will be discussed below:

1. Selection, to insure that any people who are particularly liable to have accidents are prevented from exposing themselves to situations which are hazardous to them.

2. Training, to establish necessary skills and knowledge to avoid accidents.

3. Changing of attitudes, aimed at establishing more desirable behaviour, particularly in the use of safety clothing, or aimed at making people more aware of the seriousness of accidents and the importance of risks.

4. Ergonomic design changes, to produce safer machinery and tools and working environments more conducive safe and accurate performance (Hale and Hale, 1972:70).

(1) There is a place for selection in accident prevention, but its scope is limited. It appears to be useful in two fairly obvious circumstances; (a) a very small percentage of people are totally unsuited for certain types of work due to serious physical defects or because of certain conditions such as epilepsy or psychiatric disturbances, and (b) in certain professions where an
exceptionally high degree of skill is required and costs of accidents are high (Hale and Hale, 1972:70).

(2) In job training, there was no conclusive evidence in the papers reviewed that effectively cut down accidents. Rotta et al found that young workers who had been through a training program, in fact, had a higher rate of accidents than untrained workers for the first two years of their employment, but in the subsequent five years they had less. The authors felt perhaps the trainees had acquired an exaggerated feeling of being safe in the beginning, but later their better basic grounding rendered them safer than the untrained workers. It was found, too, that "off the job" training did not make a worker safe, because of the difference in environment of the training school and the plant. However, there is broad agreement in the accident literature that the accident rate declines as experience on the job increases. This is the result of a familiarization process whereby a person trains himself to recognize hazards on the job (Hale and Hale, 1972:70).

(3) Attitudes towards accident causation and preventive devices are important considerations when practical steps are being taken to prevent accidents. The research reviewed has indicated that attitudes play an important part, in conjunction with knowledge, in any decision involving behaviour. Hale and Hale (1972:59) notes:

The central attitudes are those towards the risk involved and towards the goal of the action. The former can be regarded as directing the choice, the latter as providing the motivation. These central
attitudes are affected by a host of other attitudes; to supervision, to management, to other members of the work group and to the general social norms. . . .

Many preventive measures aim to change attitudes and to inculcate safety consciousness. To achieve this end, the measures must advocate a change in the relative values placed upon safety (refer to normative-re-educative strategy of change, page 131. Propaganda attempts to change people's attitude to risk and safety competitions try to motivate people to be safe. Hale and Hale (1972:59) says:

At the moment most of these campaigns have to be based on hunch, guesswork, and the piecing together of scraps of information about attitudes and motivation from other fields of research.

Accident prevention is truly a complex field which requires the pooled knowledge of many disciplines.

One of the more popular forms of propaganda that tries to change attitudes and behaviour is the use of safety posters. General conclusions set out by Undeutch advocate:

(a) posters should instruct rather than threaten;
(b) they should deal with specific behaviour;
(c) they should be positive rather than negative in manner;
(d) they should be placed in areas where their message is relevant;
(e) they should not be left for long periods to become part of the furniture (Hale and Hale, 1972:75).
Incentive schemes are another method of attempts to alter attitudes and behaviours. There has been a singular lack of well documented validation of this type of safety measure to warrant widespread use. However, competitions and bonuses continue to be used to develop safety consciousness in workers. It appears to be an example of a technique which has face validity without substantial objective evidence of its usefulness (Hale and Hale, 1972:75). Oftentimes, it merely accomplishes a change in reporting behaviour rather than the level of accidents.

In contrast to incentive programs, the use of harsh disciplinary measures are sometimes used against accident sustainers. Some studies have been done on the armed forces showing a drop in accidents following remedial treatment of a number of accident victims. On the whole, in industry the most such action might accomplish is a reduction in the reporting of accidents (Hale and Hale, 1972:75).

Hale and Hale (1972:76) state, from the studies reviewed, the evidence shows satisfactorily that attitude is not the only thing which governs behaviour, but it is an important ingredient which deserves further research.

(4) Ergonomics is a relatively new science. In the words of Professor Martti J. Karvonen, Director, Institute of Occupational Health, Helsinki, Finland (1974:30):
Ergonomics is an applied science that combines biomedical and engineering expertise. It helps design methods of work, tools and the environment to fit man's structure, functions and abilities. Its purpose is to reduce unnecessary effort, fatigue, wear and tear. Ergonomics does not try to modify man, it modifies work. It aims primarily at protecting the worker and not increased production. Ergonomic improvement may change a difficult job to an easy one and an easier job may increase production.

This method of accident prevention has probably been the most widely used in industry. Hale and Hale (1972:76) places guarding of machinery and other design changes, safety rules and protective clothing under this heading. Many proponents of ergonomics have been advocating better machine and tool design in the prevention of accidents but much of the published literature consists of exhortations to change, rather than concrete proposals for changes or evaluations of the effect of changes (Hale and Hale, 1972:76).

Safety clothing and safety glasses are frequently provided for workers in an attempt to prevent injuries. But safety officers and accident researchers often note a reluctance to wearing them. Various reasons are given; discomfort, cosmetic effect, supervisors not being examples nor actively encouraging use, management laying down rules without prior explanation or consultation with workers and social pressure. The conclusion seems to be the provision of safety gear alone will not ensure that it is worn.

Besides the four basic methods used in accident prevention is the regular safety walk by management personnel observing for
safety defects. Rees has shown this to be an effective stimulant to greater safety, but he provided no published analysis of the reasons for its success (Hale and Hale, 1972:77). These safety tours appear to be beneficial partly because of their propaganda effect demonstrating concern of the firm, and partly because supervisors are kept alerted to any visible safety infractions.

One other concept of accident prevention that grew out of the work of Heinrich is damage control (Hale and Hale, 1972:77). This strategy emphasizes reporting of damage (to either people or machinery) as opposed to concentrating on just those accidents that produce injury. It is felt much can be learned of the interplay of converging forces that produce accidents irrespective of resulting injury. Albeit, the various causes or factors inherent in a given situation may be evaluated differently by different people depending on their background and activities. Two Canadians, Fletcher and Douglas (1970) have written a book on this concept of total loss control.

A study on safety research was done by Simonds and Shafai-Sahri (1977:120-27) whereby eleven matched pairs of companies were examined to determine what factors contributed to the difference in injury frequency rates. Factors found to be related to lower frequency rates were:

(1) top management involvement in safety;
(2) better injury record keeping systems;
(3) use of accident cost analysis;
(4) smaller spans of control at foreman level;
(5) recreational programs for employees;
(6) higher average age of employees;
(7) higher percentage of married workers;
(8) longer average length of employment with the company;
(9) roomy and clean shop environment; and
(10) more and better safety devices on machinery.

Factors not related with injury frequency were:

(1) efforts to promote safety through workers' families and
(2) quality and quantity of safety rules.

The findings of this research work have interesting organizational implications for safety management.

4.7.3 Human Factors in Accident Prevention

It may be argued that analysis of accidents in terms of the human factors involved may have an important drawback. Nonetheless, it can provide valuable information for later safety action. If conclusions are drawn that workers are responsible for the accidents that occur, there may be a tendency on the part of employers to overlook investment in safety equipment or guarding of machinery. On the other hand, as stated in the Encyclopaedia of Occupational Health and Safety (1971:16):
...the study of the human factors involved in the accidents will bring to light faults in the man-machinery system, unfavourable influences of environmental factors such as lighting, heating, ventilation etcetera, undesirable attitudes held by the work group, and shortcomings in the organization of the work process. These can then be rectified by the installation or improvement of safety devices, by raising the standard of the physical environment, by improving selection procedures, by training in safe working practices, by eliminating negative attitudes through greater attention to employer-employee relationships and, finally, by rationalizing production systems.

4.7.4 Accident Investigation

The aim of investigating an accident is to obtain the fullest information regarding its cause or causes. Not only is an investigation fundamental for preventing similar accidents, but it may reveal new or unnoticed dangers that can lead to the devising of well planned safety measures.

Obviously, all accidents which result in injury should be investigated, but it is equally important to investigate accidents which do not result in injury - the "near misses", especially if they are of a serious nature. In many countries, certain dangerous occurrences must, by law, be notified to the competent authorities in the same way as occupational accidents. Examples of dangerous occurrences are; collapse of a crane, explosion or fire, electrical short circuit and structural collapse (Encyclopaedia of Occupational Health and Safety, 1971:14).

The person in charge of the investigation must bear in mind the importance of an objective assessment of all the conditions
leading to the accident. The aim is to uncover the facts, not to attach blame. The investigation should be carried out as soon as possible after the incident has taken place. The facts to be collected can be divided into two main groups; the first group should involve everything about the time, person and place, and the second group of facts concerns the occurrence and the conditions under which it occurred (Encyclopaedia of Occupational Health and Safety, 1971:7).

It is probably wise to have a check list regarding details of environmental conditions and whether the worker had been adequately trained and supervised, so that a judgment can be based correctly on any divergence from legal requirements or current practice.

The complementary relationship of safe work conditions and the corresponding safe conduct of the worker should be constantly borne in mind by the accident investigator, since it will provide a valuable guide when determining the action that should be taken on the basis of the investigation:

Whenever possible an attempt should be made to improve the degree of measured "technical safety" simply because technological measures are more reliable than measures which depend on the human factor (Encyclopaedia of Occupational Health and Safety, 1971:17).
Conclusion

It has been abundantly clear that in order to do any study on accidents, many factors will have to be considered. The beliefs and attitudes that people hold in connection with accidents are varied and sometimes difficult to change - which is a consideration in planning prevention programs. Other difficulties become apparent when one tries to pin down a definition for accidents, or contemplate cause. Classification systems have posed problems for many researchers, and methods of study are as yet unsophisticated. Nevertheless, the research done on the industrial worker will be very useful when applied to hospital workers.

The prevention measures used in industry are applicable to a hospital setting. Safety research done on the industrial scene regarding the major factors that reduce accident rates could have great significance for hospitals. Furthermore, accident investigation should be fundamental to an accident prevention program and be included in any well planned hazard control program in a hospital.
CHAPTER 5

EPIDEMIOLOGY: A CONCEPTUAL FRAMEWORK FOR THE
STUDY OF ACCIDENTS

5.1 INTRODUCTION

In search of a conceptual framework for the study of accidents, wherein the entire subject of accidents could be approached systematically, epidemiology was found to suit this purpose most satisfactorily. It can be equally adaptable to accidents in which environmental factors predominate as well as those in which human factors are of primary importance. Moreover, careful search of the literature revealed many parallels between disease and accidents, both in causal sequences and preventive techniques (Haddon et al., 1964:3).

The dominant impressions of accidents, in general, which tended to occlude insight into these basic similarities have been; (1) the feeling that accidents are somehow beyond human control and (2) the sudden unexpected and often violent occurrence of damage which is diametrically opposed to the longer, less spectacular time interval for disease to develop. Suchman (in Hale and Hale, 1972:73) argues:

...thus if accidents are regarded as a sign of the wrath of God, or as blind tricks of fate, then those who suffer them will be convinced that no actions of their own can prevent their occurrence.
Therefore, accident prevention needs the acceptance of accidents as dysfunctional. It follows that the existence of hazards must be condemned.

Haddon et al (1964:12) note:

...it is the unexpectedness rather than the production and prevention of that damage per se that has been emphasized by much of accident research.

They further state:

This approach is not justified by the present knowledge and is in sharp contrast to the approach to the causation and prevention of other forms of damage, such as those produced by infectious organisms, where little if any attention is paid to the unexpectedness of the insults involved, and only their physical and biological nature is emphasized - with notable success.

A conceptual framework embraces all aspects of a topic and allows for analysis, argument, evaluation, communication and decision. Thus, this epidemiologic framework is proposed to provide such a structure for the present study of hospital employee accidents.

5.2. DEFINITION OF EPIDEMIOLOGY

Two main areas of investigation are indicated in a definition of epidemiology, as expressed by Brian MacMahon (1967:3):

Epidemiology is the study of the distribution of disease in human populations and the factors that determine that distribution. Its predominant, though not exclusive, purpose is the understanding of disease etiology and the identification of preventive measures.

The first area describes the distribution of health status in terms of age, sex, race, geography, education, socio-economic
and marital status - more or less an extension of the discipline of demography to health and disease. The second area examines the patterns of distribution of a disease or condition in terms of causal factors (MacMahon and Pugh, 1970:11). Both components supply basic facts that can be put to many uses. MacMahon and Pugh (1970:12) state:

Knowledge of the distribution of disease may be utilized to elucidate causal mechanisms, explain local disease occurrences, describe the natural history of a disease, or provide guidance in the administration of health services.

The most significant purpose this knowledge imparts is that it can form a basis for prevention of unhealthy states in human populations. The classic example of the epidemiologic process is exemplified by the work of John Snow in 1854 during a cholera epidemic in London. He observed the epidemic was confined largely to people who purchased their water supply from one of two competing water companies that served the area. Dr. Snow knew he could modify the incidence of cholera by changing the water supply - years before the causative agent, the cholera bacillus was discovered (Enterline, P., 1979:45-6).

The aim of epidemiology has always been the improvement of the health of populations. In the past, the emphasis was on the conquest of communicable diseases, and the concern was with improving basic environmental factors such as sanitation, housing and work conditions. In the developed nations, this is now giving
way to an interest in the major chronic diseases, in man-made environmental hazards, and in the planning and delivery of health services in hospital and in the community (Holland and Gilderdale, 1977:12).

5.3. **BASIC TENETS**

The history of epidemiologic methodology is largely due to the development of four ideas:

1. Human disease is related to man's environment,
2. The counting of natural phenomena may be instructive;
3. "Natural experiments" can be utilized to investigate disease etiology; and
4. Under certain conditions, experiments on man can also be utilized for this purpose. (MacMahon and Pugh, 1970:5).

