Occupations, Hazardous

OCCUPATIONAL HEALTH HAZARDS TO WOMEN : - A SYNOPTIC VIEW -

BY

ANNE GEORGE

OCTOBER 1976

(VERSION FRANCAISE DISPONIBLE)

Canadian Advisory Council on the Status of Women
Box 1541 Station B, Ottawa K1P 5R5

Conseil consultatif canadien de la situation de la femme
C.P. 1541 Succ. B, Ottawa K1P 5R5

TABLE OF CONTENTS

TABLE OF CONTENTS continued.....

OCCUPATIONAL HEALTH HAZARDS TO WOMEN

- A SYNOPTIC VIEW -

Section I INTRODUCTION

This report deals with occupational health hazards to women. Specifically this refers to those hazards detrimental to health to which women are exposed during the course of their work.

The topic is endless in scope. Health hazards can be found in all occupations. Indeed, medical science has advanced sufficiently to identify enough hazards so that nearly anything one does can be considered harmful to the body in one way or other.

The World Health Organization defines health as "a state of complete physical, mental and social well-being." Health is not merely the absence of disease. It is a positive entity. While industrial man has done much to contribute to the health of the populace, new and serious hazards have gradually appeared. It may be impossible to attain the immeasurable goal of perfect health, but the number and variety of diseases and hazards now present can be reduced.

Occupational health hazards are those health problems acquired as a direct result of the work place. By far the majority of these are man-made, that is, without our present form of society and its industry, they would probably not be present. However, that is not to say that we can reverse this process by eschewing our industrial pursuits nor would such a step be necessarily desirable even in the long term.

Occupational health hazards are tolerated by society because the industries involved contribute either directly or indirectly to the well-being and survival of the total society in the form of employment, new discoveries to decrease other diseases or health problems, and benefits to our leisure lives.

In its description of dangerous substances or conditions, this report tends to sound negative. The very fact of being able to make these descriptions is, however, positive. Occupational health hazards exist either because scientific knowledge is not advanced enough to identify the problem, or because that knowledge which has been discovered is not being utilized. Having identified something as harmful is a positive piece of medical knowledge. If a substance or condition is known to be hazardous, it may be banned or strictly controlled. It is the other millions of things to which we are unknowingly subjecting our bodies that are the real dangers.

An important example of this illustrates the point. Within the past few years, vinyl chloride monomer was found to be associated with angiosarcoma of the liver, a rare form of cancer. Vinyl chloride monomer is widely used in the manufacture of polyvinyl chloride which in turn is used to produce many consumer goods including furniture and floor coverings, and plastic bags. At first these findings were considered horrific. But this discovery was used positively and industry reduced the amount of exposure to the workers involved in production and now occupationally-acquired angiosarcoma of the liver should be prevented.

Women's health may be affected by occupational hazards, by her own direct exposure at her workplace, or by indirect exposure from her husband or family. In the latter case, someone living in her household may bring home potentially dangerous chemicals on clothing, may have become

a carrier of a disease acquired at their place of work, or that person's occupation may have taken them to a highly contaminated geographical area.

Women are now being directly exposed to a greater number of occupational hazards for two reasons: they are increasing their numbers in the workforce and they are aspiring toward a wider variety of occupations. Many of these occupations are by their nature detrimental to health.

An exhaustive report on this subject would be extremely voluminous, so exclusions have had to be made, and data condensed in a number of ways.

Firstly, this report deals only with women in the paid workforce; that is 45% (1976) of the female population. This does not mean to imply that the remaining percentage of women do not work or face health hazards. Home duties have a number of specific occupational hazards, such as exposure to solvents, boredom, and numerous types of accidents. This subject is in the present context another issue in itself and should be dealt with separately. Volunteer work has also been excluded except where it naturally falls within the designated categories.

Secondly, an effort has been made to concentrate on the most important areas in terms of: 1) most dangerous hazards, 2) affecting the greatest number of people, and 3) those peculiar to women. It should be stressed that this report is not conclusive but merely a brief synopsis of a vast subject.

Thirdly, the report concentrates on Canadian information as far as possible. Unfortunately, very little work to date has been done in Canada on this subject while much information is emanating from the United States and from other countries, especially eastern European areas.

Other limits of this report should be understood. The hazards covered are those of the workplace, not the general environment. For example, some synthetically manufactured estrogens, used in contraception, or therapeutically to prevent miscarriages, have apparently been associated with health problems. It is not the oral consumption of this product with which this report deals, but rather occupational exposure, in this case in the manufacture of the substance.

Also, this report deals with health factors as distinct from safety breaches or accidents, as far as a differentiation can be made. Illnesses rather than injuries are the topic.

The full extent and number of people with occupational diseases is difficult to estimate. Reporting rates are low and so many factors exist in each work situation that it is often impossible to understand or trace the causes of many diseases. Medical people usually do not include occupational data with the medical history of a patient, making a total estimate even more impossible.

In 1975, at a meeting of federal and provincial Deputy Ministers of Health, occupational health was considered to be a priority health problem of Canadians. A report resulting from that finding, extensively describing the expanse of this problem, was written in 1976. The author, from the federal Department of Health and Welfare, has reviewed all relevant statistics, making it unnecessary to go into such detail here.

Although much research is being carried out worldwide, as with all medically-related topics, obviously much still has to be learned.

In the search of relevant literature for this study the lack of research material in two areas was noticeable. The first area concerns the effects of substances or conditions on the male reproductive system. The exposure of male genes to detrimental substances in the work situation may endanger any children fathered by men after such exposure. When future generations are being studied, and findings hypothesized, the mother is usually the priority target for research.

The second obvious gap in research relates to epidemiological studies, where women have been conspicuously disregarded. When numbers of people in specific industries are being investigated, those industries studied are invariably traditionally male-dominated and where females are within the samples, they have been excluded from the research conclusions because their numbers were too limited to be statistically valuable.

Research data on occupational diseases has limitations, mostly because of the method of data collection. Primarily because human experimentation is not available, most evidence is inconclusive. This is an important point to remember when reading this report.

The principal methods of research are:

(a) epidemiology - data is collected on the population in order to assess trends or associations (for example smokers have a higher incidence of lung cancer). The main disadvantage is that causes cannot be determined.

(b)Animal research - mammals similar to humans are used because this is a legal and practical way to determine causal relationships. However, extrapolation from animal research to human experience may be unreliable.

(c) Clinical research - other forms of research involving the treatment or analysis of bacteria, tissues, laboratory cultures and so on, are less common but equally valuable. Autopsies are an important source of information, as are <u>in vitro</u> studies in which bacteria is experimentally treated and examined.

This report begins with a description of various categories of health hazards, for example: chemical, biological. Next a number of health hazards associated with specific female-dominated occupations are described. A growing number of women work during pregnancy subjecting themselves and their fetuses to a variety of dangers, a sample list of which is provided. Cancer is a leading cause of death in Canada and is predominately related to occupations. Information relevant to other health problems peculiar to women is provided and finally a section on activities in Canada concerning current legislation, research and industry's role are among the topics briefly described.

Section II

A GENERAL DISCUSSION ON HEALTH HAZARDS FOR ALL OCCUPATIONS

> Each day millions of workers in America enter a battlefield, but they fight no foreign enemy and conquer no lands. No borders are in dispute. The war they are fighting is against the poisonous chemicals they work with and the working conditions that place serious mental and physical stress upon them. The battlefield is the American workplace, and the casualties of this war are higher than those of any other in the nation's history.[1]

There is little reason why the situation would be very different in Canada.

Only when one thinks of the human body and all its components can one imagine the number of ways in which it can be damaged.

---

[1] Stellman, J.M., and Daum, S.M. Work is Dangerous to Your Health. Pantheon Books, New York, 1973.

Once harm has been done, nearly all the parts of the body are difficult to repair. Broken bones and skin problems are relatively easy. Livers, kidneys, lungs, hearts, brains, stomachs and other organs often have irreparable damage done to them through being exposed to harmful substances or stresses. Unfortunately, damage to one organ may mean other parts of the body need to work overtime to compensate, causing strain elsewhere.

The main categories of health hazards likely to be encountered at work are chemical, biological or physical and those affecting mental health. Each is discussed briefly in this section before more specific situations particularly relevant to women are described in subsequent sections.

Chemical Hazards

In nearly all industrial processes, chemicals and their compounds are used. There are literally hundreds of thousands of chemicals, many of which may be dangerous to the health if an individual is exposed to a high enough dose over a sufficient period of time.

The chemicals invade our bodies through their fumes, dusts, mists and vapours. They can be inhaled, ingested, or absorbed through the skin and therefore affect the system in a number of different ways. For example, if inhaled for a long enough period, some substances such as asbestos will accumulate in the lungs and eventually cause severe lung damage, and perhaps trigger cancer development. Some products may be problematic to parts of the gastro-intestinal system if ingested. Other substances irritate the skin and outer surfaces causing dermatitis or ulcers on the mouth or nasal passages.

Lists of hazardous chemicals are available in most countries, along with the safe level of exposure. In Canadian provinces, the American standards are often used. These are the Threshold Limit Values, adopted by the American Conference of Government Industrial Hygienists. This is a list of hundreds of substances with the limit values which "refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect." A few pages of this list which is updated annually, are reproduced in Annex B, to give the reader an idea of the extent of the problem.

Unfortunately our medical knowledge cannot keep ahead of the manufacturers. It has been estimated that a few hundred thousand chemicals now exist and about 3,000 new ones are introduced into the world's manufacturing processes each year. At this rate, many will never be tested for health effects unless a crisis situation arises. The United States, which has conducted more research than other western countries, has data on the toxic effects of a few thousand chemicals, probably 5%-10% of the total in existence.

To complicate the matter further, usually people in their occupational environment are in contact with many more than one substance and it may be the combined chemical reaction which is dangerous.

To summarize then, there are thousands of industrial chemicals only a few of which have been tested for toxicity. Most of the research which has been done concerns males. The female is physiologically similar to males with a few important exceptions so that the toxic characteristics of a chemical may affect men and women similarly. In many cases, we can make educated guesses as to any differences. The reproductive system is the main area of dissimilarity between men and women.

Whole volumes are produced describing chemical effects on human bodies, and the parameters of this report does not allow detailed descriptions. The US government's National Institute of Occupational Safety and Health (NIOSH) does much of the original research and classifying of chemicals for toxicity and it is worth pursuing their information. The World Health Organization and the International Labour Organization are also informative sources of material on this subject.

Biological Hazards

There is still a lot to be learned about biological hazards. These problems are less likely to be man-made.

Hazards are present to humans in a number of forms and may be inhaled, ingested, or absorbed through skin. Also, most parts of the body are vulnerable to biological hazards. However, medical science has made huge advances in an effort to protect people from some of these dangers through immunology.

Some of the principal biological hazards are from:

(a) Animals A tremendous number of harmful diseases can be transmitted from animals to humans, ranging from hydatid disease to rabies. Viruses and bacterias are also transferred via cultures and vaccines. A further hazard to those working with animals is from bites, and stings, which further provides an opportunity for bacteria to invade the worker.

(b) Human Beings Contagious diseases such as hepatitis, tuberculosis, and viruses may be a problem for anyone working with groups or crowds of people. The virus or bacteria is also available through cultures, tissues, and vaccines, so that the total person need not be contacted.

(c) Plants People may be allergic to certain plants. In addition, the dusts of many plants are hazardous if enough particles are inhaled. A well-known example is byssinosis, which is a lung disease resulting from prolonged inhalation of cotton

dust. Dusts from wool, hemp, flax, wheat and other products where small particles can lodge themselves in the lungs can be dangerous. A third hazard from plants is fungi and other organisms which although not strictly plant life, are made available through plants. For example, farmers are particularly susceptible to lung problems caused by inhaling microscopic fungi, a product of mould which gathers on damp hay and other dried animal feed.

Physical Hazards

Along with accidents, physical hazards are probably the most prevalent of industrial hazards. Less often fatal, this category includes noise, vibration, extreme temperatures, and pressures.

(a) Noise Industrial deafness is common, and usually due to long exposure to excessive noise rather than loud bangs, although breaks in the eardrum may result from the latter.

Characteristics of noise are intensity (which is the sound pressure or loudness) and frequency (which is the pitch). With the resultant ear damage both intensity and frequency of sounds are less distinguishable, so that not only does the noise need to be louder to be heard, but pitches have to more dissimilar to be interpreted.

Noise can affect hearing either temporarily or permanently. With "temporary threshold shift", the ear has a chance to recover if sufficient rests from noise are frequent and long enough. The length of time needed for recuperation depends on the initial hearing loss.