The special contribution of epidemiology in seeking the determinants of disease, is its use of the knowledge of frequency and distribution of disease in populations. As well, in studying disease occurrences, it uses groups of persons as its primary units of concern, not separate individuals. In general, epidemiologists involve themselves with explanations of disease patterns and trends in communities or nations. Hence, epidemiology has long been the forte of public health personnel.
5.4 UNDERSTANDING DISEASE CAUSATION (Application to accident causation)

In the study of any disease, one finds more than one factor has contributed to its occurrence. Friedman (1974:3) gives tuberculosis as an example. He says tuberculosis is not merely caused by the tubercle bacillus, because not everyone exposed to the tubercle bacillus develops the disease. Other factors have been identified which clearly contribute to the occurrence of this disease, such as, poverty, over-crowding, malnutrition and alcoholism. Conversely, amelioration of these factors can do much to prevent tuberculosis.

Epidemiologists have been credited with organizing the complex multifactorial process that leads to disease in various ways:

One useful way to view the causation of some diseases, particularly certain infectious diseases, is in tripartite terms of the agent, the environment and the host (Friedman, 1974:3).

This host-agent-environment interrelationship is not a linear progression of steps, but rather an interactive process, whereby disease production depends on critical factors of all three components. Thus considerations of host susceptibility are important; virulence and volume of the agent can tip the balance between health and disease, and environmental factors include poverty, crowding, seasonal and climatic conditions.

Given this view, preventive strategies advocated are; reduce the susceptibility of the host, make the agent less hazardous and modify the environment to lessen possibility of a
Another epidemiologic view of disease etiology is a "web of causation":

This concept of disease causation considers all the predisposing factors of any type and their complex relations with each other and with the disease (Friedman, 1974:3).

In the case of a myocardial infarction, the many interrelated factors lead to a complex causal web, which when disentangled can present possible courses of action to prevent the condition. These actions among other considerations include dietary modification, treatment of hypertension and changing public attitude toward smoking and exercise (Friedman, 1974:5).

The search for a primary cause of disease is not always relevant to disease prevention. In terms of disease prevention it may be more practical to attack a causal web at a point that seems relatively remote from the disease. For example, draining swamps to control the mosquito population may be a practical and effective approach to prevent malaria rather than merely trying to destroy the malaria parasite (Friedman, 1974:5). As MacMahon and Pugh (1970:25) put it:

Fortunately it is not necessary to understand causal mechanisms in their entirety to effect preventive measures. Knowledge of even one small component may allow significant degrees of prevention.
5.5 SOME APPLICATIONS OF AN EPIDEMIOLOGIC MODEL

It has been noted that accidents as a health problem of populations conform to the same biologic laws as do disease processes and regularly evidence comparable behaviour (Haddon et al, 1964:3). And epidemiology as a conceptual framework for accidents offers limitless opportunities for study since its extension from the original restriction to communicable diseases. However, the difficulty with the use of an epidemiologic model has been in defining the agent in a non-infectious condition. In recent years, notwithstanding, there have been some notable attempts to modify and adapt the model to describe non-communicable states.

A health promotion model based on the epidemiological components of host, agent and environment was described by Richard Lauzon (1977:311-317). The host was perceived in terms of the individual's risk status relative to lifestyle agents commonly accepted as disease or injury precursors, for example, alcohol, automation, automobiles, tobacco etcetera. The micro-environmental situations provided the setting in which agent and host interacted.

In the study of accidents, the use of the epidemiologic approach was pioneered by John E. Gordon in 1948 (Haddon et al, 1964:15). Since then, his scientific paper has influenced many authors of accident research.
Suchman (1967) successfully applied a modified version of the epidemiologic model in an accident prevention program. The purpose of the exercise was to analyze the acceptance or rejection of a protective glove for sugar-cane workers. In his article, Suchman translated each of the epidemiologic components of host, agent and environment into social-psychological factors relevant for health-related behavioural change.

In the present study of employee accidents in a hospital, the application of an epidemiologic model considers the host as the employee at risk, the environment comprising the physical, biologic and socio-economic spheres (Gordon in Haddon et al, 1964:22-25), and the agent as the abnormal exchange of energy which can be mechanical, chemical, electrical, thermal, ionizing etcetera (Hale and Hale, 1972: 17, Haddon et al, 1964:28). The accident is regarded as being caused by the conjunction of factors from all three areas with unsafe actions and unsafe conditions creating hazards that result in injury, damage or disease (Heinrich's domino theory in Hale and Hale, 1972;16).

Host factors that contribute to unsafe actions may be stated as physical disability, genetic factors, psychological problems, job dissatisfaction, age, inexperience, work stress, alcohol, drugs, fatigue and others. Lalonde.(1974:31-32) separates the host factors into; human biology and lifestyle. Under the Human Biology element he includes the genetic inheritance of the individual, the processes of maturation and aging, and the many
complex internal systems of the body. The lifestyle category consists of the aggregation of decisions by individuals which affect their health and over which they more or less have control.

Environmental factors that influence unsafe conditions may be physical; equipment, climate, ventilation, lighting, noise, or biological; bacteria, animals, persons, or socio-economic; occupation, living quarters, income etcetera. The environmental category includes all those matters related to health which are external to the human body and over which the individual has little or no control (Lalonde, 1974:32). This last aspect of environmental factors has generally been ignored in the study of accident causation.

Gordon (in Haddon et al, 1964:25) maintains:

...The part exerted by the socio-economic environment is probably the most neglected of any epidemiologic influence, and accidents are not different in this respect from any other causes of damage....

Given the state of health where there is an established and satisfactory equilibrium or adjustment between man and his environment, a significant disturbance of that equilibrium is the basis for disease or injury:

...The disturbance may occur either through principal action of the agent, because of a characteristic of the host, or as a function of environment, but most often through some combination of the three. These are the fundamental factors in causation (Gordon in Haddon et al, 1964:20).
Figure 2 represents a potential accident situation. It depicts; (1) the multifactorial nature of causation, (2) the interaction of host, agent and environment and (3) the activation of the agent. Unlike the infectious disease model where the three entities of host, agent and environment are distinct and separate but interact to cause disease under certain circumstances, the agent in an accident situation is viewed as the energy derived from part of the environment as it interacts with the host factors.

With accident causation conceptualized in Figure 2, any remedial action must be suited to the whole of the cause as it lies in the host, agent and environment.

Preventive strategies are then employed to make the host more resistant, to decrease the agent's ability to activate and to block harmful environmental influences. Figure 3 represents an intervention scheme whereby these three strategies are incorporated in a hazard control program to reduce accidents.

Basically, intervention programs are geared to counter unsafe actions of the host and unsafe conditions in the environment. The preventive measures in the case of the former are; selection, training, supervision and changing attitudes by propaganda and incentive schemes. In the case of the latter; the preventive measures can take the form of guarding of equipment, improved machinery design, protective clothing and safety glasses, good
Figure 2

Modified Epidemiologic Model in an Accident Situation.

Figure 3

Epidemiologic Model used in a Hazard Control Program.
housekeeping and environmental controls. Though environmental factors are of great importance in making the workplace safe, it appears that the human factors require much more consideration:

...probably more causes of accidents lie within what we choose to call host factors, within people themselves, than in any other of the three parts of the triad which explain disease and injury. The host patterns of persons who suffer from accidents are of the same general order of those long recognized in many disease processes (Gordon in Haddon et al, 1964:21).

It would be unwise, however, to interpret this in such a manner that employers can blame the worker or abdicate their responsibilities for safety of operation in the work environment. Rather, it should be noted that unsafe conditions creating hazards may be the reason for some unsafe actions on the part of workers. For example, production pressure, lax safety rules, poor training and supervision, unguarded machinery etcetera can have a direct bearing on the human factors leading to unsafe acts. The emphasis, here, must be on the interactive process of host, agent and environment.

The epidemiologic model shows clearly the multifactorial nature of accident causation, the conjunction of forces that result in injury or damage and how it can be used in a hazard control program to reduce the number of injuries. Therefore, in applying this model in an intervention program, it is possible not only to decide upon preventive strategies to be employed but to evaluate their effectiveness.
This model will be re-introduced later in the study to evaluate an employee safety program and to lay the foundation for an effective hazard control program as part of an occupational health and safety service for hospital employees.

In summary, it was necessary to review some basic concepts of epidemiology in order to understand the conceptual framework as applied to the study of accidents. The host-environment-agent triad can be used effectively, since it has been noted that accidents as health problems conform to the same biologic laws as disease processes.

Conclusion

Part I has been an attempt at a comprehensive examination of occupational health and safety hazards. The reason for the extensive literature review has been two-fold. First, it provides a background for the study, which follows, on hospital employee injuries. It identifies various problems in the political, economic, social and technical fields that have been obstacles to development of prevention programs and can pose difficulties when setting up occupational health services in the public sector.

Secondly, Part I is meant to stand alone as a descriptive account of the whole gamut of occupational health - the historical background, the international developments and the major issues confronting the Canadian labour force today. It has been an
approach to systematically consolidating and coordinating the various fragments of knowledge derived from many different sources. It is hoped that it can serve as a point of reference for future use.
6.1. Introduction

Hospitals, an industry concerned with health care, have been singularly unaware of the occupational health and safety hazards that affect their employees. It can be said a hospital that does not apply vigilance to safety measures for the protection of its employees is, in fact, working against the very principles for its existence.

Taking a historical perspective of industry in general, it was not until the Industrial Revolution was well advanced that workers gained some recognition for their own protection. Prior to that, the Courts were inclined to take the attitude that (1) the employee assumed risk by willingly accepting employment in the hazardous mills and coal mines and (2) the employee's injury could result only from his own carelessness. Through the years, this attitude has gradually been reversed and the trend today is toward employer responsibility and disability compensation for industrial workers (Safety Guide for Health Care Institutions, 1972:4).

Perhaps the reason why hospitals lagged behind other
industries in worker protection has been their peculiar status with respect to charitable institutions:

Under the doctrine of charitable immunity (originated in English courts in 1846), eleemosynary institutions such as churches and hospitals could not be held responsible for employee negligence leading to the injury of others (Safety Guide for Health Care Institutions, 1972:5).

In contemporary society, this tradition has been superseded by the legal opinion that hospitals are basically business corporations and, as such, are subject to restrictions and penalties imposed on other firms.

Hospitals, then, can learn from industry since industry, in comparison, has had a longer history of safety surveillance programs. Some benefits from these programs have been reduced insurance costs, increased efficiency and greater productivity, a more satisfied labour force and a minimal loss of time. Like industry, hospitals with a dedicated management can reduce the number of accidents by controlling unsafe practices and eliminating unsafe working conditions, thereby promoting optimum efficiency and maximizing patient care outcomes.

However, unlike most industries where rigid controls are established for employees and outsiders to safeguard them from potential hazardous areas, the hospital has extra burdens. Not only is it a 24-hour operation, seven days of a week, but it involves the care and safety of patients and must contend with a heavy
traffic of visitors, salesmen and delivery personnel. Moreover, hospitals have the added risk of infection and contamination, besides patient induced injuries, for example, moving and caring for physically dependent and sometimes unpredictable and disturbed individuals involve risk. In addition, with advances in medical research and technological innovations of the past two decades, the very nature of the therapeutic and diagnostic equipment is a hazard to the employee. It is somewhat surprising, in view of the above, that hospitals have not been more concerned with personnel safety than have other establishments.

In most countries, hospital facilities in occupational health and safety are very much behind the times. In England, J.A. Lunn (1975) says:

It is true of most hospitals there is no ready means of assessing injury rates and no methods are established for doing so.

Likewise, this proclivity to minimize the health of hospital staff is evidenced elsewhere, as in Wales:

There is little published information here upon accidents in hospitals. This is partly because, unlike industry, there is no system of safety organization within the National Health Service (Kell, R.L., Personal Correspondence, 18 September, 1979).

In the United States, the need for hospital safety programs has long been recognized. In 1954, the American Hospital Administration and National Safety Council jointly published a "Hospital Safety Manual for Use by Hospital Administrators and
Department Heads" (Safety Guide for Health Care Institutions, 1972, "forward"). During the intervening years, however, advanced technology, new equipment, new facilities, new knowledge regarding such things as hepatitis risks through breaks in the skin, ionizing radiation, etcetera, have presented new hazards. In 1976 Dr. John Finklea, Director of the National Institute of Occupational Safety and Health, U.S.A., in a keynote address to the Canadian Public Health Association at the First National Conference on Occupational Health (1976:44), asked:

Do your hospitals have active programs addressing the hazards encountered by their own workers? One of our greatest failings has been that we have ignored workplace hazards in our hospitals.

The fault seems to be universal. Canadians are not exempt. Though the establishment of a safety committee has been a requirement by the Canadian Council of Hospital Accreditation (1977), there have been very few provincial statutes to make them mandatory until fairly recently, with the enactment of new provincial occupational health and safety acts (refer to Chapter 3).

In British Columbia, there is as yet, no provincial policy covering occupational health. The publication of Richard Foulkes' "Health Security for British Columbians" (1973) formulated what was closest to an occupational health policy for hospital workers:
Recommendation 144 -

A. The director of the present occupational health division be given the responsibility for the establishment of programme standards, etc., to promote occupational health programmes within the province: occupational health programmes be planned immediately for all employees of government, crown corporations and all other institutions financed by government including all public hospitals....

The Workers' Compensation Act came into effect in 1916, and is the major piece of legislation relating to occupational health and safety (Occupational Health in Canada - Current Status, 1977). The Workers' Compensation Board of British Columbia has the power, under the Industrial Health and Safety Regulations (1978) to enforce these regulations in those industries covered by the Act in which the Board holds inspectional jurisdictions, but these regulations do not have the full force of law. Nevertheless, most industries, including hospitals, are required to institute safety programs as stipulated:

(a) a workforce of twenty or more workers, in an industry classified as "A" or "B" hazard by the Board's First Aid Regulation, or

(b) a workforce of fifty or more workers in an industry classified as "C" hazard by the Board's First Aid Regulation


6.2 **TYPICAL HAZARDS**

It is true that hospitals are not prone to have employee
fatalities and major accidents that figure prominently in heavy industry and manufacturing firms. For the most part, they fall into the category of having the subtler type of accidents and minor injuries which go unnoticed until a disease develops, a chronic condition surfaces, or mutagenic and teratogenic effects reveal themselves. Yet in many respects, hospitals like large hotels are self-contained communities having their own repair and maintenance workshops, their own laundry and sewing rooms, their own food service and storage areas, all of which place the workers at risk to innumerable hazards. In these various hospital departments, occupational health and safety hazards are the same as in the trades elsewhere: safety of ladders and work platforms must be observed, dangerous parts of machinery must be guarded, electrical equipment must be efficiently grounded and protected, transportation hazards must be considered.