Standards exist and it is generally recommended that sound levels at work be kept below 90 decibels (for example: pneumatic drill for a maximum of 8 hours per day).

While much research has been done concerning noise, a lot still has to be learned, an example being the exact relationship between temporary and permanent hearing loss.

Recently, research has indicated that excessive noise may be damaging to other parts of the body besides the ears. As with other forms of body stresses, blood vessels may become constricted and adrenalin output may increase, causing increased blood pressure, pulse and breathing. Serious biological and psychological changes may result, particularly if exposure is over a constant and prolonged period.

On the positive side, much is already understood about noise, standards do exist, noise measurements are available through simple devices, ear protectors do a great deal to prevent hearing loss, and the auditory system continues to be a popular subject of research.

(b) Vibration This can either affect the whole body or various parts of the body.

Because of the nature of sources of vibration, probably few women are vulnerable to these dangers.

If someone is sitting or standing on a vibrating object for long periods, the whole body may be in danger. Disorientation, giddiness and nausea may result. More dangerous is the damage to bones and joints, where the cartilage may be damaged causing arthritis. Tractor drivers apparently suffer from damage to the joints in the spine.

Regarding the handling of vibrating tools, serious dangers to specific parts of the body, such as hands and wrists, apparently may result from long exposure. Injury to the bones, injury to the soft tissues (muscles, nerves), injury to joints (eventually causing arthritis), and injury to the circulation system (known as "whitefinger") are some of the detrimental effects.

The amount of damage the vibrating object does is dependent on the frequency, amplitude, and duration of exposure.

(c) Temperature Human bodies are comfortable at a narrow range of temperatures, but can become acclimatized to variations of that range.

Extreme cold is dangerous because of frostbite, which is the result of tissue damage, and lowered body and brain temperature which, if extreme, could lead to loss of consciousness and coma. Protection against exposure is available. It is less likely to be an occupational hazard for women.

Extreme heat exposure, however, is problematic in many industrial sites and outdoor environments during summer.

Biological changes in hot temperatures relate to circulation and perspiration. Extreme exposure may result in heat exhaustion, fatigue, stroke or shock.

There is some evidence that women have a lower heat tolerance than men, possibly due to increased body fat and reduced perspiration. However, this may be irrelevant if temperatures at worksites are controlled. Obviously the amount of physical labour, the amount and frequency of relief from the extreme temperatures, clothing and general health would all be important factors determining the risk factor.

(d) Radiation Radiation is generally the emission of rays of light or heat. Light is a visible form of radiation, but mostly radiation is invisible. The energy of the rays causes spontaneous disintegration of atoms which make up all matter. Two categories of radiation are ionizing and non-ionizing, the former being used in industry. Atoms are turned into charged particles called ions. In the case of X-rays or the radiation from radioactive material, the radiation ionizes the atoms of the body, damaging them.

Nearly everyone is exposed to natural sources of radiation. The amount of radiation one receives is called a dose and is measured in rems. The average person would receive less than 0.1 rem of radiation annually from natural sources, but this varies according to location. Televisions, air travel and rock or brick structures also emit radiation, with the average annual dose probably being about 0.2 rem. X-rays, another common source of radiation, are used for diagnostic purposes in medicine and dentistry and the average person is probably exposed to 0.07 rem per year from this source. Therefore the total annual dose of the average person in our society is less than 1 rem.

Excessive exposure is harmful, and those people occupationally exposed to radiation must be especially cautious. Any exposure is considered to involve some risk. Five rems per year is considered a safety limit for adults.

People working with radioactive substances, such as radium, and uranium, and people working in nuclear plants, radiologists and others continuously at the site of X-ray equipment must be careful to constantly protect themselves against excessive exposure. In addition, children and fetuses may be more vulnerable to the harmful effects of radiation, as discussed in the proceeding section on pregnancy.

(e) Absence of Physical Factors It seems reasonable that health problems need not arise solely from excessive exposure to physical factors. Deficiencies in lighting or ventilation, faulty equipment and poorly designed chairs and offices are only a few examples of hazards due to inadequacies.

(f) Accidents While the area of occupational accidents and related injury is not of itself a topic of discussion in this report it is a major concern in the overall issue and thus worthy of brief mention.

Broken bones, lacerations, concussions, burns, sprains, back and spinal problems are some of the afflictions which may be caused by a poor system of work, defective equipment, carelessness and/or inattention of the employee or a fellow worker, or plain bad luck.

Usually only one incident is needed to produce the injury and thus the source is mostly readily identifiable and can, from the statistical viewpoint,be easily attributed to the work situation.

Millions of work hours are lost annually in Canada through physical injury in the work situation due to accidents which may range from the temporarily through to the permanently disabling, involving mutilation and death.

Obviously some workers are more susceptible to accidents than others, and the traditional female occupations are probably less risky. Hospital workers are one example where sprains, back strains, objects striking against people, falls, scratches, are plentiful.

Most accidents are preventable when care is taken by the worker or the employer. Legislative bodies, management, unions, design engineers, workmen's compensation boards, medical people and employees all continuously make an effort to reduce accident rates. The whole subject of safety is well-documented and statistics according to occupation, time of day or week are available. In Canada, compensation for industrial accidents is available to victims or their families.

Mental Health Hazards

A number of factors contribute to the state of mental health of an individual, not the least of which are job satisfaction along with the psychological stresses incurred during work.

Mental and physical health are interrelated. Stress leading to high blood pressure, heart disease, ulcers, hypertension, has been associated with jobs, mostly those traditionally male-dominated. Air traffic controllers and executives in high pressure positions are examples. Stress may be the reaction to fast repetitive work, anxiety, fear of failure or a number of other demanding tasks. Biological responses include a release of the adrenalin hormone into the bloodstream, causing increased rates of pulse, breathing and blood pressure.

Psychological responses (which can develop through a lack of self-respect, pressure to achieve, feeling of non-accomplishment, lack of control over one's time and achievements) may indirectly lead to alcoholism, depression, alienation and drug abuse (especially analgesics and tranquillizers).

According to some surveys, alcoholism rates appear to differ according to occupation, with farmers having low rates of heavy drinking, and businessmen and semi-professionals having high rates of heavy drinking. People in some occupations have high tendencies towards heavy drinking, such as brewers, drink waiters and waitresses, those in the armed services, acting professions, commercial salesmen.[1] These differences may be due to predisposing attitudes, socialization and traditions rather than stresses.

For women, benefits may result from working. One Canadian study[2] showed that married women (between age 25 and 64) who were not in the workforce have an excessive rate of suicide compared to married women in the workforce. There was the suggestion that affiliation was an indirect benefit of work. Another example is smoking. If anxiety and nervousness at work or social pressure lead to increased smoking, the habit itself can then lead to obvious physical health problems.

---

[1] Kessel, N. and Walton, H. Alcoholism. Pelican Books, Ltd., Hammondsworth, England, 1965.

[2] Cumming, E. et al. Suicide as an Index of Role Strain Among Employed and Not Employed Married Women in British Columbia. Rev. Can. Soc. and Anthrop., 12(4): Part I, 1975.

A final example is accident rates which appear to be more prevalent among those with low job satisfaction.

Obviously stresses at work, monotonous jobs, high accident rate, frequent absenteeism, high blood pressure and all other factors associated with mental and emotional health, affect not only the total of one's life but also those with whom the worker associates.

Section III

HAZARDS IN FEMALE-DOMINATED OCCUPATIONS

Nearly all forms of employment have hazards. Those who have greater job mobility are fortunate - they have better opportunity to choose how their health may be affected. Hazards may be detrimental either physically or psychologically. Listed below is a sampling of occupations in which large numbers of women have been traditionally employed, along with discussions of the health hazards of that employment.

Reference can be made to Annex A for statistics from the 1971 Census of numbers of women in specific occupations.

1) Airline Flight Attendants[1] One of the biggest problems for airline flight attendants, about 86% (1976) of whom are female, is fatigue. Changes in time zones and temperatures, work stress, noise, cumulative loss of sleep are among contributing factors for fatigue, which can then lead to increased numbers of accidents and decreased efficiency of performance.

---

[1] Much of the data about health hazards of stewardesses is gained from a paper by S. Wofford, presented to the Conference on Women and the Workplace, sponsored by the Society for Occupational and Environmental Health, held in Washington, June 1976.

Circadian rhythmic disruption, attributable to "jet-lag", is not fully understood but is thought to have some effect on heart rate, body temperature, blood pressure, activities of the liver and kidneys, and menstrual cycle.

Noise is an occupational hazard of work in and near airplanes.

Mental stress may arise because of the risks of flying and continuous requirements to perform in front of people.

Alterations in menstrual cycles are reported among stewardesses, but opinions are conflicting about the causes.

There may be hazards to pregnant stewardesses, an issue which is currently controversial[1], and currently being argued in a Canadian court case. One side argues that turbulence and food handling may increase morning sickness; plane motion may increase change in balance, increased clumsiness may precipitate accidents, and ankle swelling may be more prevalent.

On the other side, it may be that airline companies feel the pregnant woman is less able to perform her duties as a stewardess. Apparently there is no substantiated medical evidence for either side.

Finally, airplanes are small enclosed spaces in which carbon monoxide, available from passengers smoking, may be harmful to stewardesses.

---

[1]See ACSW memo from M. Rioux to K. Cooke dated 18 February 1975.

2) House Cleaners A number of solvents and soap detergents are hazardous, both as skin irritants and because of the chemicals they contain. The products used for cleaning would be similar to those used by launderers (see page 27) and many of them are dangerous to the female reproductive system (see Section IV, page 32). About 19% of janitors and cleaners are female.

3) Dentists, Dental Nurses, Assistants and Technicians Exposure to anesthetics, radiation and mercury are probably the most hazardous aspects of the dental professions. About 3% of dentists are female, and approximately 68% of dental hygienists, assistants, and technicians are female.

Anesthetic gases are used in some dental surgeries, especially those in hospitals where major work is being carried out. In one American study[1] in which 4,797 general dental practitioners and 2,642 oral surgeons responded to a questionnaire, high exposure rates to waste anesthetic gases appeared to be a problem. Respondents indicated that there was a significantly increased rate of liver disease, and a significantly increased rate of spontaneous abortion among the wives of the exposed dentists. Although the dental societies' members questioned were male, it is probable that the female nurses in the room at the same time were equally exposed. It should be noted that this research does not give conclusive evidence that anesthetic gases are the causal factors. Hazards to the reproductive system in other professions have been suggested to result from exposure to high concentrations of anesthetic gases.

Canadian operating rooms may be less filled with waste gases, as ventilation is considered a serious issue.

---

[1] Ad hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, American Society of Anesthesiologists. A Survey of Anesthetic Health Hazards Among Dentists. JADA, 90: 1291-1296, June 1975.

Mercury may be toxic to dental office personnel who handle mercury amalgams. A recent study[1] in the United States (which repeated a Canadian study) measured air concentrations and surface of 19 offices and urine samples of 284 operatory and non-operatory dental workers. Results indicated that chronic exposure to mercury vapors may be hazardous. Dental assistants and dentists were thought to be most at risk. Extent of absorption would depend on quantity and manner in which the metal is handled and office ventilation. Mercury can accumulate in the kidney, and the central nervous system is the major organ affected by toxicity. With environmental mercury intoxication, kidney damage and respiratory problems have been reported. Mercury can cross the placenta, and thus the fetus may be at risk.

X-rays have become a common diagnostic tool in the field of dentistry. Excess exposure to radiation can be harmful to the reproductive system, increase the risk of leukemia and kidney problems and mouth and skin ulcers among other hazards. Caution need be taken to protect against over-exposure. Monitors to measure amounts of exposure are simple devices and lead aprons and doors should be used.

Soaps and disinfectants which can cause skin irritations are substances used by these professions.

4) Electrical and Electronic Workers Women are often hired in these factories because they are considered more capable of building appliances which require manual dexterity. In 1971, 42% of people in the electrical equipment fabricating and assembling occupations were reported to be female and 67% in the electronic equipment fabricating and assembling occupations.

---

[1]Schneider, M. An Environmental Study of Mercury Contamination in Dental Offices. JADA, 89: 1092-1098, Nov. 1974. This study repeats one done in Alberta in 1968: Buchwald, H. Exposure of Dental Workers to Mercury. Am. Ind. Hyg. Assoc. J., 33: 492 July 1972, (not seen).

The list of substances with which they may come in contact is extensive. A few of these are arsenic, asbestos, beryllium, cadmium, germanium, lead, mercury, platinum, phosphorous, radiation, selenium, various solvents and resins, tellurium and trichloroethylene. Each substance has particular hazards, but many can cause skin irritations while others are toxic when inhaled or ingested or absorbed through the skin.

5) Farmers Only about 3% of farmers and farm managers are female and 24% of farm workers are female according to the 1971 Census. It may be the husband who lists his occupation as farming, but usually the wife is also of necessity a farmer.

Products, such as pesticides, insecticides and fungicides as well as excessive exposure to heat, sunlight, and commercial solvents, may be hazards on farms.

Specific types of farming have different hazards. Vegetable and fruit farming may be associated with allergies. Farm personnel handling animals are at risk to bacterial infections and viruses, (see pages 9 and 10 on biological hazards).

Serious lung diseases are problematic to farmers[1] who handle grains or hay which is wet or mouldy. Three types of lung diseases are of particular concern for Canadian prairie farmers:

a) Farmer's Lung occurs after inhalation of mouldy hay dust. Symptoms are cough, fever, chills, dyspnoea, weight loss and fatigue and possible neurosis. Usually recovery is rapid if removed from the hay but repeat attacks are common.

---

[1]Information about this subject was gained mainly from personal correspondence with Dr. C.P.W. Warren, of St. Boniface Hospital, Winnipeg, who also kindly made available material yet to be published.

b) Grain dust asthma is common among grain elevator workers. Symptoms include cough and dyspnoea, as well as fever, and headache. Exact etiology is unknown. Air passages may be chronically obstructed.
c) Silo Filler's lung, probably less prevalent among women, occurs when nitrogen dioxide is inhaled and irritates the lungs. The gas is produced from silage when nitrates are oxidized.

Dr. C.P.W. Warren of Winnipeg, who has carried out considerable research of this field is of the opinion that respiratory problems occur most commonly among farmers whose equipment for storing and drying hay is less adequate, that is, less profitable farms. These are the farms where wives and daughters are more likely to be exposed to the dangers, as their assistance in running the farm is essential. Research about farm women's respiratory problems is not known.

There appears to be a high prevalence of skin cancer among farmers, probably caused by long hours of exposure of the skin to the sun.

6) Hairdressers About 51% of barbers, hairdressers and related staff are female.

Hairdressers use a large variety of commercial products which may be hazardous. Bacterial infections and varicose veins may also be dangers.

The use of hair tonics (containing, for example, mercuric chloride), detergents and soaps, perfumes, nail polishes, and dyes may all be contributing factors to skin irritations.

Hairsprays have become a matter of some concern over the past 15 years because of possible respiratory diseases and danger to other organs such as liver and bladder.

Aerosol hairsprays[1] may contain: resins (such as polyvinyl pyrollidone), plasticizers, solvents (such as methylene chloride); and other substances such as silicone or lanolin along with a propellant (formerly vinyl chloride).

There have been a number of individual cases of pulmonary disease reportedly related to hairsprays. As well, in both humans and animals, lung malignancies have been reported.

There is some controversy as to whether hairspray is a causal or merely coincidental factor. Some believe hairspray inhalation leads to a unique problem, while others believe that the sufferer is one of many who are inflicted with a more common lung disorder. The former group* believes the problem, called thesaurosis, is a result of non-biodegradable resins, primarily polyvinylpyrollidon (PVP) being stored in the lining of the lungs. Shortness of breath, mild cough and indications on chest X-rays are symptomatic of the problem.

Animal research has been conducted in this area and in addition, attempts have been made to establish a causal relationship by studying individuals during continuous use of hairspray followed by an absence of any exposure to hairspray.

A number of epidemiological studies have been conducted in the United States, an extensive one being done through the National Institute of Occupational Safety and Health (NIOSH)[2].

---

[1] The source for much of the data on hairdressers is: Palmer, A. A Morbidity Survey of Respiratory Symptoms and Functions. A publication of National Institute for Occupational Safety and Health, US Dept. of Health, Education, and Welfare, August 1975.

* Mainly Bergmann, Flance and Blumenthal.

[2] Palmer, A. op. cit.

In this study, 475 individuals (students and qualified beauticians) plus a control group were questioned and X-rayed and further examined medically. Symptoms similar to those of thesaurosis were most prevalent among the graduate beauticians, especially those who work in small salons.

Nail polishes and related products often contain a number of substances such as toluene, xylene and solvents which have been shown to be dangerous in other forms.

At least one study[1] found hair dyes to have mutagenic qualities, and suggests that the same brands also have carcinogenic properties.

7) Hospital Employees, Including Nurses[2] Approximately 60% of hospital employees are female. These include nurses, doctors, laboratory technicians (see page 25), cleaning and laundry staff, dietitians and nutritionists, nursing aides and assistants, and physiotherapists. Many of the hospital staff from all departments are susceptible to accidents. Back injuries, slips and falls, needle punctures rate among the most numerous accidents. Other accidents common in hospitals are cuts, scratches, burns, electrical shocks and being struck by moving objects.

Staff are at risk to different health hazards, depending on their jobs of course. Operating room nurses, anesthetists and related staff come in contact with anesthetic gases. In a national study of 49,585 operating room personnel in the United States, the results showed that the female staff had increased risks of spontaneous abortion, congenital abnormalities in their

---

[1]Ames, B. et al. Hair Dyes are Mutagenic: Identification of a Variety of Mutagenic Ingredients. Proc. Nat. Acad. Sci., 72: June 1975.

[2]The source of much of the information on hospital staff is personal discussions with Irene Krahn of the Ontario Hospital Accident Prevention Association.

children, cancer and hepatic and renal disease[1]. Another study[2] investigated causes of death among anesthesiologists over a 20-year period. The authors suggest that because the population is small (441), the results are not conclusive, but they showed a higher rate of suicide and a high incident of malignancies of the lymphoid and reticuloendothelial tissues.

"Possible etiological factors for the increase in spontaneous abortion among operating room personnel include exposure to low concentrations of anesthetic 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 anesthetic gases is considered the most likely factor[3]."

Various forms of cancer and reproductive difficulties have been reported by others. Halothane and nitrous oxide are suspected substances. Although anesthetics have been used for over a century, and appear to be relatively safe for the intentional acute exposure to patients, it is more recent that these findings of chronic exposure to hospital staff have been noticed. Most of the research has been done by only a few people in the United States, with some confirmation of results overseas. Some of the research has been criticized and should be repeated for validation of results.

If the equipment is faulty, the excess gases or vapours are more likely to enter the atmosphere of the room. Also, proper ventilation is essential. Major Canadian hospitals are deliberately sending the waste gases outside with the utilization of gas exhaust systems, to prevent these hazards.

---

[1] Ad Hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, Amer. Society of Anesthetic Occupational Diseases among Operating Room Personnel: National Study. Anesthesiology, 41(4): 321-340, October 1974.

[2] Bruce, D.L. et al. Causes of Death among Anesthesiologists: A 20-Year Survey. Anesthesiology, 29: 565-569, 1968.

[3] Corbett, T.H. Anesthetics as a Cause of Abortion. Fertility and Sterility, 23(11): 866-890, November 1972.

Laundry and cleaning staff come in contact with various solvents, detergents which may be toxic and irritating to the skin.

Radiologists and nursing staff are at risk due to the dangers of excessive radiation. Leukemia (see Section V) and reproductive difficulties (see Section IV), skin and mouth ulcers, kidney dysfunction, malfunction in the small intestine, and nausea are among the reported hazards of over-exposure to radiation. Simple monitors can detect the amount of exposure so that excessive dosage should not be a problem and lead can protect the body against radiation.

Contact with contagious diseases of all sorts is problematic for nursing staff in hospitals. The staff may be infected by direct patient contact, or indirect contact (such as through bed linens or from blood samples, and so on). Viral hepatitis and tuberculosis are two examples of hazards for nurses. A number of these viral infections may have teratogenic effects, (see page 34) the most famous of which is rubella. An epidemiological study which analyzed 4,100 pregnancies of Canadian nurses reported a significantly higher incidence of birth defects among nurses who cared for infants with congenital defects at home and in the hospital, and for those who cared for premature infants at home[1].

Finally, there is unsubstantiated evidence that nurses and doctors have a high rate of addiction to some drugs, such as tranquillizers and that the medical profession has a high incidence of suicide. These may be indirect results of the psychological pressures of that profession.

8) Laboratory Workers Laboratory technicians (about 73% of whom are women) and related personnel, are exposed to three main types of hazards: infections, toxic chemicals and use of radiation equipment. Scientists (such as bacteriologists, histologists and

---

[1] Haldrane, E.V. Search for Transmittable Birth Defects of Virolic Origin in Members of the Nursing Profession. Amer. J. of Obstetrics and Gynecology, 105: 1032, 1969.

chemists), technicians, students, assistants and cleaning staff may all be exposed to these dangers. Excessive exposure to those hazards is preventable through simple precautions.

Infections can be acquired from bacteria and from viruses in the laboratory. Apparently the number of laboratory-acquired viral cases, at least in the United States, has doubled every decade for the past 50 years, and is directly related to the number of viruses being handled and the type of institution[1]. Thousands of laboratory-acquired infections have been reported, with some hundreds leading to death. The risk is greatest among those people (scientists) who handle cultures directly but also exists for other staff, such as animal caretakers, students, janitors, and dishwashers[2]. Viruses produce greater risks than other infections in terms of numbers and severity and are increasingly being used in research. People are most often infected by accidental oral intake, accidental innoculation, animal bites, sprays from syringes and centrifuge accidents. As well as being dangerous to the individual infected, many viruses can cross the placenta, proving dangerous to the fetus.

Radiation is a tool often used in laboratories. Bone-marrow damage, leukemia and reproductive problems, kidney, and intestinal difficulties are some of the most serious hazards associated with over-exposure of radiation. It is recommended that the fetus not be radiated except for medical reasons of some urgency.

A number of toxic chemicals must be used in normal laboratory work. Benzene, toluene, formaldehyde, mercuric chloride are among the commonly used substances which may be skin irritants. As further examples of hazards, benzene and toluene have also been associated with bone marrow damage, reproductive problems, liver damage, and red blood cell damage.

---

[1] Stark, A. Policy and Procedural Guidelines for the Health and Safety of Workers in Virus Laboratories. Amer. Industrial Hygiene Assoc. J., 36: 234-240, 1975.

[2] National Institute of Health, US Public Health Service, as reported in Stark, A., op. cit.

In addition, one study[1] reported that professional chemists involved in research concerning carcinogenic chemicals had a higher incidence of cancer themselves. They had a higher than expected rate of lymphomas and cancer of the pancreas.

9) Launderers and Dry Cleaners People in the clothes cleaning business (approximately 62% of whom are female) come in contact with a variety of chemicals. Sores, pimples and scaling skin may result.

The epidermis may be penetrated, causing lower layers to be damaged. The epidermis protects through a mixture of dead cells, waxy coating and keratin protein. Each of these may be dissolved by some soaps,organic solvents, caustic alkalies, detergents and acids. Bleaches and acids may react chemically with the skin. The skin may set up an immunity to many substances[2]. For both launderers and dry cleaners, heat exposure and the physical exertion of carrying heavy loads may be problematic. In addition to the chemicals used in cleaning, the dirty clothes handled by employees may have high levels of dusts of hazardous chemicals. Apparently, accidents such as slipping are also common in commercial laundering businesses.

Soaps, detergents and bleaches may cause skin irritations. Acetic, formic and oxalic acids are all substances from which the skin should be protected. Solvents for spot cleaning may be particularly dangerous.

Dry cleaners may be at risk to other hazards besides dermatitis, solvents being their most serious danger. Some of the substances the dry cleaner may have to work with are: benzene, carbon disulfide, methyl alcohol, methyl chloroform, naptha, perchloroethylene trichloroethyle. A number of these chemicals are discussed in Section IV on dangers to pregnancy. Several of the foregoing are thought to be carcinogenic (see Section V).

---

[1] Li, F. et al. Cancer Mortality Among Chemists. J. of National Cancer Institute, 43, November 1969 (not seen).
[2] Stellman, J.M. op. cit., 54-66.

10) Office Workers About three-quarters (1975) of clerical staff are female. A large percentage of female workers are employed in offices. Generally, the hazards which may exist are not unique to offices: poor ventilation, inadequate lighting, noise, monotonous work, impersonal work situations. Most office jobs require long hours of sitting in one place, which will be damaging if the chair is not properly adjusted for the person. Long hours of standing for filing clerks may cause varicose veins. All of these are easily preventable. Generally, office workers are not subjected to the number and severity of hazards which afflict the factory worker. Because of the site of some offices (for example: lead factory or laboratory researching viruses), the clerical staff may be exposed to dangerous particles in the air, but usually at much safer concentrations.