According to a Canadian survey on "Accidents in Hospitals" (Le Bourdais, 1977) done on acute, extended care and psychiatric hospitals of all sizes, the most common types of accident events were, backstrains, punctures and falls. Most accidents by personnel group were, nursing, kitchen staff and housekeeping. The reasons for the accidents appeared to be careless hurry, judgment error and ignoring safety procedures.
6.2.1 **Infection**

The greatest risk in hospitals is infections. In addition to its medical staff and paramedical personnel, today's hospital labour force includes a wide cross section of support staff. All these persons need to be protected. Until recently, little acknowledgement was made of the vital role played by these employees who contribute a wide variety of skills and services, professional, technical, engineering, ancilliary, administrative and clerical.

All hospital staff are potentially subject to problems and hazards in varying degrees according to their occupation, but those with patient contact are exposed to certain added risks. These risks have generally lessened with the decline in incidence of serious infectious diseases, but are still present where there is a large immigrant or itinerant population, or pockets of poor housing and social conditions, and a related higher incidence of pulmonary tuberculosis.

Staff persons in a hemodialysis or kidney transplant units are at special risk from serum hepatitis. In intensive care or burn units, many patients have received various drugs so that staff may be exposed to drug resistant strains of organisms. Laboratory staff handle infected specimens, and in research laboratories where animals are used there is always the danger of bites and scratches and also of zoonoses (Hamilton, M., 1979:20).
Laundry workers and pathology technicians often have to handle infectious linens and contaminated articles. Housekeeping staff are required to clean and disinfect isolation rooms after a patient is discharged or deceased. Infection is a real concern for people working in hospitals and ought not to be minimized.

6.2.2 Specific Hazards

Some hazards which are unique to hospitals are found in operating theatres. These are oxygen, nitrous oxide, cyclopropane and volatile liquids such as halothane and ether. Explosions sometimes occur. Furthermore, many operating rooms have inadequate ventilation systems. This can lead to heavy pollution by waste anaesthetic gases breathed out by the patient, which is now suspected of being harmful to the health of theatre staff and of congenital abnormalities in their children (Hamilton, M., 1979:21):

Possible etiological factors for the increase in spontaneous abortion among operating room personnel include exposure to low concentrations of anaesthetic gases and x-rays, exposure to viruses, exposure to cleaning solutions used in operating rooms, fatigue from working long hours, and strenuous physical demands. Exposure to anaesthetic gases is considered the most likely factor (Corbett, T.H. 1972:866-890).

Laboratory technicians are exposed to daily hazards. Risks vary according to the type of laboratory, for example, haematology, microbiology, histopathology, biochemistry, nuclear
medicine, animal unit etcetera. Besides direct and indirect patient contact, these technicians work in areas surrounded by risks. These can be cited as; chemical burns, lacerations from broken glass apparatus, dermatitis from handling chemicals, eye injuries from chemical splashes, explosions from chemicals, burns from bunsen burners, dangers from ingesting pipette contents where this technique is still used.

Technicians in the Department of nuclear medicine and medical physics are at particular risk from exposure to ionizing radiation since this work involves the preparation, handling and disposal of radioactive material and sources. Cyanide is used in small quantities in some culture media in laboratory work (Jones, V.E., 1978:26).

A number of other toxic chemicals are used in normal laboratory work. Benzene, toluene, formaldehyde, mercuric chloride are among the substances commonly handled which may be skin irritants. Benzene and toluene have also been associated with bone marrow damage, reproductive problems, liver damage and red blood cell damage (George, A., 1978:15). There is evidence to suggest that acute toxicity to xylene is even greater than the acute toxicity of toluene or benzene (Bush, C.L. and Nelson, G. an Article used in Trail Regional Hospital Laboratory, 1979). Especially important to the histology and cytology technologists is the requirement to have a hood or some type of exhaust system over the area where staining is performed in order to avoid chronic
poisoning brought on by daily contact with the vapours of xylene.

Ionization hazards in the nuclear medicine laboratory is counteracted by three devices; (1) laboratory monitor, (2) patient dose isotope calibrator and (3) film badge that comes from The Atomic Energy Radiation Protection Bureau in Ottawa. This device contains copper and lead which filters direct and indirect gamma or x-rays and records how much a technician receives. A safe level is 40 millirems each month (Searle, R., June 1976). A Radiology Department staff also uses these badges for the same purpose, as radiologists and nursing staff can be exposed to excessive radiation. Over-exposure to radiation is reported to cause leukemia and reproductive difficulties, skin and mouth ulcers, kidney dysfunction, malfunction in the small intestine and nausea (George, A., 1978:15).

Chemical hazards in hospitals are not limited to laboratories. Ethylene Oxide used in Central Sterile Supply areas can cause possible reproductive changes in workers who breathe in the fumes (Rendell-Baker L., and Fredericks, R.J., 24 January, 1979). Many new chemicals coming on the market each year pose their own brand of hazards, affecting pharmacy staff who mix various solutions, and housekeeping staff who use them in cleaning.

In other areas today's hospitals have many advantages of the technological explosion. Up-to-date electronic equipment is used extensively in intensive care units and premature nurseries.
The use of electricity in the care of patients in hospitals introduces the hazards of burn, fire, electric shock and power failure. The more intimate the application of electricity, the more subtle the hazard, and the more critical the protective measures required to assure safety (Walter, C.W., 1969:142).

It is obvious that everyone using electricity in the care of the patient must be highly trained or continuously instructed and supervised.

An area that is usually considered part of the "hazard of the trade," but receives minimal recognition is patient inflicted injuries - nonetheless important for staff who willingly expose themselves to this particular type of risk. These vary in degree from minor injuries to severe wrenches, strains and sometimes even death. While these conditions may arise in any of the clinical areas in hospital, they usually occur when patients are disturbed or uncooperative. In psychiatric wings of hospitals, the injury to an employee generally occurs when a patient is "acting out":

"ACTING OUT" is a polite way to say fighting, but the term also includes such actions as patients injuring themselves, attacking other patients, destroying or damaging property, setting fires, injuring employees, and other unacceptable behaviour, usually involving force (Pederson, T., 1970:121).

In such a potentially harmful situation, it is extremely important that the employee control his temper and feelings, in order to properly evaluate and bring the incident under control without injury to himself or to the patient, or to others. Perhaps the
most effective way to prevent accidents of this nature is through the employee's knowledge of the patient, which includes what behaviour may be expected of him or her. But the danger is ever present and the staff must be thoroughly trained to understand and to handle combative behaviour.

With respect to how much abuse hospital employees must take from patients under their care, the question was tested in court recently. A patient was successfully charged with assault of a nurse on a psychiatric unit of Vancouver hospital, and was placed on probation for one year. In this particular case, it was found that the legal action had beneficial effects on the clinical outcome of the patient who was thus confronted with acceptance of responsibility for her own behaviour (Schwartz, C.J. and Greenfield, G.P. 1978).

6.3. SPECIAL RISKS TO WOMEN

Approximately 60% of hospital employees are female (George, A., 1978:15). These include nurses, doctors, laboratory technicians, cleaning and laundry staff, dieticians, aids and physiotherapists, plus clerical staff. There is no evidence to suggest that women are more susceptible than men to either infections or injuries encountered in hospitals:

The only exception for women workers is one related to pregnancy. There is no doubt that there are special risks in pregnant and nursing women exposed to ionizing radiation, to toxic chemicals, and to strenuous physical exertion (Mastromatteo, 1976:13).
There is need, however, to consider more carefully such things as machines and lifting equipment used in hospitals to suit an average woman's height, weight and frame.

6.4. **LABOUR IMPACT**

Hospitals are in the main a "people service". Labour now accounts for 69-83% of an acute care hospital's total budget. The numbers of health care workers have now increased to the point where there are almost three employees per patient bed (MacDonald, H.D., 1976).

Hospitals have a great deal of catching up to do as far as occupational health and safety are concerned. It would be prudent of them to initiate action in this direction rather than have labour demand their rights. From labour's point of view, enlightened self interest might open up new vistas in occupational health and safety that would in the long run, serve both management's and labour's interests and promote a better climate and increased production.

Health is a fundamental human need, as the constitution of WHO recognized more than thirty years ago. It should be pursued for itself and not only as a bargaining item. The well-being of people, in general can only be achieved by way of an approach to health that is oriented to the needs of working people who make up the bulk of the population. An occupational health and safety
program in a hospital ought to be considered an essential service and high priority.

It is indeed a sad commentary on today's values that the focus appears to be on the conservation of the world's "natural" resources rather than on our human resources. And in many modern hospitals, machines take precedence over personnel.

**Conclusion**

It has been observed that hospital hazards are in some respects similar to those found in industry. Many are attributable to "hotel-type" functions carried out in hospitals. Special hazards are characteristic to specialized areas. Infection and patient care risks, not normally problems in industry, are added hazards peculiar to health care institutions.
CHAPTER 7

THE STUDY AREA

7.1 Trail, British Columbia

Trail, British Columbia known as the "Silver City" is located in the south-eastern part of the province in the Kootenay Boundary Regional Hospital District (Figure 4). It was established in 1895 following the discovery of gold in Rossland, initially serving as a landing point on the Columbia River to service the mines along the pack trail up Trail Creek. Trail is the only survivor of the early smelter towns at the turn of the century in the Kootenays, its future assured by the unlocking of the lead and zinc ores from the nearby Sullivan Mines in Kimberley. Cominco Limited in Trail, reputed to be the world's largest non-ferrous smelter and the economic mainstay of the region, has been deeply involved in the community life of the town it spawned -- its generosity exemplified in many beautification programs, recreational and education facilities donated to the city.

The City of Trail was incorporated on June 14, 1901 and today has a population of 12,000 and services an area of 25,000. The multi-ethnic composition of the city and surrounding districts, predominantly Italian, Anglo-Saxon and Russian Doukhobor reflects a cosmopolitan atmosphere. The annual International Folk Festival is a well attended attraction. The climate is modified continental
Regional Hospital Districts of British Columbia

Source: Division of Health Services Research and Development University of B.C.
with low humidity, above average sunshine, some rain and heavy snow at the higher levels. The average temperature ranges from \(-15^\circ\text{C}\) to \(35^\circ\text{C}\). Trail is on the southern Trans-Provincial Highway No.3, has twice daily air service from Castlegar Airport to Vancouver and Calgary, and direct Greyhound bus service once a day with a shuttle service connecting the greyhound bus service with Trail twice a day. Vancouver and Calgary are equidistant from Trail—approximately 450 miles. Trail is also the medical centre of the British Columbia southern interior. It has two private medical clinics, the West Kootenay Health Unit, and the Regional District's 237 bed hospital, besides a good representation of the province's health professionals (Trail District Chamber of Commerce, 1978).

7.2 Trail Regional Hospital

The Trail Regional Hospital stands as a monument to the early pioneers of the city and in particular to Dr. Douglas Corsan, the first physician to set up practice in the area in 1896. The first hospital was part of his home and office. In 1906 a building was erected, the present Park Hotel, which served as Trail's only hospital for twenty years. With the expanding facilities of the smelter matched by the increase in the size of the town, the need for increased hospital facilities also grew. In 1926 a 50 bed hospital was built by Cominco at the corner of Cedar Avenue and Victoria Streets. A hospital society was formed under the chairmanship of
Mr. S.G. Blaylock, general manager of the consolidated Mining and Smelting Company. Mayor Herbert Clark became the first president of the hospital. When a new wing was added to the hospital in 1932, the bed capacity was increased to 129.

The present hospital complex, then called the Trail-Tadanac Hospital, was built in 1954, on the east side of the Columbia River with a bed capacity of 150 and at a cost of $2,250,000 (Figure 5). It housed separate facilities for the departments of pathology, radiology and physiotherapy, and provided a centralized laundry and dietary service. With the Regional District Hospital Act (1967), the Trail-Tadanac Hospital assumed the role of the regional referral centre and in 1969 officially became the Trail Regional Hospital. The catchment area comprises the East and West Kootenay regions and includes Grand Forks and Greenwood. Two new wings were added in January 1970; a 50-bed extended care unit, and a regional pathology laboratory, below which there is a 24-bed psychiatric unit.

Many new services were incorporated in the years following. A renal dialysis unit which began in a modest way in 1968 was gradually being improved. It was one of the first to be set up outside the lower Mainland. In 1971 an electrodiagnostic service was started. Both nuclear medicine and a social service department were added in 1973. By this time, an intensive care unit was also started on a 4-bed ward on the surgical floor. A pulmonary department to work with the rehabilitation services was begun in 1974. This year also marked the
Figure 5

TRAIL REGIONAL HOSPITAL

Source: Trail Regional Hospital Annual Reports
official opening of the Nuclear Medicine Laboratory on the main floor, and the establishment of a coronary pulmonary rehabilitation unit on the second floor. The newest section of the hospital built over the pathology department was completed in February 1975. It comprises the new 7-bed intensive care unit and a separate 3-bed renal care unit. It is in these two units that advances in medical technology over the past few decades are most apparent. These additions have brought the capacity of the hospital to 237 beds and 22 cots.

According to the Master Plan (1973), the dietary department was re-organized and renovated in June 1976. Phases II and III of the Master Plan are now in progress. A complete renovation of the operating room theatres, post-anaesthetic room facilities and central supply room are planned. The emergency department will be enlarged and out-patient facilities will include 3 day care surgical beds. All electro-diagnostic and radio-isotope services will be centralized on the main floor. When completed the redistribution of beds will be as follows: 46 medical, 87 surgical, 15 pediatric and 13 obstetrical, 50 extended care, 24 psychiatric (Trail Regional Hospital, Master Plan, 1978).