However, women are now aspiring to and achieving positions of greater responsibility. And it is hoped that the number of females of executive standing will continue to increase. But with success come some mental and physical hazards. Middle-aged sedentary executives are often in poor physical health, mostly because of lack of exercise. The psychological stress, if women will copy the example of men, produce such problems as ulcers and hypertension. Heart disease is common. Current thoughts about heart disease theorize that "type A" people who are aggressive, hostile, struggling for success, are more prone to heart disease than "type B" who are more relaxed, less ambitious. Is there any reason that women should not gain the advantages and disadvantages of "type A" personalities as they enter a new environment?

11) Salesclerks Salesclerks, about 66% of whom are female, usually spend long hours on their feet, a factor possibly contributing to the formation of varicose veins and difficulties with feet. Of course, proper footwear prevents some problems. In constant contact with the public, they may be more susceptible to acquiring contagious diseases.

12) Switchboard Operators About 95% of telephonists are female. According to a Medical Director of Bell Canada*, there are no health hazards peculiar to switchboard operators, except in the case of people with ear infections wearing earphones. New developments in switchboards may overcome any possible detrimental effects of long hours of wearing earphones, sitting in front of the monotonous scene of a switchboard. Again proper design of chairs is, of course, important to those employed in this type of sedentary occupation.

13) Teachers About 60% of teachers up to university level, are female. They are susceptible to a variety of contagious diseases, such as mumps, measles and influenzas, and so on, with which they are brought into contact by the children they supervise. Many of the viruses to which teachers are exposed have teratogenic effects (see Section IV on pregnancy). Prevention is available through immunization for many of these diseases.

Teachers have complained of stress, due to having to continuously perform in front of others.

14) Textile Industry Workers Women have always been employed in the textile and clothing industries, and books could be written on the occupational hazards these women have been subjected to both historically and presently. Nearly 80% of labourers in this industry are female.

One can only imagine the number of chemicals used in textiles for dying or waterproofing or shrinking or oiling or permanent pressing or cleaning the product, along with the resultant effects on the worker.

The fabrics themselves create lints and dusts which are hazardous when continuously inhaled.

---

*Personal discussions with Dr. R.G. Leckey, Toronto Area Medical Director.

Noise is a problem in many textile factories.

Long hours sitting at sewing machines, from which occasionally broken needles fly, would not only be tiring physically but also mentally.

Many of the materials and chemicals with which the workers may come in contact are skin irritants. Some (such as solvents) may be teratogenic (see page 34), and some may be carcinogenic. Because of the enormous range of substances, nearly every part of the body could be affected adversely in some way or another through exposure to the work situation in the textile industry, if proper precautions were not adhered to.

For example carbon disulfide, a liquid used in the manufacture of viscose rayon can irritate the skin, eyes, and nose. Excessive exposure to this chemical affects the brain and can cause death, while lower concentrations cause headaches, dizziness, and psychological changes. Heart disease and sexual problems have also been associated with this chemical. Excessive exposure to carbon disulfide is now rare.

Byssinosis, also called brown lung, is a respiratory problem resulting from inhalation of cotton (or flax or hemp) dusts. This disease has been well-researched in animals and humans during the past couple of decades throughout the world. Cough, shortness of breath, and chest tightness are symptoms, and these are apparently more obvious on Mondays after a break from the hazardous environment.

Byssinosis appears to be caused by thick mucus accumulating in air tubes and the air tubes narrowing, making breathing more difficult. Some people (such as smokers) seem to be more susceptible to acquiring the disease, but the incidence of byssinosis is also related to the amount of dust particles in the air.

Asbestos is also commonly used in the textile industry for the production of curtains, rugs, pot holders, and ironing board covers. It can cause a disease known as asbestosis, first recognized in England early in the 20th century and now well-documented. As with byssinosis, asbestosis can occur after fairly short exposure but both usually develop after a number of years. Cough, breathlessness and scarring of the lung as seen by X-rays are symptoms.

The tiny fibres of asbestos are accumulated in the lungs, and are not destroyed by the body. Scar tissues form around the fibres and the lungs become inelastic and reduced in size. As with most respiratory problems, pulmonary function is altered. There is a lowered lung capacity and decreased amounts of oxygen are transferred to the bloodstream.

Besides this crippling disease, asbestos also appears to be responsible for a number of types of cancer. Lung cancer, mesothelioma (cancer of the membrane lining of the lungs or abdominal cavities) and gastrointestinal cancers (stomach, large intestine, and rectum) all appear to be more common among asbestos workers[1,2].

Often, research about asbestos is conducted only among men, especially among miners to whom the dangers are probably greatest. One exception is a cohort study[3] in which 900 women at an asbestos factory in the textile industry are described. Increased rates of death from cancers of the lung and pleura and other cancers and respiratory diseases were reported.

---

[1]Stellman, J.M. op. cit.

[2]Newhouse, Muriel. The Medical Risks of Exposure to Asbestos. The Practitioner, 199: September 1967.

[3]Newhouse, Muriel et al. A Study of Mortality of Female Asbestos Workers. Br. J. Indust. Med., 29: 134-141, 1972.

Some people, such as smokers, may be more susceptible to the dangers of asbestos. The Department of Epidemiology and Public Health at McGill University in Montreal has been world-renowned for its research on the hazards of asbestos, especially to asbestos miners.

Unfortunately, due to limited space, only a few of the dangers found in the textile and allied industries have been briefly described here. These, however, can give some indications of the potential health hazards to which millions of workers in this industry are exposed. Much research has been done and can be easily gathered by the reader for further investigation.

Section IV

HAZARDS TO PREGNANT WOMEN AND FETUSES

Up to twenty years ago most of the research in this area investigated the dangers to the unborn of working mothers, mainly to indicate the effects of the mother's working and the potential relationship to higher prenatal death rate, lower birth weights and congenital defects.

In 1975, 36.7% of the Canadian labour force were women. Of these, 75.5% were in the child-bearing ages of 15 to 44 years and 58.0% in the prime child-bearing ages of 15 to 34 years. The labour scene has changed and research must rapidly alter its focus.

Canadian research can shed little light on the hazards to the unborn from dangers of their mother's work. Recently this country was reported in international news because of a 34-year-old woman who was voluntarily sterilized in order to retain her job in the General Motors battery plant in Oshawa, Ontario. It seems an unfortunate way for a country to gain fame particularly when it concerns such an important topic.

The United States and some eastern European countries are conducting extensive research in this area.

For organization and definitions, this section relies upon two sources from the United States[1].

There are a number of ways in which the exposure to certain substances may affect the fetus. It is difficult to be conclusive on the subject for many reasons but mainly because the fetus is exposed to numerous substances during its 9-month life; because the existence of some defects (such as mental retardation) may not be noticeable for a number of years; and because of inadequacies of reporting. In addition, epidemiological and animal studies essentially remain the usual means of gaining evidence, rather than direct human experimentation.

Obviously exposure to substances may have varying results on the unborn. These are described below:

1) Spontaneous Abortion. An abortifacient is a product which causes miscarriage.
2) Stillbirth.
3) Prematurity.
4) Carcinogenesis. A carcinogen is a cancer-causing agent. The fetus may be harmed when the agent crosses the placenta, but the effects may not be known for many years.
5) Mutagenesis. A mutagen is a substance or agent which can cause changes in the generic material of living cells. Mutations can also occur in germ cells (the sperm or egg), which can then be passed on to offspring and to future generations. Up to conception, a mutagen may affect either the male sperm or the female egg cells and after conception the fetus may be affected. The change may have an advantageous, disadvantageous or a neutral effect on the species. The results may be spontaneous miscarriage or the development of the fetus with a genetic defect in any or all of its cells. Mental or physical problems may result. Mutations may occur after instant, continuous or repeated exposures to the substance.

---

[1] Hricko, A. with Brunt, M. Working for Your Life: A Woman's Guide to Job Health Hazards. Labour Occupational Health Program and Public Citizen's Health Research Group. California, 1976.
Also Hunt, V.R. Occupational Problems of Pregnant Women. A Report and Recommendations for the Office of the Secretary, Dept. of Health, Education, and Welfare. Pennsylvania, 1976.

6) Teratogenesis. A teratogen is a substance which causes harm to the fetus. The chemical or agent may cross the placenta without causing any harm to the woman. The result may be a miscarriage or congenital defects. A teratogen may be acutely toxic, needing only instantaneous exposure to cause harm to the fetus.

Many hazardous agents may reach the embryo or fetus after exposure to the mother by inhalation, digestion or through the skin. Probably most substances which are in the mother's bloodstream can be transmitted in some proportion to the embryo and fetus. Much is still to be discovered about the rate of transmission and the effects at different stages of the pregnancy. A particularly dangerous stage appears to be the first trimester of pregnancy.

In addition, the fetus (and the newborn) does not appear to have developed the mechanisms to detoxify and excrete all poisonous materials. As a result, the mother may not show symptoms of being exposed to the noxious substances, but the fetus may be affected[1].

The mother may be exposed to a wide variety of dangerous products in the environment or through foods and drugs. A substance can have more than one effect. For example some mutagens may also be carcinogens, as in the case of nitrosamines. Some of the more common products in the workplace which are said to have carcinogenic, mutagenic or teratogenic effects or result in stillbirth, prematurity or miscarriage are listed below, along with a description of the dangers involved and the type of work in which they may be found.

---

[1] Spyker, J.M. "Occupational Hazards and the Pregnant Woman" in Behavioural Toxicology Early Detection of Occupational Hazards Xintaras, C. et al.(editors) U.S. Dept. of Health, Education and Welfare, Washington, 1974.

1. ANESTHETIC GASES

Gases, such as nitrous oxide, are used to induce sleep in order that surgical operations may be performed. The gas may enter the operating room and affect doctors, dentists, nurses and technicians who are continuously or repeatedly present. Headache, dizziness and sleepiness are noticeable symptoms. Evidence has shown that anesthetics may have properties which produce spontaneous abortion, premature delivery and congenital defects.

Cohen et al (1971)[1] showed that there was a spontaneous abortion rate of: 38% among anesthetists, 30% among operating room nurses, and 10% among the control group of other nurses.

Adverse exposure to the reproductive system appears to be a risk for males as well. Offspring of male anesthetists were shown to have 1¼ times the number of birth defects than those of unexposed medical personnel[2], and the risk of miscarriage for wives of exposed dentists were 1 3/4 times that of unexposed dentists[3].

Most of the research on this subject is being done by a few epidemiologists in the United States[4] with some overseas

---

[1]Ad Hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, Society of Anesthesiologists. A Survey of Anesthetic Health Hazards among Dentists. J. Amer. Dental Assoc., 90: 1291-1296, June 1975.

[2]Ad Hoc Committee on the Effect of Trace Anesthetics, American Society of Anesthesiologists, Occupational Diseases among Operating Room Personnel. Anesthesiology, 41(4): 329-340, October 1974.

[3]Ad Hoc Committee, JADA, op.cit.

[4]Notably E. Cohen, T.H. Corbett, D.L. Bruce, and others.

research[1] but more work need be done for validation. Causal relationships have not been proven. Corbett has mentioned that the high incidence of spontaneous abortion among operating room staff may be due to X-rays, viruses, fatigue, and so on, but anesthetic gases are the most likely factor (see page 24).

Halothane and nitrous oxide are two suspected substances.

It may be that exposure at the different stages of the pregnancy have different results (early exposures produce miscarriage, later ones produce teratogenesis and still later ones produce malignancies[2]).

Canadian hospitals attempt to prevent chronic exposure to staff through proper exhaust systems.

Female workers who may be at risk: operating room nurses, doctors, technicians, dentists and dental assistants, as well as wives of men in those occupations.

2. BERYLLIUM

Beryllium is a light metal used to harden alloys. Excessive exposure to beryllium and its compounds has been reported to cause damage to liver and kidneys, irritate the skin and most often to damage lungs. It can cause a reaction similar to pneumonia in which inflammation in the lungs occurs. The US government's National Institute of Occupational Safety and Health mentions that the pregnancy or other body stresses may precipitate the onset of pneumonitis. Severe berylliosis may cause death. The lungs have difficulty transferring oxygen to the bloodstream, and after some years, the overworked heart may fail.

---

[1] See: Vaisman, A.I. Working Conditions in Surgery and their Effect on the Health of Anesthesiologists. Eksp. Khir. Anest., 3: 44, 1967 (Not seen), and
Lencz, L., Nemes, C. Morbidity of Hungarian Anesthetists in Relation to Occupational Hazards. 3rd European Congress Anesthetists. Prague August 31, 1970 (Not seen).

[2] Kuntz, W.D. The Pregnant Woman in Industry. Am. Industrial Hygiene Assoc. Journal, 423-426, July 1976.

One report has shown that of 95 females who died after having been affected by beryllium, 66% were shown to have had pregnancy as the precipitation factor[1].

Thus, this is probably not a substance which affects the reproductive system, but rather the combination of beryllium and stresses such as pregnancy may be detrimental to the female's health.

In addition, traces of beryllium have apparently been found in the urine of babies indicating that it can cross the placenta, but this may or may not be dangerous to the neonate[2].

Female workers who may be at risk: ceramic makers, workers in electronic factories, including manufacturers of valve components. Principal danger may be handling beryllium oxides and salts, in which places women have been less frequently employed.

3. CARBON MONOXIDE

Carbon monoxide is a colourless, odorless gas which is produced when the combustion of substances containing carbon (such as wood, coal, charcoal) is incomplete. Carbon monoxide is breathed into the lungs and from there goes into the blood-stream. It replaces oxygen when picked up by hemoglobin (the chemical which carries oxygen to the blood) because it resembles oxygen chemically and can thus prevent oxygen from reaching tissues by blocking off the means of transfer.

---

[1] Hardy, H.L. Beryllium Poisoning. Lessons in Control of Man-made Disease. NEJM, 273, 1965. As reported in Hunt, V. p.53.

[2] Hall, J.C. et al. Case Data from the Beryllium Registry. AMA Arch. Ind. Hyg., 19, 1959 as reported in Hunt, V. p.53.

Of 20 individual cases of carbon monoxide poisoning during pregnancy which have been reported, 10 of the mothers survived and of these, 8 of the babies had central nervous system defects[1].

Carbon monoxide is emitted with the exhaust gases of most internal combustion engines, such as are found in most automobiles.

Carbon monoxide is also found in cigarette smoke. Mothers who smoke cigarettes produce babies who weigh less than those produced by non-smoking mothers[2]. An increased rate of abortions and stillbirths has been reported by some investigators[3]. However, the evidence is not conclusive as to whether carbon monoxide is the determining factor.

Research with rats shows that those animals chronically exposed to carbon monoxide produce smaller young which may also develop abnormally[4].

It may also be that cigarette smokers have an increased incidence of miscarriages, stillbirths and premature births[5].

---

[1]Curtis, G.W. et al. The transplacenta diffusion of CO. A Review and Experimental Study. Arch. Path., 59: 677-690, 1955.

[2]American Academy of Pediatrics Committee on Environmental Hazards. Effects of Cigarette Smoking on the Fetus and Child. Pediatrics, 57: 411-13, March 1976.

[3]Astrup, R. et al. Effect of Moderate Carbon-Monoxide Exposure on Fetal Development. The Lancet, 1220-1222, December 9, 1972.

[4]Longo, L.D. Carbon-Monoxide in the Pregnant Mother and Fetus and its Exchange across the Placenta. Annals N.Y. Acad. Sc., 174: 313-341, 1970.

[5]Stellman, J.M. op. cit. p. 31.

There is a growing concern that one need not be a smoker to be exposed to the hazards, but merely need to breath fumes from other people who smoke.

Female workers who may be at risk: Employees may be exposed to carbon monoxide from a number of sources:

a) furnaces and ovens burning various products;

b) working near internal combustion engines (for example: fork lift drivers, sanitary workers, front end loaders);

c) working near automobiles (for example: collecting tolls on highways and bridges);

d) working in enclosed spaces where cigarettes are smoked (airplanes and offices).

Females are not often employed at the sites of a) and b) above, that is metal works, refineries, smelters, furnaces, mines. Those females supposedly at risk, therefore, would be road workers, automobile toll collectors, brewery workers, and people who continually mix with smokers in small spaces such as bar attendants, waitresses, airline personnel and office workers.

4. CARBON DISULFIDE

Carbon disulfide is a volatile liquid which is clear and colourless. It is used as an insecticide and as a solvent for gums, resins, waxes and rubber. It is used in the manufacture of viscose rayon.

The adverse effects of carbon disulfide have been known for about a century but more recently the effects on the female reproductive system have been noted, especially in Eastern European countries[1]. The USA and USSR are currently cooperating in research concerning a number of industrial chemicals, including carbon disulfide.

Reproductive problems arising from carbon disulfide such as irregularities in menstruation, have been reported and it is suggested that pregnant women should not be exposed to this substance[2].

There is some evidence that the male reproductive system may also be affected by carbon disulfide exposure.

For the past few decades, concentrations of carbon disulfide has been low enough in viscose rayon factories to prevent major difficulties.

Female workers who may be at risk: Those in the viscose rayon industry, and workers in rubber, rubber cement, and resin factories. Production processes are generally controlled enough to limit exposure.

---

[1] See Hunt, V. p. 66 (for references).

[2] Ehrhardt, W. Experiences with Employment of Women Exposed to CS_2. International Symposium on Toxicology of CS_2. Prague 1966. Excerpta Medica Fdn, 1967. (As reprinted in Hunt, V., op. cit., Appendix 5).

5. ESTROGENS AND OTHER SYNTHETIC HORMONES

Estrogen, progesten and androgen are hormones in the human body. They can also be produced synthetically for use in birth control pills, drugs to prevent miscarriage and drugs for other uses connected with the reproductive system.

They may be inhaled, ingested or absorbed through the skin and therefore people handling the substance occupationally may be affected by these hazards.

Interference of the endocrine metabolism results from exposure to these products. As well as causing irregularities in menstruation, cases of teratogenicity have been reported. Male children have been born with enlarged breasts, and testes abnormalities while female offspring have apparently been born with masculinizing anomalities[1].

There is evidence that male workers have also reaped the hazards of prolonged exposure to estrogen as have the children of those male workers.

Female workers who may be at risk: Those working in drug factories in the manufacture of synthetic hormones or the products extracted from same.

---

[1]For references, see Hricko, A., p. c-23 to c-25. Also see Fraumeni, J.F. Chemicals in Human Teratogenesis and Transplantal Carcinogenesis. Pediatrics, 53 (5), Part II, Supplement, May 1974.

6. HYDROCARBONS

There are different types of hydrocarbons, two of which will be briefly described.

a) Aromatic hydrocarbons These are organic compounds derived from benzene, and include benzene, toluene and xylene, among other products. They are used basically to manufacture solvents among other industrial materials, such as paint strippers and degreasers. Benzene is the most toxic of these substances. It can affect the bone marrow so that blood properties such as red or white blood cells are not adequately produced. Benzene has been associated with leukemia.

Reproductive problems arise in two ways. First, in animal studies benzene has been shown to cross the placenta and enter the blood stream of the fetus. Secondly, benzene has been shown to damage chromosomes[1].

Toluene does not appear to cause the same blood damage as benzene and may be a useful substitute. However, chromosomal damage has been associated with toluene.

Xylene, also apparently less toxic than benzene, has been associated with low production of red and white blood cells. Some women develop problems with menstruation after chronic exposure[2].

Combinations of the products (benzene, toluene and xylene) have been associated with menstrual problems[3].

Blood samples can be taken to discover the amount of benzene in workers exposed to this substance.

---

[1] Stellman, J.M. op cit. p 190.

[2] Stellman, J.M. op cit. p 191.

[3] National Institute for Occupational Safety and Health, US Dept. of Health, Education, and Welfare. Criteria Document for Toluene (not seen).

Much more research has to be done with respect of human exposure to these chemicals but benzene is generally considered to be a dangerous substance and pregnant or lactating women in particular should avoid exposure to it*.

Female workers who may be at risk: Factory workers manufacturing adhesives, batteries, pesticides, drugs, rubbers, soaps and detergents, solvents, dyes, glues, lacquers, linoleum, inks, perfumes, paints; as well as drycleaners, hairdressers, dyers, furniture and leather workers, histology technicians, photographic chemical users and manufacturers, printers, textile workers.

b) Halogenated hydrocarbons These are compounds of hydrogen, carbon and some combination of halogens (chlorine, bromine, fluorine, iodine). They have many uses, such as in aerosol propellants, in degreasers, in drycleaning, as general solvents, in pesticides, and in anesthesiology. Examples of these are: methylene, chloride, trichloroethylene, carbon tetrachloride, chloroform.

Liver, kidney, and respiratory problems have been reported in relation to exposure to many of these chemicals. Some are relatively non-toxic while others may be dangerous with acute or chronic exposure.

Some of these chemicals, such as carbon tetrachloride and methylene chloride have been shown in animal studies to have the capacity to cross the placenta. Chloroform has apparently destroyed embryos in rats[1].

---

*Exxon Corporation is currently studying the effects of benzene on women.

[1]Schwetz et al. Embryo and Fetotoxicity of Inhaled Chloroform in Rats. Toxicology and Applied Pharmacology, 28: 442-451, 1974 (not seen).

Female workers who may be at risk: People who work in the manufacture of aerosol propellants, degreasers, disinfectants, drugs, fumigants, paint removers, waxes, plastics and resins, varnishes; dry cleaners; textile workers; and food processers.

7. HEAT

Much work has been done on the effects of heat on human beings. The human body will adjust to bear most reasonable changes but the acclimatization process takes a few days. People exposed to high temperatures are uncomfortable, distressed, less alert, more careless and less efficient. The result in a work process may be more accidents. In addition, blood vessels dilate in hot temperatures and there is a corresponding increase in the heart and pulse rate[1], as the blood is circulated closer to the surface of the body in the attempt to facilitate cooling by radiation and also evaporation of perspiration.

Research has shown that body temperatures of pregnant females differ from those of non-pregnant women. Temperature standards have been recommended by the ACGIH[2] for different working conditions, but differentiations have not been set for pregnant women.

Female workers who may be at risk: Those working in areas of high temperatures such as factories which use heavy furnaces or ovens, or refineries.

---

[1]See Stellman, J. op. cit. p. 124.

[2]See page 8 for explanation: American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances in Workroom Air. Cincinnati (published annually).

8. INFECTION

A number of infections have been shown to cause harm to the fetus. One well-documented example is rubella (german measles), which produces heart, dental and eye defects, deafness, and mental retardation in the neonate. These effects are invariably manifested if the mother contracts the disease in the first trimester of pregnancy, but may also occur after a later exposure.

Numerous other viral diseases (such as mumps, herbes zoster, herbes simplex, cytomegalovirus, hepatitis A) and non-viral diseases (such as typhus, typhoid, tuberculosis, syphilis, malaria) have been reported to have teratogenic effects. Risks of abortion, developmental defects, fetal disease, stillbirth, prematurity and congenital disease have been associated with various viruses[1].

Potential immunity to many of these diseases is available through innoculation. However, in laboratories where new cultures are being researched, this is obviously not always the case.

Female workers who may be at risk: Scientific laboratory personnel (both scientists and related staff such as clerical and maintenance personnel, janitors, students[2]), hospital staff (including nurses, doctors, assistants, clerical staff, dieticians, technicians), some agricultural workers, teachers, and others involved in child and infant care.

---

[1] See Hunt, V, op.cit. p.48 and 48(a).

[2] Stark, A. Policy and Procedural Guidelines for the Health and Safety of Workers in Virus Laboratories. Am. Industrial Hygiene Assoc. Journal, 36: 234-240, March 1975.

9. LEAD

Lead is a heavy metal used in the manufacture of numerous products ranging from pipes to paints. It is also part of all soil and is therefore available to us through food. In industrialized areas, lead exists in the air and is inhaled. As a result of these sources, nearly everyone has some lead in their body. Persons who work with lead are being exposed to much higher concentrations.

Dangers arise when the amount of lead, which is easily measureable by blood tests, reaches a high level in the body. The hazards of lead poisoning have been reported since early Roman and Greek days and scientific research has advanced during the past century.

There are a number of known hazards to the female reproductive system. For over a century, lead poisoning in women has been associated with sterility, abortions, stillbirths and high neonatal loss. Lead easily crosses the placenta to the bloodstream of the fetus and, according to some animal and human studies, has been found as early as the 12th to 14th week of gestation. Concentrations may rise in later weeks, and it is possible that fetuses have the capacity to store the substance. Effects of dosage and duration of exposure to the fetus are still unclear. It is generally felt that the first trimester is a particularly dangerous period, but without conclusive evidence for the selection of this period[1].