7.2.1 Occupational Health Services

Prevention in health care of hospital employees has been practiced at the Trail Regional Hospital since the latter part of 1972. At that time an occupational health service on a part time
basis was instigated by the local medical health officer, Dr. N. Schmitt. Then in July, 1974, the hospital administrator Ross Cavey, influenced by R. Foulkes' recommendation in "Health Security for British Columbians" (1973), offered a full time occupational health service to the employees. In June, 1975 the duties of infection control officer were added to the occupational health department. Notwithstanding, a comprehensive program of promotion of health, prevention, protection and counselling was carried out. However, with budgetary constraints in 1979, this service was cut back to three days a week.

It appears that preventive services for employees in hospitals are still low priority. This status is almost certain to continue as long as governments at all levels view occupational health as a "fringe benefit" rather than an essential service (G. Shoblom, January 1979).

7.2.2 Safety Committee

The Trail-Tadanac Hospital Safety Committee was organized on November 16, 1967. From its inception until 1969 it appeared actively involved with its stated functions. From 1969 to 1971 there seems to have been a period of inactivity. The absence of records of this earlier time make it difficult to reconstruct the setting into which the present safety committee emerged. On May 26, 1971, urged by the Workers' Compensation Board, the safety committee was reactivated and re-named
The Trail Regional Hospital Safety Committee (Trail Regional Hospital Safety Committee minutes 1971).

7.2.3 Infection Control Program

In accordance with national standards recognized and established by the Canadian Council of Hospital Accreditation, the Trail Regional Hospital has had an infection control program for many years.

The purpose of the program is:

- to maintain a bacterially controlled hospital environment;
- to facilitate patient and staff well-being;
- to insure an uninhibited progress in the patient's condition.

The infection control program is the responsibility of the Infection Control Committee which comprises; the medical health officer, the hospital administrator, a pathologist, a surgeon, a medical doctor, a representative from nursing, the housekeeper, the infection control officer and the dietician. The infection control officer is directly responsible to the medical health officer and the hospital administrator with duties pertaining to the surveillance of patients, personnel and environment (Trail Regional Hospital Orientation Pamphlet for Employees, no date).
7.2.4 **Union Representation**

There are four bargaining associations represented in the Trail Regional Hospital. These are:

2. Hospital Employees Union.
3. International Union of Operating Engineers.
4. Registered Nurses' Association of British Columbia.

It is a condition of employment that employees join the union or association whose certification they come under, and remain members of those organizations throughout their employment (Trail Regional Hospital Orientation Pamphlet for Employees - no date).

7.2.5 **Board of Trustees**

The governing body, or Board of Trustees, of the Trail Regional Hospital comprises 12 local community appointees representing Trail and the surrounding areas. The City of Trail is represented by 6 members. The villages of Warfield, Montrose and Fruitvale have one member each. There is one member who represents the Kootenay Boundary Regional Hospital District and one member who represents the Women's Auxiliary to the Trail Regional Hospital. There is also a provincial government's representative to complete the total of twelve (Trail Times, 6 January, 1975:4).

The Trail Regional Hospital has been an accredited hospital for over twenty years, having met the standards of service laid down by the Canadian Council on Hospital Accrediation. It has
maintained this status during the period of the study 1970 - 1976 (Trail Regional Hospital Administration and Annual Reports, 1970 - 1976). These standards are revised periodically and the hospital is surveyed every 3 years to insure that it still warrants accreditation status.

Table 3 shows the annual statistics for the Trail Regional Hospital, 1976 (Trail Regional Hospital Administration, 1976).

TABLE 3
Annual Statistics for the Trail Regional Hospital, 1976

| TABLE 1 |
|---|---|
| Beds - Acute Care | 175 |
| - Newborn | 22 |
| - Extended Care | 62 |
| Admissions - Adults and children | 5,923 |
| - Newborn | 298 |
| - Extended Care | 35 |
| Births | 298 |
| Patient Days - Adult and children | 49,154 |
| - Newborn | 1,852 |
| - Extended Care | 22,815 |
| Average Days Stay - Acute Unit | 8.3 |
| Occupancy Rate | 77% |
| Personnel (Full Time Equivalent) | 404 |
| Surgical Procedures | 2,987 |
| Electrocardiograph Exams | 2,763 |
| Electroencephalograph Exams | 506 |
| Emergency Treatments - out | 5,153 |
| - in | 342 |
| Physiotherapy Treatments | 20,632 |
| Occupational Therapy | 1,771 |
| Radiological Exams | 10,470 |
| Nuclear Medicine Units | 383,230 |
| Laboratory Units | 2,532,857 |
| Gross Expenses | $7,571,256 |
| Salaries Expenses | $5,839,815 |
| Social Service Visits | 1,814 |
| Auxiliary Members | 166 |
| Volunteer Hours | 9,146 |

Source: Trail Regional Hospital Administration
Figure 6 shows the Trail Regional Hospital Organizational Chart.

Conclusion

The Trail Regional Hospital, in 1976, had 237 beds. It is located in the Kootenay Boundary Regional Hospital District but serves the East and Central Kootenays as well. It is one of eleven public general hospitals in British Columbia with a bed capacity of 200-299 (Canadian Hospital Directory, 1977:23). With an annual payroll in excess of 500 persons, it was deemed possible that an examination of employee injuries at the Trail Regional Hospital might serve some useful purpose.
Figure 6

TRAIL REGIONAL HOSPITAL ORGANIZATIONAL CHART

Source: Trail Regional Hospital Administration
CHAPTER 8

RATIONALE AND OBJECTIVES OF THE STUDY

8.1 Occupational Health Concerns in Hospitals

The growth of the hospital industry started in 1948 when national health grants for hospital construction were available following submission of a provincial plan. By the mid 1950's, the provinces needed support to meet operating costs. In 1957 and 1966 further cost-shared programs helped to train health professionals and to run acute care hospitals. In 1957 The Hospital Insurance and Diagnostic Services Act was set up with fairly rigid criteria, but these were abandoned in 1966 when the Medical Care Act was introduced and passed. The National Health Insurance Plan in 1967 made medical coverage available to all and great changes took place as the supply created the demand. Thus overcrowding with intensified utilization of services, shortage of nursing staff, many innovations and new therapeutic procedures made the hospital environment a potentially hazardous place in which to work.

In British Columbia, hospital insurance was introduced in 1951 and the British Columbia Medical Plan has operated since 1965. The Federal Government stopped the cost-sharing construction grant in 1970. Consequently, fewer smaller hospitals are being built. However, there is a trend in the lower mainland of British Columbia to concentrate on larger tertiary care facilities and to consolidate
special therapy equipment in these hospitals. This seems to be a move in the right direction as it eliminates costly duplication. At the same time, occupational health concerns for workers in these institutions have not kept up with the demands expected of them in this changing milieu.

Hospitals as an industry employ many workers of various categories. They constitute the fourth largest business in the United States according to Perrow (1960). In Canada, the picture parallels that of the United States. British Columbia has half of the health care personnel employed in the public hospital system—a total of 20,300 employees. Private hospitals employ 1,900 persons (Foulkes, 1973). With the introduction of the Long Term Care Program in 1978, other facilities such as personal care homes, long term care and intermediate care institutions were built, increasing the number of people working in health care facilities.

There are indications that injuries due to accidents are occurring with increasing frequency in the work environment of British Columbia hospitals. The Workers' Compensation Board reports that over a seven year period from 1970 to 1976, hospital employees' paid total injuries rose from 744 to 2,254. out of which back injuries were 256 in 1970 to 810 in 1976 (W.C.B. Finance Department 1970 - 1976).

Considering that safety programs are mandatory in all establishments employing more than 50 persons (Industrial Health and
Safety Regulations, W.C.B. 1978, Section 4.04), regarding hospitals, the questions arise: to whom do these figures apply? what kinds of accidents are they? why are they occurring? and what can be done about the situation?

Other questions as to cause may be pondered. Are there more employees at risk than there were previously or are there more hazards in the hospitals? Are there too few people to care for the number of patients, or are there too many "chiefs" and not enough "indians". The extent of the problem can only be clarified by professional involvement and adequate research.

While the accidents which occur to hospital employees, for the most part, may not have the drama or the urgency of some industrial accidents, nonetheless they are of great concern as they account for many lost days of production and much human suffering and discontent.

8.2 Rationale

This study bases its justification on the needs; (a) for an effective safety program in hospitals in order to reduce the number of injuries sustained by employees and (b) to promote a comprehensive occupational health and safety program as being of significant benefit to the institutions.
8.3 **General Objectives**

This study will attempt to throw light on accident trends in a medium-size public general hospital in a seven year study of injuries sustained by employees which will identify the frequency and type of accident, so that measures can be taken to prevent or reduce the numbers occurring. It also proposes to measure the impact of an employee safety program and to develop guidelines for a hazard control program based on an epidemiological model.

In addition, it is hoped the findings will indicate further possible studies to be conducted in a field yet barely explored.

8.4 **Specific Objectives**

It is possible to delineate frequencies, trends and associations from primary data, which give rise to the following questions;

1) Who are having the accident? What Department?
2) Where are the accidents occurring? In what area?
3) When are the accidents occurring? Time of day, time of year?
4) How are the accidents happening? What are the external causes?
5) What parts of the body are involved?
6) What is the nature of the injuries?
7) Is there a relationship between age and number of accidents?
8) Is there an association between length of employment and the number of accidents?

9) What effect has a safety program on controlling the number of accidents?

Conclusion

With over 20,000 people employed in the public hospital system in British Columbia, it seems fitting to investigate some of the causes of injuries sustained by hospital personnel.
CHAPTER 9

DESIGN AND METHODOLOGY

The study is a descriptive analysis of injury trends of employees in a medium-size public general hospital in British Columbia for the seven year period from 1970 to 1976. It is primarily descriptive inasmuch as the epidemiologic characteristics of injuries sustained are described. It is also a retrospective study as it depends upon data already existing. The design of the project has three sections which are linked together in an overall epidemiologic framework. This tri-partite approach addresses; first, an epidemiologic investigation; secondly, an evaluation of a safety program; and thirdly, an epidemiologic model of accident causation used in a hazard control program.

9.1 Tri-partite Approach

1. Epidemiologic Investigation

In examining the distribution and determinants of the recorded injuries, several procedures are possible. Frequency rates were selected for measuring injury experience of the various departments of the hospital so that comparisons could be made of the distribution of injuries by persons, time and place. An attempt at identifying causation was made by listing external causes of injuries, nature of the injuries and parts of the body
involved. In analyzing the objective data, contingency tables were used to investigate associations between the number of accidents and the independent variables of age and length of employment.

2. Program Evaluation

(a) To investigate the effectiveness of an existing safety program, research into the early history of its predecessor was necessary. A small questionnaire was distributed to former members of the original committee and the results were analyzed (Appendix A). The goals and activities were then reconstructed to determine the success of achieving objectives. It was established that the new safety committee was formed on May 26, 1971. A quasi-experimental design was then set up on a "before and after" pattern and the number of accidents before and after the institution of the safety program was compared. The basic comparisons were of injury rates of the departments for the two years from 1970 to 1971 to the period after the program took effect, arbitrarily using the period from 1972 to 1976.

(b) A documentary analysis of the Trail Regional Hospital Safety Committee minutes and other records was done in an attempt to link events in the external environment which could affect the injury rates before, during and after the intervention program.
(c) A third strategy used in the program evaluation was to compare safety committees of similar size public general hospitals in British Columbia for their reported numbers of injuries in the same period of time between 1970 to 1976; the figures to be obtained from the Workers' Compensation Board of B.C.

3. Use of An Epidemiological Model for a Hazard Control Program

Having explored the distribution and determinants of employee injuries, developing guidelines for an effective hazard control program was made possible by using the principles of epidemiology; (a) making the host more resistant, (b) making the agent less effective and (c) placing a barrier in the environment (Figure 3).

9.2 Definitions

Medium-size public general hospital - For this study, "medium-size" refers to hospitals which have a bed capacity of 200 to 299 (Canadian Hospital Directory, 1977:23): "public hospital' is defined as:

one which "is not operated for profit, accepts all patients regardless of their ability to pay, and is recognized as a public hospital by the province in which it is located" (Canadian Hospital Directory, 1977:54).

"General" refers to the beds normally set up for use, including medical and surgical, obstetrical, intensive care, coronary care, paediatric, urological, gynecological and neurological (Canadian
In British Columbia there are eleven hospitals that fit into this category - nine with "lay" boards and two with "religious" sponsorship.

**Injuries** - These are recorded accidents according to the Workers' Compensation Board regulations, both "medical aid only" cases or "time loss" accidents, and must be reported within three days of the occurrence.

**Employees** - These are employed persons of the hospital, hired on a full-time, permanent part-time or casual basis, excluding nursing or medical students and volunteers.

**Equivalent persons or full-time equivalents** - These represent the man-hours worked by one (or more) employee in a single two-week period of 75 hours. It is obtained by dividing the total paid hours in each pay period by 75 - being the total hours an employee is paid. If computed for a month, it is arrived at by dividing total paid hours by 163.125 hours rather than 150 hours which is a four week period. When computed for a year, it is arrived at by dividing total paid hours by 75 hours multiplied by 26 pay periods.

Hospitals in B.C. who have their payroll processed by the British Columbia Health Association use the same accounting system using "equivalent persons" (T.R.H. Accounting Department, 1978). For the purpose of this study "equivalent persons" will indicate a set period of employee exposure to occupational hazards at the hospital
(or on the premises if in line of duty) and will be used as the denominator in calculating injury rates for the various departments.

**Number of pay cheques issued** - This represents the number of people receiving pay cheques in each single two-week pay period and is a better indicator of the number of persons at risk at any one time, than "equivalent persons".

**Trend** - This refers to a general direction or tendency.

### 9.3 Abbreviations

- **E.P.** - Equivalent persons
- **N.P.I.** - Number of pay cheques issued
- **V.T.** - Vacation time
- **S.L.** - Sick leave
- **W.C.B.** - Workers' Compensation Board
- **M.A.O.** - Medical aid only
- **T.L.** - Time loss
- **T.R.H.** - Trail Regional Hospital

### 9.4 Sources of Information for the Study

**Data Collection** - The Workers' Compensation Board form No. 7 is the "Employer's Report of Injury or Industrial Disease." The total number of injuries recorded for the years 1970 to 1976 was 561, both "time loss" and "medical aid only" accidents (duplicate forms retained at
T.R.H.) The data were analyzed using the computer Statistical Package for the Social Sciences, at the University of B.C. (Nie et al, 1975).

Other Sources of Information - The Workers' Compensation Board of British Columbia provided the lists of industrial injuries for the years 1970 to 1976 as well as the number of injuries incurred in eleven medium-size public general hospitals of B.C. for the years 1970 to 1976, together with notations on their safety committees.

The Trail Regional Hospital Administration made available the Annual Reports for the years 1970 to 1976 and the Joint Management minutes starting from 1967, including the "Master Plan" for renovations. The accounting department furnished information on personnel data - equivalent persons, for the period of the study, 1970 to 1976 as well as information regarding the number of pay checks issued for a sample 75 man-hour work period in August for the years, 1976, 1977 and 1978. Payroll information on social security numbers was used for coding injuries, as this identified accident repeaters as well as those persons with name changes. This information filled in some gaps on the W.C.B. form No. 7 such as starting dates of employment, inaccurate birth dates and changes in occupation within the hospital. The Trail Regional Hospital Safety Committee minutes from 1970 to 1976 were helpful in the documentary analysis. As well, the Trail Regional Hospital Orientation Pamphlet furnished additional information.
9.5 Population

The population at risk consists of approximately 500 employees reported on the payroll. Total recorded injuries were 561 for the period of seven years, 1970 to 1976. This sample is self selected and may involve a number of accident repeaters. Marital status was difficult to determine at any one time as frequent name changes occurred - some reported and some not. Though males are usually in the minority in hospitals, this was also difficult to determine at any one time, as relief persons could be anyone available, and counted in as "equivalent persons". Therefore, the sex ratio would perhaps be meaningless in this study. Length of employment also posed problems, as some employees terminate for a time then are re-employed and perhaps change their status from full time to permanent part-time or casual relief. Employees also take maternity and educational leave. To complicate matters, after 90 days leave, the employee is re-classified as of changed status. For the purpose of the study, the length of employment was considered the period from the starting date of employment to the time of the accident.

9.6 Assumptions

1. That all employees are basically healthy and are able to function at optimum efficiency. In lieu of a pre-medical examination, a health assessment is done at the time of hiring. This includes taking a medical history, eye and hearing test, blood pressure reading
and routine blood and urine tests.

2. That all employees at work who report injuries, are in fact, injured as they fill out Workers' Compensation Board forms for compensable reasons. They are asked to complete these forms as accurately as possible giving details of the accident. The employer is required to submit a report within three days. Failure to do so is an offence and may result in the employer being charged with paying the cost of the claim.

3. That all accidents that occurred for the years 1970 to 1976 were recorded.

4. That all employees on vacation or sick leave were not exposed to occupational risks at the hospital.

5. That all employees will avoid occupational hazards if possible and will curb unsafe acts and report unsafe conditions to management.

9.7 Limitations

1. Use of retrospective data is usually free from bias as at the time of recording of the injury, there is no prior knowledge that the information will be used for a study. However, bias may be present as the sample is a self selected group of individuals who report accidents from a population of approximately 500 hospital employees.
2. In the smaller departments, injury rates seem out of proportion to the larger departments in the hospital.

3. The recorded data allows for limited control over extraneous variables that may influence the number of accidents. Also environmental factors and predisposing factors that led up to the accident are not always recorded, making the causal mechanism difficult to ascertain.

4. There may be recording errors by employees, especially if they are under stress. Inaccuracies and omissions of detail can occur when injuries are reported up to three days after the event.

5. There may be the researcher's errors in transcribing the raw data and in coding.

6. There may be mechanical errors in computer input.

7. "Equivalent persons" excludes the half-hour allotted for meals, but accidents occurring during this time are recorded as happening on duty. It also excludes the time before or after reporting for duty, but during these periods, accidents are recorded as happening on duty, as they occur on the premises.

8. Each of the 561 observations of recorded injuries does not necessarily represent the number of different individuals.

9.8 Ethical Considerations

The study used retrospective data and was non-experimental and used no names of persons or hospitals, besides the Trail Regional
Hospital. Therefore, permission to proceed with the study was granted by the administration of the Trail Regional Hospital.

9.9 Method of Computing Injury Rates

Frequencies were first calculated from the demographic data supplied by the W.C.B. form No. 7.

In order for a count to be descriptive of a group it must be seen in proportion to it. In other words, it must be divided by the total number in the group. Percentage, or number per hundred, is one of the most common ways of expressing proportions. Number or rates per one thousand or one million, or any other convenient base may be used:

...one of the central concerns of epidemiology is to find and enumerate appropriate denominators in order to describe and to compare groups in a meaningful and useful way (Friedman, 1974:8).

The commonly used Disabling Injury Frequency Rate relates injuries to the hours worked during the period and expresses them in terms of a million-hour unit by use of the following formula:

\[
\text{Disabling Injury Frequency Rate} = \frac{\text{number of disabling injuries}}{\text{employees hours of exposure}} \times 1,000,000
\]


However, since the T.R.H. injury rates were meant only for internal comparisons, and also to keep the figures small, the American Standards Association Method was not used.
In search of an appropriate denominator to compute injury rates, and failing to obtain any records denoting "number of pay-checks issued" during the seven year period from 1970 -1976, the annual December year-to-date "equivalent persons" were used (minus V.T. and S.L.) since they were the only available official records found at the hospital depicting staff allocation for each department. However, no statistical records could be found for the year 1972. To overcome this difficulty, the December year-to-date E.P.'s for 1971 and 1973 were averaged for each department and the resultant means were used as the 1972 figures. Fortunately, the Trail Regional Hospital fiscal year and calendar year coincided during the seven years of the study, but was changed shortly after.

To compute the injury rate, then, for each department for each of the seven years, the total number of injuries for the year was divided by the "equivalent persons" in that particular department.

Having done this, the researcher was confronted with the question, does "equivalent persons" or employees hours of exposure accurately reflect the number of individuals at risk to occupational hazards? For example, one E.P. could represent one person at work for seven and a half hours a day for ten days. It could also mean three persons working two and a half hours a day for ten days. The potential for more accidents may not be any greater in the latter case, but certainly there are more people at risk over the same
Thereupon the researcher was advised to seek further information whereby some recent statistics denoting both "equivalent persons" and "number of pay cheques" issued could be applied to the period of the study, 1970-1976, with a view to adjusting the injury rate in order to more accurately reflect manhour exposure as well as number of persons at risk. With the assurance that the payroll at the Trail Regional Hospital has been fairly constant over the years, a sample 75 man-hour work period with E.P.'s and N.P.I.'s was obtained (Parisotto, R. and Saunders, B. in November 1978). This "table" depicted the corresponding two week period in August for the years 1976, 1977, 1978. The number of pay cheques issued were considerably more than the numbers of "equivalent persons". Overtime was also noted in the departments showing fewer N.P.I.'s than number of E.P.'s.

Using this table, first, all overtime was converted into straight time by subtracting N.P.I. from E.P. and multiplying by 2/3 (time and a half) and adding the excess to the straight time. When each set of pairs was converted for the three years 1976, 1977 and 1978, a ratio of E.P. to N.P.I. was calculated by adding the E.P.'s for three years and dividing by the sum of the three N.P.I.'s for the three years. Table 4 shows the August figures for 1976, 1977, 1978 corrected for overtime, along with the ratio.
Table 4
Trail Regional Hospital
Number of Pay Cheques Issued to Departments
Per 75 Manhour Work Period (Equivalent Persons).
(Corrected for Overtime)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E.P.</td>
<td>N.P.I.</td>
<td>E.P.</td>
<td>N.P.I.</td>
</tr>
<tr>
<td>Housekeeping</td>
<td>34.6</td>
<td>43</td>
<td>30.9</td>
<td>35</td>
</tr>
<tr>
<td>Nursing</td>
<td>237.5</td>
<td>295</td>
<td>224.1</td>
<td>275</td>
</tr>
<tr>
<td>Dietary</td>
<td>935.4</td>
<td>44</td>
<td>34.9</td>
<td>45</td>
</tr>
<tr>
<td>Administration</td>
<td>27.0</td>
<td>34</td>
<td>30.2</td>
<td>32</td>
</tr>
<tr>
<td>*Radiology</td>
<td>6.07</td>
<td>6</td>
<td>6.5</td>
<td>7</td>
</tr>
<tr>
<td>*Maintenance</td>
<td>13.73</td>
<td>13</td>
<td>13.8</td>
<td>14</td>
</tr>
<tr>
<td>Laundry and Linen</td>
<td>11.4</td>
<td>13</td>
<td>11.3</td>
<td>15</td>
</tr>
<tr>
<td>*Laboratory</td>
<td>25.5</td>
<td>26</td>
<td>25.0</td>
<td>29</td>
</tr>
<tr>
<td>*Rehabilitation</td>
<td>11.6</td>
<td>12</td>
<td>9.2</td>
<td>10</td>
</tr>
<tr>
<td>*Pharmacy</td>
<td>2.0</td>
<td>2</td>
<td>2.07</td>
<td>2</td>
</tr>
<tr>
<td>Medical Records</td>
<td>5.6</td>
<td>7</td>
<td>5.3</td>
<td>6</td>
</tr>
<tr>
<td>*Nuclear Medicine</td>
<td>4.07</td>
<td>4</td>
<td>3.0</td>
<td>5</td>
</tr>
<tr>
<td>Social Service</td>
<td>2.2</td>
<td>3</td>
<td>2.7</td>
<td>3</td>
</tr>
<tr>
<td>*E.E.G.</td>
<td>2.0</td>
<td>3</td>
<td>3.27</td>
<td>3</td>
</tr>
<tr>
<td>*Pulmonary</td>
<td>1.07</td>
<td>1</td>
<td>1.0</td>
<td>2</td>
</tr>
</tbody>
</table>

* Corrected for Overtime
The ratio was then applied to the previous injury rates which had been computed with "equivalent persons" as the denominator. The ratio divided by 26 (for an annual rate) multiplied by the old rate produced an adjusted rate which reflects better the numbers of employees exposed to hospital hazards. Annual injury rates per 1000 for departments, for the years 1970 - 1976, are listed in Table 5.

As long as the departmental comparisons were on a one-to-one basis, this new injury rate worked rather well. However, if a combination of departments were considered as services (Hospital Statistics and Administration of the Hospital Act, 1971:23), it was first necessary to use the formula:

$$N.P.I. = \frac{E.P. \times 26}{\text{RATIO}}$$

Then to obtain rates for services, the following formula was used:

$$\text{Injury Rates} = \frac{\text{sum of (number of accidents for Dep'ts for each year)}}{\text{sum of (N.P.I.'s for Dep'ts. for each year)}}$$

These injury rates per 1000 for services were used in comparing services, as well as in the "Before and After" exercise.

**Conclusion**

Proportions, expressed as rates, are tools frequently used in epidemiology. Therefore, the injury rates of hospital employees were examined by departments and services for the period 1970-1976. Frequency Tabulations were done to determine distribution for
Table 5
Trail Regional Hospital
Annual Employee Injury Rates per 1000 for Departments
For the years 1970 - 1976

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Housekeeping</td>
<td>14.0</td>
<td>22.4</td>
<td>27.7</td>
<td>18.5</td>
<td>13.8</td>
<td>19.4</td>
<td>7.0</td>
<td>17.4</td>
</tr>
<tr>
<td>2. Nursing</td>
<td>5.0</td>
<td>4.3</td>
<td>6.7</td>
<td>6.9</td>
<td>7.2</td>
<td>7.2</td>
<td>6.0</td>
<td>6.2</td>
</tr>
<tr>
<td>3. Dietary</td>
<td>15.1</td>
<td>17.3</td>
<td>24.6</td>
<td>12.3</td>
<td>25.3</td>
<td>20.8</td>
<td>7.2</td>
<td>17.7</td>
</tr>
<tr>
<td>4. Administration</td>
<td>4.9</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>5.3</td>
<td>3.9</td>
<td>4.0</td>
<td>2.9</td>
</tr>
<tr>
<td>5. Radiology</td>
<td>11.4</td>
<td>0</td>
<td>7.6</td>
<td>0</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>6. Maintenance</td>
<td>4.3</td>
<td>4.3</td>
<td>35.4</td>
<td>3.6</td>
<td>11.5</td>
<td>6.7</td>
<td>13.5</td>
<td>11.3</td>
</tr>
<tr>
<td>7. Laundry</td>
<td>0</td>
<td>3.1</td>
<td>13.0</td>
<td>0</td>
<td>6.7</td>
<td>3.4</td>
<td>0</td>
<td>3.6</td>
</tr>
<tr>
<td>8. Laboratory</td>
<td>0</td>
<td>2.0</td>
<td>3.7</td>
<td>0</td>
<td>13.5</td>
<td>2.8</td>
<td>2.8</td>
<td>3.8</td>
</tr>
<tr>
<td>9. Rehabilitation</td>
<td>0</td>
<td>0</td>
<td>5.7</td>
<td>0</td>
<td>0</td>
<td>11.5</td>
<td>11.1</td>
<td>4.7</td>
</tr>
<tr>
<td>10. Pharmacy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Note: Medical Records, Nuclear Medicine and Social Service reported no injuries during this period.
persons, time and place; cross tabulations were also computed to establish relationships between the number of accidents and age category and length of employment.

The Trail Regional Hospital Safety Committee was evaluated according to; a "before and after" comparison of injury rates following the intervention of a safety program; a documentary analysis of events; and a comparison to other safety committees in similar size hospitals in B.C.