At birth, the lead concentrations in the mother and the fetus have been shown to be similar. But the significance of this may be that the fetus may be more susceptible to tissue damage than the adult. Before birth, concentrations of lead in the fetal bone, liver and blood have been found to be higher than that found in the mother's tissues. This means that there is a possibility that the fetus may be affected by lead without clinical symptoms of lead poisoning being obvious in the mother. Suggested explanations have

---

[1] Scanlon, J.W. Dangers to Human Fetus from Certain Heavy Metals in the Environment. Reviews on Environmental Health, II(1), 1975.

included speculations about a one-way transfer system from mother to fetus or that fetal tissues are more capable than adult tissues in removing lead from blood.

Association of miscarriages, stillbirths and neonatal fatality with high levels of lead have been frequently reported. Individual cases of neonates with very high levels of lead have been reported[1], with varying results. Numerous animal studies (rats, mice, lambs, goats, hamsters, chicks) have shown effects of surviving offspring who have been prenatally exposed to high doses of lead. Renal tumors, lower motor activity, slow growth rates, hyperactivity, and slow learning have been reported. Dosage is likely important, as noted in one study where lower levels of exposure did not affect the rate of learning of lambs while higher levels produced slow learners[2]. Problems in the immune-response system of the fetus exposed to lead have also been discussed.

Lead appears to interfere with the formation of hemoglobin in human beings. This in turn may produce anemia, as well as problems in the cardiovascular system. Fetal blood supply may be altered.

There is some evidence that interactions with other products, such as Vitamin D supplements, may add to the absorption rate of lead. The combination of lead and the tranquillizer

---

[1]For examples: - Angle, C.R. and McIntire, M.S. Lead Poisoning During Pregnancy. Am. J. of Diseases of Children, 108(4): October 1964. and
- Palmisano, P.A. et al. Untaxed Whiskey and Fetal Lead Exposure. J. of Pediatrics, 75(5): 869-872, Nov. 1969.

[2]Carson, T.L. et al. Slowed Learning in Lambs Prenatally Exposed to Lead. Arch. Environ. Health, 29: 154-156, September 1974.

lithium may result in a greater amount of fetal liver damage[1].

Formerly women were considered to be more susceptible to the risks of lead, but the evidence is inconclusive. It is possible that the rate of excretion of lead is lower among women, and that the distribution of lead in the bodies of men and women differ[2].

In summary, the evidence available shows that in human beings, abortion and stillbirth are prevalent when high levels of lead are present, while animal studies have reported various deficiencies in the offspring highly exposed prenatally.

There is much animal research describing detrimental effects of lead. To get a full picture, these should be studied in detail.

It is also interesting to note that this is one of the few areas where detrimental effects to the reproductive system of men have been studied[3]. Decreased fertility and loss of libido may be results of lead toxicity, but again dosage and duration of exposure are probably important factors.

Female workers who may be at risk: There are vast numbers of industries in which people may be exposed to lead, both in the mining and smelting of the product as well as in the fabrication of other products incorporating this metal. Often, women are excluded from working in lead industries because of the physical burdens involved. However, in some industries where lead exists in the manufacture of other products (such as automobile batteries), women are employed. Suggestions for safe levels of exposure for pregnant women are levels similar to normal adult environmental exposure (that is 30 mcg./100 ml.).

---

[1] Boulos, B.M. Health Effects of Occupational Lead and Arsenic Exposure - A Symposium. National Institute of Occupational Safety and Health, US Dept. of Health, Education, and Welfare. Chicago, 1976.

[2] Boulos, B.M. op.cit.

[3] For example: Lancranjan, I. et al. Reproductive Ability of Workmen Occupationally Exposed to Lead. Arch. Environ. Health, 30: 396-401, August, 1975.

It is generally considered that pregnant women should be transferred away from any unnatural sources of lead. Some industries have also recommended that all women of child-bearing age should not be occupationally exposed to lead.

Most people working in lead industries are regularly given blood examinations to measure lead concentrations. Controls of lead levels in factories are strictly adhered to, but safe levels vary according to individuals and authorities argue as to the level of lead which is considered to be safe.

10. METHYLATED MERCURY

Mercury is a heavy metal and the only liquid metal. It vaporizes easily when left open to the air. It is used in different forms: a) as a metal in a wide variety of products including thermometers, dental fillings, neon lights, mirrors and in the manufacture of other products; and b) in both organic and inorganic mercury compounds in the manufacturing of drugs, dyes, inks, explosives, and pesticides.

In excess, mercury is extremely toxic. It is stored in and may damage the kidneys, and may affect the brain and nervous system.

It can cross the placenta and has been shown in a small sample of mice to have a 30% higher concentration in red blood cells of the fetus than in those of the mother. Those exposed "in utero" have shown more neurological problems than those exposed as children or adults[1].

---

[1]Scanlon, J.W. Dangers to the Human Fetus from Certain Heavy Metals in the Environment. Reviews on Environmental Health, II(1), 39-62, 1965. Reporting on Suzuki, A. et al. Placenta Transfer of Mercuric Chloride, Phenyl Mercury Acetate and Methyl Mercury Acetate in Mice. Indian Health, 5, 149-155, 1965.

Detrimental effects upon human reproduction were first clearly demonstrated at Minimata Bay, Japan, where contaminated fish were eaten. For a five-year period, 6% of the children were born with various afflictions including severe intellectual deficiencies. Two infants who died at birth were reported to have high concentrations of mercury in their brains, livers and kidneys. Another well-examined case occurred in New Mexico, USA, where a pregnant woman ate the meat of a hog which had been fed grain containing mercury. Physiological and mental defects of the child were severe. The mother was asymptomatic. Animal research with mice and hamsters has also shown offspring to demonstrate neurological development problems[1]. Abortions and stillborn babies may also be the result of acute mercury exposure of the mother[2].

Environmental exposure to methyl mercury is now being well-publicized in Canada because of Indians of the White Dog and Grassy Narrows reserves near Kenora, Ontario, who have acquired "Minimata syndrome" through eating fish caught in mercury-polluted waters.

Much more research needs to be done to determine the relationship between mercury and fetal defects. However, one author concludes that "available information suggests that mercury, when methylated, is potentially the most hazardous trace element for the fetus[3]."

Much of the data has been gathered about environmental poisonings rather than occupational ones. The dental profession has shown some concern, however, of the hazards of chronic exposure to mercury vapour from dental almalgams.

Female workers who may be at risk: Those exposed to mercury because of their employment in the industries which manufacture products such as: neon lights, mirrors, and thermometers. Also dentists and their staffs may be chronically exposed to mercury vapour. Precautions against excessive exposure are reasonably simple.

---

[1]Weiss, B. and Spyker, J.M. Behavioural Implications of Prenatal and Early Postnatal Exposure to Chemical Polutants. Pediatrics 53(5): Supplement 851-56, May 1974.

[2]See Hunt, V. p.59.

[3]Scanlon, J.W. op.cit.

11. PESTICIDES

These are chemicals or combinations of chemicals used as insecticides, fumigants, herbicides or fungicides, and so on. Unless strictly controlled, occupational exposure to these products would be much greater than environmental exposure which has been well-publicized. Hazards may be lessened by well-laundered clothing, good ventilation, and frequent medical checks.

Pesticides can be categorized by their chemical compositions, some of which are described as follows:

a) Chlorinated hydrocarbons:
For example: aldrin, benzene hexachloride, chlordane, chlorophenathane (DDT), dieldrin, and so on. If exposure is excessive, these products can be dangerous to humans. Some of the products are thought to be potential carcinogens and have been banned.

b) Organophosphate esters:
For example: chlorthian, diazinon. These products may be inhaled or ingested and chronic exposure may affect the nervous system.

c) Lead arsenate and lead arsenite.

d) Rotenone.

e) Nicotine.

f) Dithiocarbamates:
For example: ferbam, zuram, nameb, zineb. Allergies and hormone changes have been associated with chronic exposure to some of these products.

Reproductive problems of female humans has not been adequately researched in regard to these products. A number of animal and bacterial studies have indicated that more work should be done. It appears that some of these substances may cause adverse reproductive reactions in different animals; for example: carbaryl has produced abnormal offspring in guinea pigs, thiram in hamsters and captan in rabbits and mice[1]. Concern has been expressed that the dithiocarbamates may be mutagenic in humans[2].

---

[1]See Hricko, A. p. c-32 for references.

[2]See Stellman, J.M., op cit., p. 223.

Again, all these hazards may exist only in acute or chronic exposures; but more research needs to be done to learn of hazards to human beings.

Female workers who may be at risk: Food processors, textile workers, those involved in farming and agricultural work, and those involved in the manufacture of pesticides, insecticides, fungicides, and so on.

12. IONIZING RADIATION

There are various degrees and areas of radiation, ranging from power transmission and radios or television transmission and reception to cosmic rays. The energy of some types of radiation (X-rays, alpha rays, beta rays, gamma rays) is strong and can actually break up atoms, causing an electric charge. The charged particles are called ions. Ionizing radiation is so called because the radiation turns atoms into ions. Radium, uranium and plutonium are radioactive elements which give out ionizing radiation.

The average person is subjected to less than 1 rem (dose) of radiation annually from natural radioactive elements on the surface of the earth, and from commercial products such as televisions. Medical and dental radiation for diagnostic and therapeutic purposes gives an individual a greater exposure. Of course, greatest exposure is to those who spend much time in the presence of radiation. There is a cumulative effect, (see pages 12 and 13).

There are recommended limits concerning the amount of radiation to which any person should be subjected. A long list of potential dangers exist from constant exposure ranging from mouth ulcers to kidney dysfunction to leukemia.

Research concerning radiation and reproductive problems has been reported since the 1920's. Excessive exposure has three possible results: total destruction of cells, gene mutations, or direct damage to the fetus. The fetus is extremely sensitive to radiation. The recommended limit not to be exceeded is about 1/10th of the adult annual rate for the full nine month life of the fetus. Exact limits have not been agreed on. Radiation is more dangerous to growing individuals; thus adults are least sensitive, children fairly sensitive and fetuses most sensitive to the effects of radiation exposure. In the first trimester of pregnancy, the fetus should be well-protected from ionizing radiation, because at this stage the rapid cell growth of the fetus renders it particularly susceptible to adverse effects. Very early in pregnancy, prenatal fatality is a potential hazard of radiation.

Radiation is potentially mutagenic, according to animal and bacterial research. In addition, sperm and egg production cells are apparently affected.

Large amounts of prenatal exposure to radiation has resulted in physical and behavioural changes in animals. Lower doses have not shown the same alterations in development.

A number of epidemiological studies have also shown an increased incidence of childhood cancer (especially leukemia) among children whose mothers were exposed to high doses of radiation during pregnancy. Those children may also have an increased incidence of mental retardation.

The radioactive material radium has long been associated with hazards for women in another occupation. After the First World War women were hired to paint luminous dials on watches. These women often ingested radium unintentionally through wetting the

paint brushes on the ends of their tongues. A high incidence of abnormal chromosome structure was found among former female dial painters[1].

From the above-mentioned hazards, it can be seen that radiation in excess can be extremely dangerous -- miscarriages, sterility, mutagenicity, teratogenicity, carcinogenicity, all being associated with heavy exposure. The high doses referred to are those such as in animal studies or in studies of populations after the Nagasaki and Hiroshima bombs or men or women heavily radiated for medical treatment. Occupational exposure, although potentially more hazardous, is usually much more controlled, with the workers often being monitored for exposure rates.

In any case, it is highly recommended that pregnant women be removed from the site of radiation.

Female workers who may be at risk: Doctors, nurses, dentists, dental nurses and assistants, laboratory workers, in short any person located where heavy radiation is employed or radioactive chemicals (for example radium) are regularly handled.

13. VINYL CHLORIDE

Vinyl chloride monomer is a colourless gas which may be polymerized (combined with other substances) to produce polyvinyl chloride, which is a popular plastic. Polyvinyl chloride is used to manufacture vinyl furniture coverings, bottles, and so on.

---

[1]Boyd, J.T. et al. Chromosome Studies on Women Formerly Employed as Luminous-dial Painters. Br. Medical Journal, 377-382, February 12, 1966.

Workers may be exposed at three stages: to vinyl chloride monomer in the production of polyvinyl chloride; to polyvinyl chloride in the production of the plastic; or in the use of polyvinyl chloride plastic to manufacture the final plastic product. It appears that the first stage during the polymerization of the vinyl chloride monomer is particularly dangerous. One risk of exposure to vinyl chloride monomer is a rare form of cancer - angiosarcoma of the liver.