Lastly, the use of an epidemiologic model in reducing the number of injuries was explained. From the findings of the study, it was possible to formulate prevention strategies directed towards target persons, places and time periods.
CHAPTER 10

RESULTS AND DISCUSSION:

1. Epidemiologic Investigation

Employee injuries recorded over the seven year period from 1970 to 1976 were examined separately by department, site of accident, time of day and year, and type of accident in order to gather information which would attempt to reduce the numbers occurring.

Occupation or category of personnel was not differentiated within each department in this study owing to its exploratory nature, but departments were compared. Figure 7 shows which departments are having the most injuries. Nursing being the largest group appears to be the leader with 46.3 percent. However, when rates are calculated according to staff allocation, the trend indicates other departments have definitely higher rates as illustrated in Figure 8. For the total seven year period, it is evident that dietary with 17.7 per 1000, housekeeping with 17.4 per 1000 and maintenance with 11.3 per 1000 are in the lead. Nursing's average total injury rate is 6.2 per 1000. Table 5 presents the accompanying annual employee injury rates per 1000 for the years 1970 to 1976, from which the average totals are derived.

Services were also compared. According to Hospital
Figure 7

Trail Regional Hospital. Frequency Distribution of number of Employee Injuries According to Departments, for the period 1970-1976.
Figure 8
Trail Regional Hospital. Average Total Employee Injury Rates per 1,000 According to Departments, for the period 1970-1976.

(Medical Records, Nuclear Medicine and Social Service recorded no injuries for the period 1970-1976)
Statistics and Administration of the Hospital Act (1971:23), four groupings of; Nursing and Special Services Department; Administration; other General Services and Physical Plant are advocated.

Nursing and Special Services include the departments related to patient care and entail a degree of professional competence and technical expertise, such as; radiology, nuclear medicine, rehabilitation, laboratory, pharmacy, social service, etcetera. In the case of the Trail Regional Hospital, nuclear medicine and social service were only added in 1973. And though they both recorded no accidents for this period to the end of 1976, nevertheless, injury rates would have to consider the numbers of their personnel in the yearly calculations when combined in special services.

The Administration Department incorporates; management personnel, business office and clerical staff, as well as the payroll officer, purchasing and stores, switchboard, admitting, and the medical records department. Medical records reported no injuries for the seven years period from 1970 to 1976, but here again, the numbers of their personnel were calculated in the annual injury rates for Administration.

The General Services refer to support staff in the dietary, housekeeping and laundry. They generally operate with hotel-type functions and are necessary for the smooth running of the system.
Plant and Maintenance include a variety of skilled trades, such as boiler-room engineers, electricians, carpenters and painters, and often have the responsibility of security guard in medium-size hospitals.

Table 6 compares the services by using the annual injury rates per 1000 for the years 1970 to 1976. The corresponding graph in Figure 9 show the three services, except Administration, having a sharp rise in injury rates in 1972. This may be attributed to better reporting of accidents after the inception of the safety program in mid 1971. In 1973 there is a general drop in recorded injuries except for Administration which had an increased rate of 1.5 per 1000, having had zero accidents in the previous two years. In 1974 all four services recorded increased rates, but from thereon the injury trend appears to gradually lower or level off, except Plant and Maintenance. This department being a relatively small force in numbers tends to show an erratic pattern, even when accidents are not frequent. On the other hand, there may be too few people to cover an increased work load with the expansion program that has been underway since 1974 at the hospital. It may be argued that understaffing can be responsible for some accidents. Yet, with the addition of new services and facilities starting in 1973, the increased number of "equivalent persons" per department may have some effect on the number of accidents. In 1973, 1974, 1975, and 1976, the "equivalent persons" were 326, 342.1, 363.3 and 363.2 respectively.
Table 6
Trail Regional Hospital
Annual Employee Injury Rates per 1000 For Services
For the years 1970 - 1976

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing and Special Services</td>
<td>4.6</td>
<td>3.9</td>
<td>6.4</td>
<td>6.0</td>
<td>7.4</td>
<td>6.7</td>
<td>5.6</td>
<td>5.8</td>
</tr>
<tr>
<td>Administration</td>
<td>4.9</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>5.3</td>
<td>3.9</td>
<td>4.0</td>
<td>2.9</td>
</tr>
<tr>
<td>General Services</td>
<td>13.9</td>
<td>17.2</td>
<td>24.1</td>
<td>13.0</td>
<td>18.2</td>
<td>18.0</td>
<td>6.1</td>
<td>15.9</td>
</tr>
<tr>
<td>Plant and Maintenance</td>
<td>4.3</td>
<td>4.3</td>
<td>35.3</td>
<td>3.6</td>
<td>11.5</td>
<td>6.7</td>
<td>13.5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Note: Services are categorized in the above manner under Departmental Distribution (Hospital Statistics and Administration of the Hospital Act, 1971:23).
Figure 9

Trail Regional Hospital. Annual Employee Injury Rates per 1,000 According to Services, for the years 1970-1976.
With each additional "equivalent person" representing a corresponding increase in employees at risk, the injury rate could be affected one way or another. An interesting future study could be done on the relationship between the number of accidents with the number of employees at risk. Another project could be to study how overtime might be associated with accidents.

The distribution of recorded injuries according to site of accident, places most of them on the clinical areas, 59.2 percent. Figure 10 shows, however, the general service areas have 24.4 percent of the total injuries, and maintenance and plant has 7.3 percent. Next come the special services areas with 4.6 percent and administration with 3.2 percent. The 1.3 percent attributed to "others" include such areas as cafeteria, parking lot, and hospital grounds. From an epidemiologic point of view, it would appear that the focus of attention in any hazard control program should be directed towards the nursing floors and in the general service areas.

When do most employee accidents happen in the hospital? A cross tabulation was done of hour of occurrence by departments. Table 7 presents the distribution of number of injuries according to departments for time of day. It is evident that most accidents occur on the day shift between 7.30 a.m to 3.30 p.m., and mostly to nursing, housekeeping and dietary personnel. For housekeeping and dietary the injuries were spread fairly evenly over the eight hours. For nursing, however, the riskiest time appeared to be
Trail Regional Hospital. Frequency Distribution of number of Employee Injuries According to location of occurrence, for the period 1970-1976.
Table 7
Frequency Distribution of Number of Employee Injuries According to Departments 1970 - 1976 By Time of Day (Day Shift, Evening Shift, Night Shift)

<table>
<thead>
<tr>
<th>Department</th>
<th>7.30 a.m.-3.30 p.m.</th>
<th>3.30 p.m.-11.30 p.m.</th>
<th>11.30 p.m.-7.30 p.m.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Housekeeping</td>
<td>86</td>
<td>12</td>
<td>7</td>
<td>105</td>
</tr>
<tr>
<td>2. Nursing</td>
<td>145</td>
<td>79</td>
<td>33</td>
<td>257</td>
</tr>
<tr>
<td>3. Dietary</td>
<td>84</td>
<td>27</td>
<td>13</td>
<td>124</td>
</tr>
<tr>
<td>4. Administration</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>5. Radiology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6. Plant and</td>
<td>16</td>
<td>4</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Laundry and</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Linen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Laboratory</td>
<td>13</td>
<td>0</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>9. Rehabilitation</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>10. Pharmacy</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>366</strong></td>
<td><strong>128</strong></td>
<td><strong>62</strong></td>
<td><strong>556</strong></td>
</tr>
</tbody>
</table>

N = 556
Data not available 5.
9 a.m. to 12 noon with the heaviest reported injuries, 27.6 percent of all accidents, in a 24 hour period.

For time of year when most injuries occur, a cross tabulation was done of month of occurrence by departments. A frequency distribution is presented in Table 8, using spring, summer, fall and winter as convenient trimesters. Nursing and dietary show the winter months as being the most dangerous time of year with 73 injuries reported out of a total 172 for all departments for those months, whereas housekeeping does not fare so well in the summer months, reporting 34 injuries out of a total 106 reported by their department for the seven year period. Two reasons can be advanced for these observations. In the winter months, more falls are recorded due to wet floors and icy parking lots. This is born out by the contingency table when month of occurrence was cross tabulated with external cause of injuries. It showed out of 71 falls of persons for the seven year period, 42.3 percent occurred in December, January and February. The almost half of the falls occurring in the winter months should indicate the appropriate preventive measures. The summer months run into vacation time and there is usually a staff shortage which could account for more accidents occurring at this time. Summer relief personnel could also be a factor. Machinery and equipment, sharp instruments and heat steam rank high as the external causes of accidents during these months. Whether these
### Table 8

**Frequency Distribution of Number of Employee Injuries According to Departments**

1970 - 1976 by Time of Year
(Spring, Summer, Fall and Winter)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Housekeeping</td>
<td>28</td>
<td>28</td>
<td>34</td>
<td>16</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>106</td>
</tr>
<tr>
<td>2. Nursing</td>
<td>86</td>
<td>57</td>
<td>68</td>
<td>49</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>260</td>
</tr>
<tr>
<td>3. Dietary</td>
<td>37</td>
<td>33</td>
<td>26</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>125</td>
</tr>
<tr>
<td>4. Administration</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>5. Radiology</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>6. Plant and Maintenance</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>5</td>
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<td>7. Laundry and Linen</td>
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<td>8</td>
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<tr>
<td>8. Laboratory</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>16</td>
</tr>
<tr>
<td>9. Rehabilitation</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>10. Pharmacy</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>172</td>
<td>128</td>
<td>145</td>
<td>116</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>561</td>
</tr>
</tbody>
</table>

N - 561
are due to unfamiliarity, carelessness on the job, poor judgment or fatigue it is difficult to say, but the evidence is clear that the summer months have more injuries recorded than in the spring or fall. The same table shows 145 injuries in June, July and August out of a total 561 for all departments for the seven year period.

In an attempt to pinpoint some causes of hospital accidents, the principles of epidemiology were used. If an external cause is sought, the coding of injuries had to centre around determining what was the agent in a particular accident situation that could be classed as mechanical, chemical, electrical, thermal or biological (refer to chapters 4 and 5). Often there is some confusion as to the terms, "kind", "type", "nature" and "cause" of accidents and interpreting the raw data posed some difficulties. However, for this study, "external cause" implies the agent, and "nature of injury" manifests the result of the accident, not the cause. Table 9, 10 and 11 present the External Causes of Injuries, Nature of Injuries and Parts of Body Involves respectively.

The causes of injuries are summarized according to services. As shown in Table 9, over-exertion, sharp instruments, falls of persons, and machinery and equipment constituted 63.6 percent of all accidents for Nursing and Special Services. Heat and steam, and machinery and equipment, seem to be the major hazards for General Services and Maintenance. Administration had fewer accidents but a high proportion of injuries reported by them had to do with falls of
Table 9
Trail Regional Hospital
Injuries Sustained by Employees According to Services 1970 - 1976
External Causes of Injuries
(By Number, Percent, Rank)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Nursing and Special Services</th>
<th>Administration</th>
<th>General Services</th>
<th>Plant and Maintenance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>% R</td>
<td>No.</td>
<td>% R</td>
<td>No.</td>
</tr>
<tr>
<td>1. Over Exertion</td>
<td>57</td>
<td>20.4</td>
<td>1</td>
<td>7.7</td>
<td>4</td>
</tr>
<tr>
<td>2. Sharp Instruments</td>
<td>47</td>
<td>16.8</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Falls of Persons</td>
<td>37</td>
<td>13.2</td>
<td>3</td>
<td>4</td>
<td>30.8</td>
</tr>
<tr>
<td>4. Machinery and Equipment</td>
<td>37</td>
<td>13.2</td>
<td>3</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>5. Objects: Struck by</td>
<td>32</td>
<td>11.4</td>
<td>5</td>
<td>4</td>
<td>30.8</td>
</tr>
<tr>
<td>Struck against</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Struck between</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Patient induced</td>
<td>23</td>
<td>8.2</td>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. Heat and Steam</td>
<td>22</td>
<td>7.9</td>
<td>7</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>8. Miscellaneous</td>
<td>18</td>
<td>6.4</td>
<td>8</td>
<td>2</td>
<td>15.3</td>
</tr>
<tr>
<td>Insects,animals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Harmful Substance</td>
<td>7</td>
<td>2.5</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>280</td>
<td>100.0</td>
<td>-</td>
<td>13</td>
<td>100.0</td>
</tr>
</tbody>
</table>

N = 545
Data not available 16
Table 10
Trail Regional Hospital
Injuries Sustained by Employees According to Services 1970 - 1976

Nature of Injuries
(By Number, Percent, Rank)

<table>
<thead>
<tr>
<th>Nature of Injury</th>
<th>Nursing and Special Services</th>
<th>Administration</th>
<th>General Services</th>
<th>Plant and Maintenance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>R</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1. Cuts, Bruises, Punctures</td>
<td>106</td>
<td>37.9</td>
<td>1</td>
<td>4</td>
<td>30.8</td>
</tr>
<tr>
<td>2. Pain, Strain</td>
<td>103</td>
<td>36.8</td>
<td>2</td>
<td>5</td>
<td>38.5</td>
</tr>
<tr>
<td>3. Swelling and Inflammation</td>
<td>27</td>
<td>9.6</td>
<td>3</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>4. Burns</td>
<td>25</td>
<td>8.9</td>
<td>4</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>5. Others: Imbedding Chipping Bites</td>
<td>19</td>
<td>6.8</td>
<td>5</td>
<td>2</td>
<td>15.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>280</td>
<td>100</td>
<td>-</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

N = 546
Data not available 15
Table II
Trail Regional Hospital
Injuries Sustained by Employees According to Services 1970 - 1976
Parts of Body Involved
(By Number, Percent and Rank)

<table>
<thead>
<tr>
<th>Parts of Body Involved</th>
<th>Nursing and Special Services</th>
<th>Administration</th>
<th>General Services</th>
<th>Plant and Maintenance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>R</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1. Upper Extremity</td>
<td>124</td>
<td>43.5</td>
<td>1</td>
<td>5</td>
<td>35.7</td>
</tr>
<tr>
<td>2. Back and Trunk</td>
<td>74</td>
<td>26.0</td>
<td>2</td>
<td>5</td>
<td>35.7</td>
</tr>
<tr>
<td>3. Lower Extremity</td>
<td>44</td>
<td>15.4</td>
<td>3</td>
<td>2</td>
<td>14.4</td>
</tr>
<tr>
<td>4. Head and Face</td>
<td>27</td>
<td>9.5</td>
<td>4</td>
<td>1</td>
<td>7.1</td>
</tr>
<tr>
<td>5. Multiple and Internal</td>
<td>16</td>
<td>5.6</td>
<td>5</td>
<td>1</td>
<td>7.1</td>
</tr>
<tr>
<td>Total</td>
<td>285</td>
<td>100</td>
<td>-</td>
<td>14</td>
<td>100</td>
</tr>
</tbody>
</table>

N = 559
Data not available 2
persons and being struck by objects. It is surprising to find Administration showing back and trunk injuries as part of the body most involved in Table 11, and pain and strain ranking first in nature of injuries in Table 10. Yet over-exertion ranks fourth under external causes in Table 9. One wonders if some factor other than over-exertion at work causes back strain. Definitely, there is need for more research into the causation of back pain.

In Table 11, with parts of the body involved, The Spearman's rho rank order correlation between Nursing and Special Services, and Administration was significant at the 1.4 percent level. Between Nursing and Special Services, and General Services it was significant at the 3.7 percent level. Between Administration and General Services it was not significant. The correlation between General Services, and Plant and Maintenance, was significant at the 3.7 percent level. The smaller the level, the more significant is the correlation (Siegel, S., 1956: 202-213).

Age is an important factor in employee accidents according to most research done in industry. Hale and Hale (1972:11) say:

... during the teens and early twenties the number of accidents is high: it then drops sharply, levelling out in the mid twenties. After this, there is a slight decline until the middle or late forties when the numbers start to rise again 'til the end of the working life....
Figure 11 shows the frequency distribution of number of employee injuries according to age category. This graph shows only the spread of accidents according to age groups. It is not meant for comparative purposes, as the numbers in each category were not available. From an epidemiologic viewpoint it has some significance. It shows 20.4 percent of all the recorded accidents occurred in the under 25 age group, which is greater than any of the other groups. This would indicate the necessity for concentrating on training and supervision within this age category.

On a cross tabulation between age and external cause of accidents, it was evident that the main types of accidents occurring in this age category were; 22 percent caused by sharp instruments; 16.5 percent caused by machinery and equipment and 15.4 percent from over-exertion.

Figure 12 shows a frequency distribution of number of employee injuries according to length of employment. The findings of industry say that in new recruits, experience is the critical factor in accident causation. There seems to be strong evidence that length of service has an effect on accident rates over the first one to two years of employment in a company (Hale and Hale, 1972:37). Figure 12 does not compare each interval category as to who are having the most accidents. The significance of the spread is of epidemiologic interest to note where most of the accidents are happening.
Figure 11

Trail Regional Hospital. Frequency Distribution of Number of Employee Injuries According to Age Category For the Period 1970-1976.

Data not available: 2
Figure 12


\[ N = 557 \]

Data not available: 4

Length of Employment
In the period under two years, 41.8 percent of all the accidents are occurring. This may suggest that accident prevention measures should be directed towards employees in their first two years. Particularly, it would be wise to consider the first month of orientation as vitally important in view of the fact that 7.2 percent of accidents occur in the under one month period before it drops to 6.6 percent in the 2-3 month period. The 2-7 years experience group accounts for 40.4 percent of all recorded accidents. This may mean there are more people working at the hospital in this group. On the other hand, it may be wise to investigate what kinds of accidents they are having and why. At the extreme end of the scale, the 17.7 percent of those with seven years of more experience may not be recording a high percentage of accidents, but there are probably fewer people working in this category.

A cross tabulation done on length of employment and external cause of injuries revealed that the under one month group had mainly heat and steam accidents. The under two year group's main injuries were due to machinery and equipment, sharp instruments, and heat and steam. The 2-7 year category indicated over-exertion, sharp instruments, falls of persons, and machinery and equipment, in that order, as the main causes of injuries. The employees in the over seven years experience group had mostly falls, heat and steam, and machinery and equipment accidents.
Conclusion

It is interesting to note that the findings from the epidemiologic investigation of hospital employee injuries bore a remarkable resemblance to those which have been reported from research studies of industrial workers (refer to Chapter 4).

The main causes of accidents found in the study were; over-exertion, sharp instruments, falls, machinery and equipment in Nursing and special services; heat and steam and machinery in the General Services and maintenance; falls and struck by objects in Administration.

In both the age category and experience category, again, similar figures were produced. The under 25 age group had the greatest number of injuries. Likewise, in the period under two years length of service, was found the most accidents. It has been the main purpose of the epidemiologic investigation to gather information regarding the who, what, where and when of employee accidents. With this knowledge, the planning of preventive programs can be directed at areas that require the most attention.
II  Evaluation of the Trail Regional Hospital Safety Committee

History

The original safety committee of the Trail Regional Hospital was organized in 1967. From a questionnaire (Appendix A) that was sent to former members, together with some old records, it was possible to reconstruct the structure and functions of the committee. Of the six information gathering questionnaires sent, four were returned. One member had moved away and one had died.

The original committee consisted of; a chairman who was the hospital fire warden, the representatives from the nursing service, housekeeping, dietary and laboratory, with management's right to enlarge the membership. The committee held monthly meetings and recorded minutes by an appointed secretary. The functions centred around; safe working conditions and practises, a review of accident reports advising both management and labour how to cut down on the number of accidents, monthly building inspections and instructing hospital staff on fire safety. It had an ambitious program of activities focusing on accident reduction. However, with a change in administration in 1968 which was unsympathetic to its cause together with general apathy of staff, the committee disbanded in 1969.

The present safety committee sprang from the ashes of the old at the instigation of the Workers' Compensation Board of
B.C. in May, 1971. Most of the former principles were retained. The purpose was simply to make the Trail Regional Hospital a safe place to work, free of fires and accidents. The objectives were:

1. To implement fire lectures, drills and to educate staff in fighting fires.
2. To set up safety rules for employees.
3. To set up an accident investigation committee.
4. To set up a building inspection committee.

(a) Comparison of Rates Before and After

The decision to compare injury rates of services in the hospital before and after the inception of the new safety committee was with the understanding that the difference in the rates would not be the only criterion of success or failure of a safety program:

A design which Campbell and Stanley term non-experimental rather than quasi-experimental is the single group "before-after" design: The status of an outcome (dependent) variable is measured in a single group before and after the introduction of some treatment. Although research specialists have long pointed out the dangers in drawing conclusions from this design, it is widely used in public health programs (Deniston, O.L. and Rosenstock, I.M., 1973:154).

Table 12 presents the comparison of Employee Injury Rates per 1000 before and after the institution of the safety committee in 1971. Each service showed a higher rate in the 1972-1976 period than in the 1970-1971 period. However, as explained in the previous section, referring to Figure 9, it is quite likely that the accidents had not increased but the recording of them had.
### Table 12
Trail Regional Hospital
Comparison of Employee Injury Rates per 1000
Before and After Institution of Safety Committee in 1971

<table>
<thead>
<tr>
<th>Services</th>
<th>Rates per 1000 Before 1970-1971</th>
<th>Rates per 1000 After 1972-1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing and Special Services</td>
<td>4.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Administration</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>General Services</td>
<td>15.6</td>
<td>15.9</td>
</tr>
<tr>
<td>Plant and Maintenance</td>
<td>4.3</td>
<td>13.7</td>
</tr>
</tbody>
</table>

**Note:** Safety Committee started in May, 1971
The Workers' Compensation Board who insisted on reactivation of the safety committee, no doubt, would have also informed the hospital of the penalties for not reporting employee accidents. The same figure shows a downward trend for three of the services in 1973 and a rise of all services in 1974 perhaps due to increased services and increased staff, and again a slight trend downward in 1975 and 1976, except for Maintenance and Plant. It would be interesting to examine the injury trends from 1976 onwards.

Perhaps in the future, obtainable, measurable objectives might be attempted, for example: Time loss and Medical Aid only injuries to be reduced by 25 percent in a given period.

The final test of an effective safety program would be reflected in the decreasing numbers of T.L. and M.A.O. accidents.

(b) Documentary Analysis

How well the committee has carried out its objectives should be the main criteria of its effectiveness. After a careful analysis of the safety committee minutes from 1971 to 1976, it appears that all four objectives itemized have been implemented. Fire safety lectures and demonstration of fire fighting equipment commenced on July 22, 1971 and followed by monthly programs for some time, then intermittently. Nevertheless, this is an important item in the safety program and fire drills are done
regularly. In February, 1972 Safety Rules and Regulations were
drafted and completed in June 1972 and distributed to each depart-
ment. An accident investigation committee and a building inspection
committee make their reports to the monthly meetings and suggest
recommendations. These recommendations are then followed up
promptly by reporting unsafe conditions to management, posting
warning notices, organizing films and demonstrations on proper
lifting techniques, fire hazards etcetera. They often enlist
the aid of other departments who cooperate in the areas of their
expertise.

The Trail Regional Hospital Safety Committee is an
active organization with enthusiastic members. They keep
 abreast of the times by attending safety seminars, exchanging
information with other safety committees and have hosted joint
meetings for the Kootenays.

Despite the efforts of the safety committee, there are
some variables over which it has little control, such as;
administrative leadership, staff attitude to safety, individual
responsibility, departmental supervision over task and personnel,
and perhaps unusual weather conditions. Looking back over the
records, it was found that a great deal of construction was going
on during the whole of 1974 with the addition of new facilities for
the nuclear medicine laboratory and a pulmonary department, as
well as the completion of the intensive care and renal care units.
This may have been a factor in creating extra hazards that contributed to the high accident rate in 1974 for all services.

(c) **Comparing Medium-Size Hospitals of B.C.**

On the premise that hospitals that have safety committees, not only are upholding the law, but are cognizant of occupational health and safety hazards that can affect the well-being and productivity of their employees, a list was compiled of eleven similar size hospitals in B.C. to compare how the Trail Regional Hospital stood in relation to the others regarding reported accidents to the Workers' Compensation Board. The total figures cited in Table 13 denote only the number of cases reported and does not indicate the severity or rate. The Trail Regional Hospital is F. No. 14970. Table 14 presents a list of medium size public general hospitals in British Columbia which have Safety programs. The Safety programs do not indicate structure or function or, indeed, how effective they are, but they do show that they are a fairly recent trend. The Trail Regional Hospital Safety Committee can be justly proud of its early beginnings and its active program.

III **The Use of an Epidemiologic Model in a Hazard Control Program.**

**Concerning the Host**

Some answers to questions of distribution and determinants of employee injuries are shown in the results of the frequency
### Table 13

Number of 1st Payment Time Loss Cases and Number of 1st Payment Medical Aid Only Cases for Selected Hospitals 1970 - 1976 inclusive

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>J.</td>
<td>4858</td>
<td>T.L.</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>12</td>
<td>19</td>
<td>16</td>
<td>26</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>33</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>17</td>
<td>25</td>
<td>27</td>
<td>162</td>
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<tr>
<td>E.</td>
<td>12847</td>
<td>T.L.</td>
<td>3</td>
<td>5</td>
<td>31</td>
<td>19</td>
<td>30</td>
<td>29</td>
<td>24</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>32</td>
<td>26</td>
<td>23</td>
<td>20</td>
<td>28</td>
<td>25</td>
<td>28</td>
<td>182</td>
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<td>C.</td>
<td>14438</td>
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<td>7</td>
<td>8</td>
<td>20</td>
<td>15</td>
<td>22</td>
<td>14</td>
<td>94</td>
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<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>14</td>
<td>17</td>
<td>20</td>
<td>17</td>
<td>25</td>
<td>32</td>
<td>26</td>
<td>151</td>
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<tr>
<td>F.</td>
<td>14970</td>
<td>T.L.</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>17</td>
<td>18</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>40</td>
<td>28</td>
<td>61</td>
<td>27</td>
<td>51</td>
<td>44</td>
<td>25</td>
<td>276</td>
</tr>
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<td>A.</td>
<td>16692</td>
<td>T.L.</td>
<td>3</td>
<td>4</td>
<td>13</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>17</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>13</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>13</td>
<td>7</td>
<td>56</td>
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<tr>
<td>H.</td>
<td>21803</td>
<td>T.L.</td>
<td>6</td>
<td>14</td>
<td>10</td>
<td>15</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>93</td>
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<td>M.A.O.</td>
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<td>11</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>11</td>
<td>8</td>
<td>67</td>
</tr>
<tr>
<td>I.</td>
<td>27345</td>
<td>T.L.</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>17</td>
<td>22</td>
<td>13</td>
<td>80</td>
</tr>
<tr>
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<td></td>
<td>M.A.O.</td>
<td>7</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>55</td>
</tr>
<tr>
<td>B.</td>
<td>29102</td>
<td>T.L.</td>
<td>6</td>
<td>10</td>
<td>32</td>
<td>30</td>
<td>30</td>
<td>31</td>
<td>38</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>22</td>
<td>18</td>
<td>21</td>
<td>14</td>
<td>20</td>
<td>21</td>
<td>13</td>
<td>129</td>
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<tr>
<td>D.</td>
<td>42345</td>
<td>T.L.</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>16</td>
<td>18</td>
<td>12</td>
<td>26</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
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<td>8</td>
<td>8</td>
<td>14</td>
<td>9</td>
<td>16</td>
<td>18</td>
<td>88</td>
</tr>
<tr>
<td>K.</td>
<td>62427</td>
<td>T.L.</td>
<td>24</td>
<td>32</td>
<td>33</td>
<td>41</td>
<td>47</td>
<td>38</td>
<td>35</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>62</td>
<td>53</td>
<td>20</td>
<td>37</td>
<td>38</td>
<td>25</td>
<td>33</td>
<td>326</td>
</tr>
<tr>
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<td>114178</td>
<td>T.L.</td>
<td>6</td>
<td>11</td>
<td>25</td>
<td>29</td>
<td>34</td>
<td>32</td>
<td>31</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
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<td>25</td>
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<td>31</td>
<td>45</td>
<td>43</td>
<td>29</td>
<td>231</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>T.L.</td>
<td>87</td>
<td>105</td>
<td>177</td>
<td>211</td>
<td>245</td>
<td>243</td>
<td>259</td>
<td>1327</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.A.O.</td>
<td>271</td>
<td>219</td>
<td>227</td>
<td>203</td>
<td>259</td>
<td>268</td>
<td>218</td>
<td>1665</td>
</tr>
</tbody>
</table>

Please note that these counts are by year of 1st payment and are not analyzed by year of accident occurrence.