There are three plants in Canada producing these substances. Women are generally not hired for work in this field of production, probably because this process involves heavy physical labour.

Vinyl chloride is a known carcinogen and concern has arisen since 1974 about its teratogenicity and mutagenicity.

Laboratory research with bacteria has shown vinyl chloride monomer to have mutagenic effects.

Epidemiological studies have also shown that wives of men who work with vinyl chloride monomer have higher rates of miscarriage and stillbirth[1].

In the United States, two recent research studies were conducted because of concern about high incidences of congenital central nervous system defects. In both areas (Painesville, Ohio and Kanawha County, West Virginia) polyvinyl chloride polymerization plants exist, among other industries. Both were carefully controlled studies (N = 15 and N = 41) and both showed no association between the incidence of the congenital defects and occupational or environmental exposure to polyvinyl chloride[2].

---

[1] See Infante, Peter. Genetic Risks of Vinyl Chloride. Lancet April 3, 1975, 734-735

[2] Edmonds, L.D. Research results made available to ACSW. As yet unpublished. West Virginia, USA, July 1976.

Dow Chemical has recently researched the effects of vinyl chloride on embryonal and fetal development in mice, rats and rabbits[1]. Maternal toxicity was observed, and especially prominent among mice. Vinyl chloride alone did not cause significant embryonal or fetal toxicity. However, inhaled vinyl chloride in combination with ethanol in the drinking water resulted in increased effects, both in maternal and embryonal toxicity.

Female workers who may be at risk: Few women work with vinyl chloride monomer, which may be the potential hazard. Probably less hazardous but more populated with female employees are the numerous production lines in which polyvinyl chloride is used in the manufacture of bottles, furniture coverings, and so on. There is as yet no reported evidence of any dangers regarding this product in its finished form.

CONCLUSION

In addition to the above substances, a number of others have been mentioned as mutagens or teratogens. The US government's National Institute of Occupational Safety and Health has studied the research evidence of about 3,000 chemicals, on which nearly 200 it has found evidence of teratogenicity or mutagenicity.

Substances, other than those detailed above, which are suspected to have the potential to affect the fetus or embryo are[2]:

- Aluminum and compounds
- Anilene
- Arsenic
- Cadmium
- Captan
- Carbaryl
- Chromium compounds
- Copper and compounds
- Cyanides
- Drugs, such as amphetamines, antithyroid drugs, streptomycin, anticonvulsants

---

[1] John, J.A. et al. The Effects of Maternally Inhaled Vinyl Chloride on Embryonal and Total Development in Mice, Rats, and Rabbits. Dow Chemical, USA, Mich. March 1976 (As yet unpublished).

[2] For references, see Hunt, V.,Fraumeni, J.F.,Kuntz, W.D. and Scanlon, J.M.

- Fluorine
- Formaldehyde
- Hexachoratbutadene
- Hydrogen sulfide
- Malathion
- Nickel and compounds
- Nicotine
- Nitrobenzene
- Oxides of nitrogen
- Paraquet
- Phenol
- Phosphorous
- Polychlorinated biphenyls
- Selenium and compounds
- Tin
- Titanium
- Turpentine
- Vanadium

and numerous others*

It should be reiterated that conclusive evidence on this subject is difficult to obtain. Animal studies may give good indications but may also supply false leads regarding humans. Epidemiological studies indicate incidences of abnormalities, which may be correlated with various factors, but cause-effect relationships can only be hypothesised. In short, correlations are shown but not causes. However, even without the direct causal relations being identified, evidence may be substantial enough to mount preventative campaigns, as in the example of smoking and lung cancer.

It should also be repeated that dangers usually arise when excessive exposure exists. Often, management is aware of hazards and conscientious about minimizing exposures. However, safe exposure limits for the fetus are rarely known. Even if more knowledge were available about effects on fetuses, the mother is not always aware of the pregnancy in the first months which may be the most critical.

---

* For an extensive documentation of teratogenicity, the following reference should be studied: Shepherd, T.H. Catalog of Teratogenic Agents. Johns Hopkins Univ. Press, 1973.

Finally the amount of information available in this area is still inadequate and incomplete.

It may be that before the detrimental carcinogenic or mutagenic effect is produced, an interrelation of factors is required and not just the presence of the offending substance.

For example a lack of calcium in the body at a particular stage of exposure, plus the excess of the damaging chemical may create the situation that leads to the susceptibility of the genes or fetus to subsequent injury. In that case, diet would be particularly important.

In animal research this was illustrated in studying vinyl chloride. Toxicity of vinyl chloride for the mother or fetus was not evident when it was given alone, but was prominent when both ethanol and vinyl chloride were administered[1].

Another example of this was demonstrated in studies of animals and of tissue cultures of human liver cells, where it was shown that the combination of the drug lithium and lead produced higher fetal liver damage than either compound alone[2].

Although medical scientists have made great advancements concerning this complex subject, much more still has to be learned. Unfortunately new chemicals are being utilized at a much faster rate than scientific knowledge becomes available about the potential hazards to future generations.

---

[1]John, J.A. op.cit.

[2]Boulos, B.M., op.cit.

Section V

CARCINOGENS

Because cancer has become, along with heart disease, a leading cause of death in Canada, it is being singled out as a topic for discussion. Approximately 20% of deaths in Canada annually are attributable to some form of cancer.

Cancer is a social disease, that is its origin is in a way attributable to modern man's way of life. Our way of life has altered from that to which humans are biologically adapted. Heart diseases, hypertension, cirrhosis of the liver, death by traffic accidents, suicide are examples of social diseases. While the toll from many causes of death (for example: infant mortality, viruses, infections) has been declining, deaths from social disease continue to proliferate.

Work is at least one of the factors involved with the aetiology of cancer.

Definition: Carcinogens are cancer-causing agents or substances. Cancer is really a family of diseases rather than one disease, with the common factor being an unnaturally rapid growth in cells[1]. The cells grow to tumors.

Parts of the body are made up of tissues, which in turn are made up from different cells. Any cells can become malignant, and of course the site of the cells give the disease its name, as in lung cancer or brain tumors. The rapidly multiplying cancerous cells can destroy surrounding tissue, which is growing at a normal rate.

---

[1]Source for much of the data is: US government's Council on Environmental Quality. Environmental Quality, Washington, 1975.

One of the characteristics of cancer is that it is a latent disease, meaning there is a delay (usually 15-40 years) between cause and manifestation of the symptoms. A number of factors, including age and sex, can decrease or increase the length of the latency period. This presents problems for research because someone may work with a carcinogen for a few years but not realize the effects until long after their exposure to the substance has been forgotten.

Another complication is that the amount of exposure to a carcinogen does not indicate the extent of the risk factor. Although it is generally believed that long-term exposure increases the risk of developing the disease, this is not always so and single exposures can be dangerous. Carcinogens vary in the dose needed to be potentially dangerous.

Sex differences Various populations are more susceptible to different forms of cancer. Age, sex, race, site in the body, diet, ethnic origin, and geographical residence can all affect the incidence of varying types of cancers. Health and Welfare Canada report has the following to say about sex differences and carcinogens:

> "Sex differences in response to carcinogens have been well documented. Bates (1968) for example, found a higher incidence of tumors in male mice given 7,12-dimethylbenzanthracene than in females while Mulay and O'Gara (1956) noted that 85% of male and only 19% of female Osborne-Mendal rats developed tumors on exposure to 4-dimethylamino-azobenzene. On the other hand, Andervont (1950) found that the female mouse was much more responsive to the carcinogenic action of o-aminoazotoluene than were the males. Some reasons for sex differences in response to carcinogens are reviewed by Bock (1964). Hormonal factors influencing the development of tumors were considered by Morris and Firminger (1956) who found that male ACI rats developed more liver tumors following exposure to 2-dimethylaminofluorene

> than females but castration of males and treatment with estrogens gave a response similar to females."[1]

Occupational health hazards of women in relationship to carcinogens exists in two ways.

a) Firstly, women in the course of their work may be exposed to dangerous substances. Nurses exposed constantly to anesthetics for example, appear to have a high incidence of lymphoid malignancies[2]. Dental assistants may be equally exposed when using the same anesthetic gases. X-ray technicians appear to be at risk to various forms of cancer. Women working in laboratories may handle a number of carcinogenic chemicals, such as benzedene, or beta-propiolactone. Asbestos dust found in the textile industries may be a causative factor in lung cancer, mesothelioma (cancer of the membrane lining of the chest or abdomen) and gastrointestinal cancers (cancers of stomach, rectum, intestine). These are but a few of many examples.

b) Secondly, women may be exposed to the risks of certain carcinogenic chemicals through their husbands' occupations.

Occupational carcinogens

The first report of an occupationally related form of cancer was in 1775 by an English surgeon Sir Percival Pott, who described cancer of the scrotum among young boys working as chimney sweeps.

In the past 200 years, science has not given us an answer as to the causes of cancers, but has identified a number of strong associations, the best known of which is cigarette smoking and lung cancer. Thus, exact causative factors are unknown to date, but it is well-established information that smokers have a higher incidence of lung cancer than non-smokers.

---

[1] Government of Canada. Health and Welfare Canada. The Testing of Chemicals for Carcinogenicity, Mutagenicity, Teratogenicity. Ottawa, 1975.

[2] Corbett, T.H. et al. Incidence of Cancer among Michigan Nurses-Anesthetists. Anesthesiology 38 (3): 260-263, 1973.

It has been estimated that environmental factors are responsible for 60% to 90% of all cancers. Usually, if a substance is found in the general environment, it is found in much greater concentrations in the factory where it was produced or is used in the manufacture of other products. Thus protection and frequent examination for symptoms is especially important for workers who are exposed for many years to a potentially dangerous substance.

Some people appear to be more susceptible to the risks of cancer. It may be that a mixture of hazardous chemicals can multiply the risk. For example, asbestos workers who smoke appear to contract lung cancer at a much higher rate than asbestos workers who do not smoke and people who are neither smokers nor in the asbestos industry[1]. Asbestos then appears to be a co-carcinogen with cigarette smoking.

The list of chemicals which are thought to be carcinogenic is too extensive* for this paper. However, a limited list merely to give examples follows (see Table I).

Prevention

The two main reasons workers' health continues to be affected by occupational carcinogens are the toxicity of a substance is not adequately known, or protection against the substance is not respected.

Unfortunately, industry is multiplying its use of chemicals at a much faster rate than medical science is learning about the cancerous effects of those substances.

---

[1]Council on Environmental Quality (US Government) op. cit.

*A valuable source of information is: US Government's National Institute for Occupational Safety and Health, "Suspected Carcinogens - Subfile of Toxic Substances List", US Government Printing Office, Washington (published annually).

Table I: Examples of suspected products associated with types of cancer.

Site of Cancer	Product or Occupation
(a) Skin Cancer	- coal tar and derivatives (for example: pitch, asphalt, soot, tar) - arsenic - sunlight - X-rays - petroleum oils and derivatives (for example: tar, fuel oil, diesel oil, methylated naphthalene)
(b) Cancer of Lungs and Respiratory System	- Dust and fumes from: asbestos arsenic, gases, lubricating oils, arsenic, chromates (found in paints, wool processing, lithography), nickel, radioactive substances such as uranium, vinyl chloride, coke-ovens.
(c) Urinary Bladder Cancer	- benzidene and derivatives - beta-naphthylamine - rubber products - gases
(d) Liver	- production of vinyl chloride
(e) Brain Tumors	- rubber - production of vinyl chloride
(f) Blood-forming Tissues (including leukemia)	- painters - radioactive substances (radiologists have a high incidence of leukemia) - benzol - rubber and rubber goods - paints, paint removers - rotogravure printing

Small advances in cancer therapy have been made, and a lot has been done regarding associations between causes and effects. Thus prevention should be the area of concentration. People working with potentially dangerous substances must ensure that their exposure is limited. Degrees of exposure should be kept to a minimum and individual exposure rates should be frequently measured.

Research

It is well-known that extensive research in most large countries has been developed and sponsored in the continuous effort to make discoveries about cancers. Hopefully, the future will show this disease to be a priority in medical research. The topic of cancers is complex: there are numerous types of the disease, factors determining susceptibility, trends in survival rates, and so on. Co-carcinogens is likely as important a subject as any in understanding the risk factors of occupational carcinogenicity.