Source: Workers' Compensation Board, B.C.

Accident Prevention Department
Table 14

Medium-size Public General Hospital in British Columbia with Safety Programs (Bed Capacity 200-299)

<table>
<thead>
<tr>
<th>HOSPITAL</th>
<th>SAFETY PROGRAM</th>
<th>DATE INITIATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>B</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>C</td>
<td>No information available.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>E</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>F</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>I</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>J</td>
<td>Active Safety Program.</td>
<td>Date initiated not available.</td>
</tr>
<tr>
<td>K</td>
<td>Active Safety Program only because it is required by W.C.B. Regulations.</td>
<td>Date initiated not available.</td>
</tr>
</tbody>
</table>

Source: Worker's Compensation Board, B.C. Accident Prevention Department
tabulations. The host or employee most likely to be injured in a hospital will be in the nursing, dietary or housekeeping departments. The safest occupations appear to be medical records, nuclear medicine, social service, pharmacy and radiology.

A clear distinction in age category places the under twenty-five year group to be at most risk and employees with two years experience or less are more liable for injuries on the job.

Other biological and lifestyle factors of the host were not a consideration in this study. However, these aspects of the host are important components of the total person, and could be central to other research studies.

Concerning the Environment

The most hazardous environments were in the following order; patient care areas, general service areas, plant, special service areas, administrative offices, hospital grounds and cafeteria. The time when injury is most likely to happen is on the day shift, possibly in December, January or February, between 9 a.m. and 12 noon.

Due to the unavailability of information regarding the physical and psychological character of the environment from the records, it was left to conjecture as to why certain areas were more hazardous than others.
Concerning the Agent

External causes of accidents (agent) in the hospital varies for different services. Nursing and Special Services, along with General Services, in the main, showed; over-exertion; sharp instruments; falls; machinery and equipment; and heat and steam to be the worst hazards. Other causes inflicting injury on employees were objects; struck by, struck against, struck between; patients; insects; and harmful substances. The resulting injuries were mostly; cuts, bruises and punctures; strain and pain; burns; swelling and inflammation; and others; such as bites, chipping and imbedding injuries. The great majority of hospital injuries affected the upper extremities, followed by back and trunk, lower extremity, head and face, and multiple or internal injuries.

The results of the study make the application of the epidemiologic model for a hazard control program fairly straightforward, as the roles played by the host, environment and agent are better understood. This will be discussed in more detail in the final chapter.

Conclusion

The Epidemiologic study of employee injuries for the period 1970-1976 brought to light many previously unknown details regarding distribution and determinants of accidents at the Trail
Regional Hospital. It was found that the typical accidents happening at the hospital were very similar to those occurring in industry. The specialized areas reported minimal numbers of injuries, suggesting that the selection process was excellent and hazards were well under control. Very few infections were reported among staff members, which indicate good infection control techniques. The obvious direction, then, is to concentrate on reducing the number of injuries that are the major problems, which seem to be the ones most often found in industry.
The study represents a systematic analysis of employee injuries sustained in a medium-size public general hospital in British Columbia within an overall epidemiologic framework. As such, the study has provided comparative data on the frequency of accidents in a hospital population at risk. Of more relevance, it has provided the necessary information regarding "who, what, where, when and how" of accidents, but not "why". It has also shed some light on what should be the appropriate measures of prevention of occupational hazards in a hospital milieu, which is the cornerstone of any hazard control program.

Developing Guidelines for a Hazard Control Program

This study has been limited in establishing contributory and predisposing factors that cause accidents, because of the unavailability of necessary data. However, the multicausal nature of accidents, though not fully observed, need not preclude any efforts in providing a safe environment for hospital workers.

Edward Tufte (1974:22) has said:

Almost all efforts at data analysis seek, at some point, to generalize the results and extend the reach, of the conclusions beyond a particular set of data...

Thus, planning a hazard control program from insights gained from the study would need to consider the three aspects of
the epidemiological triad, of host, environment and agent. It can be argued that each component can be differentiated for a specific method of attack so as to avoid the disequilibrium that can precipitate an accident. Education, engineering and enforcement - the three E's - are the three flanks that can counteract the effects of the epidemiological triad in accident causation.

From the data, it was observed that nursing, dietary and housekeeping had most of the injuries in the seven year period. Younger employees under twenty-five years and those who were new recruits were at increased risk. Education and training should be directed, then, at these services and these groups of employees, ostensibly to make the "host" more resistant.

Again from the data, the results showed the environment on the nursing floors and general service areas to be the most hazardous for employees. Special ergonomic design and safe conditions would come under the engineering flank. Proper lifting mechanisms, guarding of dangerous machinery and equipment and good housekeeping would be appropriate measures here to combat the environmental dangers.

In the case of external causes of injury, the third flank, enforcement, could be most effective in inactivating the agent component. Therefore, strict supervision of procedures, safety rules, controls and regulations must be observed. Mechanical, chemical, ionizing, thermal, electrical and biological hazards are
the agents in question.

Therefore, the development of guidelines for a hazard control program would consider these three approaches.

A New Approach

Why are hospital accidents increasing? Are safety committees the answer? Or should there be built-in safety instrumentation for each job? Some industries are finding the Job Safety Analysis procedure to be effective. This process breaks down each job into basic steps, potential accidents or hazards are noted and precautions are recommended (Rustemeyer, C.R., 1979:9).

Perhaps a new approach to the whole question of safety is necessary. Attitudes need to be changed to effect behavioural change. The trouble with "safety" is that it implies a positive goal that is attainable and desirable, but does not indicate any concrete action towards it. Besides, it is difficult to become safety conscious when there is a cultural dichotomy about the term. On the one hand, the public is bombarded with slogans like "live dangerously" and on the other hand they're told "it's better to be safe and sorry". But who want to be "safe"?

The public also seems to have trouble with the phrase "accident prevention". It has a negative connotation. It conjures up a violent situation that is best avoided, but does not indicate
any concrete action towards a goal.

It may be a case of simple semantics, but 'hazard control seems to be a concept that people can identify with. It denotes both health and safety hazards and indicates positive action towards a definite goal. Human beings like to control. This researcher prefers to use this term rather than accident prevention or safety.

However, whatever term is used, the success of committees will depend upon:

1. top management involvement;
2. defining measurable objectives;
3. periodic evaluation;
4. cooperation of staff; and
5. personal responsibility for actions.

Summary

Despite the high technology equipment and hazardous substances found in modern hospitals, very few accidents were recorded in areas where these were used. The great majority of injuries sustained are still the usual strains, cuts, bruises and burns, caused by over-exertion, sharp instruments, falls and heat and steam.

From the information obtained from the data, it was found that the types of hospital employee injuries were similar
to industrial accidents.

Except for mishaps peculiar to operating rooms, laboratories and patient care areas, most accidents involving hospital personnel are the ones most frequently listed as occupational injuries. For instance, it was found in both hospitals and industry, that the great majority of causes were falls and improper handling of materials. The back injuries from lifting patients are not too different from the injuries maintenance men sustain from heavy lifting of equipment. Cuts and burns that occur in the laundry and the diet kitchen are replicated in public laundries and restaurants. The risk of tripping and falling in corridors of public buildings and schools apply equally to hospitals. Therefore, most of the hazards of hospital operation are commonplace and the remedies are already known.

Industry has long recognized the substantial benefits that result from well developed hazard control programs. Hospitals must, then, follow industry's lead.

Industry has also demonstrated that accidents are not chance occurrences or are they necessarily inevitable. They are caused by unsafe practices and unsafe conditions. Likewise, industry has shown that these unsafe conditions and unsafe actions can be controlled by effective management. Hospitals, too, can reduce the incidence of employee injuries with better control programs.
However, the long term effect of occupational disease and chronic conditions has not been well researched even in industry, though recently there has been noticed a great interest evolving. There is room for much more research in this area, and as industry accepts the concept of occupational health as an important consideration for both economic and ethical reasons, perhaps the spin off will bring benefits to the hospital workers.

Meanwhile, there are no magical solutions. Hospitals which are in the forefront of the health care system ought to be examples to other health care institutions. The epidemiologic study has revealed the who, what, where and when of employee injuries. Industry has already shown the way in reducing hazards that cause workplace accidents. Other factors that affect the well-being and productivity of working people have been discussed in Part I. Hospitals themselves must now make a concerted effort to implement programs of protection for their employees, considering their physical, mental and social health.

**Recommendation**

This study has shown that employees are exposed to many hazards in a hospital milieu. Therefore, an occupational health and safety service is recommended for all hospitals.

The nurse practitioner-employee ratio should be 1-500.
Figure 13
OCCUPATIONAL HEALTH SERVICES FOR HOSPITAL EMPLOYEES

Administration
Personnel
Occupational Health Services
(Umbrella Concept)

Health Promotion
- Health Education:
  - Films & Lectures
  - Behaviour Modification Program
- Exercise Program
- Weight Control Program
- Non Smoking Program
- Recreation

Health Protection
- First Aid & Emergency Investigation of sick time
- Hospital & Home Visits
- Health Assessments and Screening of New Employees
- T.B. Control
- V.D. Control
- Routine Tests with referrals to Doctors
- Rehabilitation:
  - Injuries
  - Back Care
  - Alcohol & Drugs

Prevention
- Hazard Control Program:
  - Hazard Control Committee - Safety Hazards
  - Environmental Hazards
  - Accident Investigation
- Plant Maintenance:
  - Special Areas - Operating Theatres
  - Radiology
  - Laboratories
  - Nuclear Medicine
  - Other
- Infection Control Program:
  - Infection Control Committee
  - Infection Control Officer
  - Immunization Program:
  - Health Office
  - Research Program:
  - Surveys etc.

Counselling Service
- Mental, Social & Physical Health:
  - Nutrition Guidance
  - Management of Stress
  - Job Related
  - Personal
  - Marital
  - Financial etc.
  - Retirement Preparation

Record Keeping
- Health Records:
  - Medical History
  - Health Assessment
  - Laboratory Reports
  - X-rays
  - Immunization Records
- Visits:
  - Office
  - Home
- Personal Work Habits:
  - Absenteeism
  - Illness etc.

Record Keeping
Health Records:
- Medical History
- Health Assessment
- Laboratory Reports
- X-rays
- Immunization Records
Visits:
- Office
- Home
Personal Work Habits:
- Absenteeism
- Illness etc.
A comprehensive occupational health and safety service in hospitals would have three basic components:

1. Hazard Control Program
2. Infection Control Program
3. Employee Health Service

It should be within Administration and Personnel, and include a whole spectrum of activities relating to health promotion, health protection, prevention, counselling service and record keeping. Figure 13 presents an umbrella concept of occupational health services which incorporates many services and departments in the hospital, with the view to keeping all employees on the job, and healthy and happy on the job.
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The Trail-Tadanac Hospital Safety Committee was organized in November 16, 1967. From its inception until 1969 it appeared actively involved with its stated functions. (enclosed appendix) From 1969 to 1971 there seems to have been a period of inactivity. The absence of records of this earlier time makes it difficult to reconstruct the setting into which the present Safety Committee emerged. In May 26, 1971, at the instigation of the Workers' Compensation Board, the Safety Committee was reactivated and renamed the Trail Regional Hospital Safety Committee.

In order to obtain a historical perspective on the current Safety Committee, information pertaining to its predecessor will be appreciated.

Please answer the following 5 questions. The information will be considered confidential. If you don't know the answer, give your opinion.

1. Structure
   a. Can you recall the members of the original Standing Committee?
      i. How many were there?
      ii. Who were the officers? Where did they live?
          Chairman __________________________
          Secretary__________________________
          Others ____________________________
      iii. Were any added later? Yes [ ] No [x]
          If yes, can you recall their names?
          ____________________________
          ____________________________
          ____________________________

APPENDIX A
Questionnaire
2. Objectives

a. Were regular monthly meetings held? Yes □ No □
   If no, state your opinion why. __________________________

b. Were accident reports reviewed prior to meetings? Yes □ No □
   If no, state your opinion why. __________________________

c. Were building inspections done monthly? Yes □ No □
   If no, state your opinion why. __________________________

d. Did instruction in fire safety take place through films and talks? Yes □ No □
   If yes, how often did these occur __________________________

e. Did instruction in fire fighting take place in the use of fire extinguishers and fire fighting equipment? Yes □ No □
   If yes, how often did these occur? __________________________

f. Apart from fire safety, was there education in other types of accident prevention? Yes □ No □
   Please comment. ______________________________________

3. Minutes

a. Were minutes taken of the meetings? Yes □ No □
   If yes, in whose keeping were they? __________________________

b. Did others besides the members receive copies? Yes □ No □
   If yes, who were they? __________________________

4. Functions

a. Do you recall any event during the period from November 1967 to 1969 that affected the functioning of the Committee? Yes □ No □
   If yes, please comment. ______________________________________
b. Do you recall any event during the period from 1969 to 1971 that affected the functioning of the Committee? If yes, please comment.  

5. General Information  
a. In your opinion what were the reasons for the discontinuance of the former Safety Committee?  

b. What can be learned from your experience with the first Safety Committee?  

***  
In addition to the questionnaire, would you consider a personal interview? If yes, when may I see you?