Section VI

OTHER OCCUPATIONAL HEALTH HAZARDS PECULIAR TO WOMEN

In this section, a number of health hazards which may be peculiar to women, because of their biological characteristics, are discussed. As with pregnancy, the woman should be conscious of possible altered physical needs during periods of menstruation and lactation. Physical and psychological differences in women may mean hazards which are unique to them. As with many topics concerning medical sciences where information is inconclusive, more research needs to be carried out in this area.

1) Menstruation There are various issues involved in the topic of work and the menstruating woman in relationship to health.

Originally, women were excluded from some employment because they may be incapacitated for 5-odd days monthly during menstruation. This is no longer considered to be the case.

Evidence exists to say that the nature of some occupations may affect menstruation. For example, alterations in menstrual patterns (especially more intense and prolonged bleeding) may result from exposure to a combination of benzene, toluene and zylene[1]. Other examples are polystyrene (ethyl benzene) production workers who claim to suffer from irregularities in menstruation and ovulation[2], and viscose factory workers where carbon disulfide may be associated with excessive bleeding[3].

Also, airline flight attendants have reported changes in menstrual cycles apparently due to upset circadian rhythm[4]. And women manufacturing synthetic hormones have reported altered menstrual cycles.

The opposite may also be true, that is, menstruation is a causative factor in occupational health hazards of women. Much has been written lately about menstruation and its physical and psychological effects and symptoms. One study[5] examined 84 accidents to find that over half occurred during the last three days before and the first four days of menstruation. Other studies have shown similar findings but of course this is not conclusive. Contraceptive pills may lessen the changes of the menstrual cycle to a woman. This information has valuable implications in the workforce.

---

[1]National Institute of Occupational Safety and Health, US Department of Health, Education and Welfare. Criteria Document of Toluene, p. 19, Washington (not seen).

[2]Stellman, J.M. and Daum, S.M. op.cit., p. 231.

[3]Ehrhardt, W., as reprinted in Appendix 5 of Hunt, V., op.cit.

[4] Wofford, S., op. cit.

[5]Dalton, K. The Premenstrual Syndrome. William Heinnemann Medical Books, London, 1964.

Understanding the female in menopause and the male in a comparable stage of life should have equal significance for the workforce.

2) Lactating Mothers The lactating mother should be conscious of her occupational environment and the effects it may have on the neonate. Some chemicals which enter the mother's body are secreted to breast milk. As in the case of the fetus, the tiny body's organs may not be able to cope with the chemicals in the same way as the adult does.

Research with rodents and goats have measured concentrations of mercury in the mammary glands. With the rodents[1], the mercury reached a peak level twenty minutes after injection. With the goats[2], the concentration of mercury in the mother's milk and blood was considerably lower when the mercury was administered orally instead of intravenously. Human milk may also be a source of mercury, especially if the mother has had long-term exposure to high levels of mercury.

Lead has also been found in human breast milk, but it is important to note that lead is also available from cow's milk and from environmental sources so that here it is possible that a baby may receive higher concentrations of lead from cows milk than from the mother's milk.

Methylene chloride (a chlorinated hydrocarbon), has also apparently been reported to be secreted into breast milk, as has arsenic and undoubtedly many other chemicals. In September 1976, the US Environmental Protection Agency announced a report showing concentrations of polychlorinated byphenyis (PCB) in human milk after being exposed environmentally. Again, this chemical is also available through cow's milk.

---

[1]Berlin, M. and Ullberg, S. Accumulation and Retention of Mercury in the Mouse. Arch. Environ Health 6: 589-595, 1963 as reported in Scanlon, J.W. op. cit.

[2]Howe, M. et al. Transfer of Inorganic Mercury to Milk of Goats. Nature, 237: 516-518, 1972 as reported in Scanlon, J.W. op. cit.

As in the case with the pregnant women, chemicals cannot be totally avoided nor need they be. But the fetus and neonate will probably be more easily affected by the detrimental qualities of large doses and so moderation of exposure is important.

3) Fatigue It has often been argued, especially in previous decades, that women's bodies could not stand up to the same work as men. Indeed, working women often complained about continuous fatigue. Tenseness, nervousness and increased accident rate and lack of concentration may result from exhaustion. Some theorists now believe that fatigue is not due to sex differences as such, but attributable to the fact that women often have two full-time jobs. As well as employment in the workforce, the mother is often manager of the home and family. The latter job is time-consuming and may be physically, emotionally, and psychologically demanding. Single parents may find the combination of the two forms of employment even more burdensome.

In addition, because of their manual dexterity, women are often employed for simple jobs which require speed, and concentration. The rhythm and repetition of these jobs would put anyone to sleep!

4) Safety While safety and accidents on the job are an issue separate from this report and also worthy of extensive research, some brief comments can be made.

Accidents are a serious and overt problem of work. Management, union, employee and legislative bodies are constantly in motion trying to reduce accident rates for both male and female workers. Poor safety records are expensive for everyone involved.

Women may have different types of accidents than men. For example, women may be more likely to be hit by flying pieces of broken sewing machine needles and being cut by broken syringes in hospitals.

Safety risks for women may be related to fatigue. Ideas relevant to the contributing factors for this are discussed on the preceding page, but no matter what the cause, fatigue on the job can lead to increased susceptibility to accidents.

Another unfortunate problem is inadequate self-protection against accidents. Falls or slips are a leading cause of industrial accidents and women have a reputation for wearing inadequate footwear, such as sandals. Better education and availability of proper apparel may overcome these problems.

Finally, statistics may be misleading. It is likely that women who are seriously injured on the job will stay out of the workforce, while men may find it an economic and social necessity to return within a few years. Also it is thought that women and men have different tendencies in reporting minor injuries on the job. While men may be more likely to make use of the industrial nurse, women may self-administer first aid treatment and more frequently perceive the industrial medical team as people with whom to discuss personal problems. While males and females may or may not have equal safety records, the actual record-keeping may give a confusing picture.

5) Physiological Differences Matching the demands of the employment with the physical abilities of the person is important, as individual as well as sex difference do exist. Obviously there are physical differences in men and women. It would not be safe for some women nor some men to handle certain jobs. Generally, women have less muscle mass than men, which results in lowered strength and work capacity. However, industrial women appear to be able to handle significantly more weight and work load than housewives[1]. One can speculate as to whether women can handle more weight because they are in industry or vice versa.

---

[1]Snook, S.H. and Ciriello, V.M. Maximum Weights and Work Load Acceptable to Female Workers. Journal of Occupational Medicine, 16(18): 527-535, August 1974.

Several studies[1] have demonstrated sex differences in tolerances to heat, and recommendations for work environments often acknowledge this. Differentiations have also been reported in vision, colour blindness and olfactory and auditory senses. Manual dexterity and muscular-skeletal development in men and women are dissimilar. These differences can obviously affect the performance, health and safety of individuals on their jobs.

Section VII

CURRENT ACTIONS, POLICIES AND IDEAS IN CANADA AND ELSEWHERE

Although our society has been aware of some occupational diseases throughout the twentieth century, considering the size of potential problems, relatively little has been done to alleviate this.

Early unionism developed partly because of hazardous working conditions. The first Factory Act was passed nearly a century ago. Workers could financially recuperate losses from industrial accidents when the Canadian Workmen's Compensation Act took effect in 1915. Factory inspectors have supervised conditions since before World War I and industrial medical people have long been on staff of larger companies. In the thirties and forties, the federal and most provincial governments established divisions of industrial hygiene.

This section of the report deals with the current situation of occupational health. It is far from conclusive because of the time and length limits of the report. To gather information, extensive material was read and a number of people contacted either by correspondence or personal interview.

---

[1] National Institute of Occupational Safety and Health. See US Department of Health, Education and Welfare. Problems of Occupational Safety and Health: A Critical Review of Select Workers Physical and Psychological Factors. Vol. I p. c-30 to C-57. Cincinnati, November 1974.

All the interviews were within Ontario with either agencies or individuals located in that province, although some of these people represented national bodies. While this appears to exceedingly limit the study, Ontario always has been and continues to be a leader in this field.

In this section an attempt has been made to survey and report on the status of occupational health in Canada in respect of the legal situation, provincial and national responsibilities, international trends, research and literature resources, and some interests taken by professionals and by industries.

While most of the material deals with the status of occupational health for both men and women, this approach may be beneficial if protective legislation, which would exclude women from certain occupations, is to be avoided.

Provincial Governments

Health is a provincial matter under the British North America Act, with a few exceptions. Therefore, where laws exist in relation to occupational health, they are mostly provincially enacted. Usually these laws or recommendations are enforced and administered by the Workmen's Compensation Boards or the Departments of Labour or Health of each province. More specific hazards are often regulated by each provincial governments' Departments of Environment, Mines and Energy, Agriculture, Transport, and so on. The problems of occupational health are multi-disciplinary and each province has developed its own mechanisms for dealing with the health of its citizens while they are at work.

A full study of the legislative situation would be complex, as laws range in subject from the Public Health Acts to the Silicosis Act (Ontario) to Fire Prevention Acts. Annex C details the various acts and the departments which enforce them.

The issues are actually more confused than the list would indicate. For example, in Ontario, a set of standards are recommendations only and are based on the ACGIH Threshold Limit Values* for hazardous materials. People from the Ministry of Health have the authority to inspect and take samples from workplaces but have no enforcement powers if the recommended levels are exceeded. They may report the existence of unsafe workplaces to the Ministries of Labour, Natural Resources and Environment which have the power to enforce health standards.

In some cases, legislation covers particular industries (for example mining), in other cases specific hazards (for example fires, pesticides or noise).

As far as hazardous substances are concerned, most provinces have used the ACGIH's Threshold Limit Values, by adopting them completely and using them in the form of regulations or merely as a guideline or by modifying them. As mentioned on page 8 these are time-weighted measures which are considered to be a safe level of concentration in which an average person can work. There are no differences between men and women mentioned in this list.

Beyond enforcing standards and penalizing those who do not comply, provinces have assumed other roles. Some provinces provide medical examinations for the purposes of preventive medicine, record-keeping facilities, advisory groups and health education programs, support for research and extensive libraries, all in the interests of the workforce.

Provinces have also been involved with specific exploratory activities relating to this subject of occupational health. Examples of recent commissions of inquiry are the Beaudry Commission which examined the asbestos industry of Quebec and Ontario's Royal Commission on the Health and Safety of Workers in Mines

---

*American Conference of Governmental Industrial Hygienists, a sample list of whose standards are in Annex B.

(known as the Ham Report), both released in 1976. Specific studies of this magnitude on women and their occupational health are not known.

The Ministry of Health in Ontario has a large Occupational Health Protection Branch which includes safety engineers, nurses, and physicians. As well as an extensive library, the Ministry provides education, technical, advisory and research services. Some of their research includes epidemiological studies of vinyl chloride monomer, uranium and nickel refinery workers; and the analysis of various samples or cultures to determine safe levels.

Ontario has interesting advisory committees as well. One is the fourteen member Advisory Council on Occupational Health, chaired by Dr. H. Rocke Robertson, which began in mid-1975. It provides a formal medium through which industry, labour, medical people and others can advise the provincial government on health standards, programs and recommended policies. The Council reports to the Ministry of Health. One of their current projects is an investigative study of occupational health hazards of pregnant women.

Also in Ontario, a new committee of epidemiological medical experts was set up in late 1976 to monitor trends in birth defects. The committee meeting fortnightly has the responsibility to regularly submit statistics on the existence of congenital defects throughout geographical areas of Ontario. Although not its primary purpose, this committee may indirectly give us information on occupational hazards.

Workmen's Compensation Boards

In each province, an active role in occupational health services is assumed by Workmen's (an alternative name is Worker's) Compensation Boards. They are funded by employers on a scale determined by the health record of the particular industry. Their principal purpose is to provide financial compensation for health

losses incurred because of work. Additional responsibilities some of the boards have undertaken are medical and rehabilitative services. In some provinces, the boards are responsible for setting and enforcing standards.

In the past few years, the Ontario Workmen's Compensation Board has initiated preventive programs in the area of safety, with other provinces following suit. The Board has set up nine associations to provide advice concerning the prevention of accidents within specific industries, such as forestry, mines, transport, electrical, farming, construction, pulp and paper. The Industrial Accident Prevention Association is the largest, while the Hospital Accident Prevention Association deals with a large population of women. These Associations advise their member industries on ways to promote the reduction of accidents, setting up medical services, and so on.

While Workmen's Compensation exists in all provinces, every worker is not eligible for the services. The exclusions vary according to province, but agricultural workers, for example, are not covered in most areas. Probably over 70% of Canadian workers are covered.

Provinces also vary in the amount and variety of benefits they pay for accidents and illnesses. As well as accidents, all provinces provide benefits for some illnesses through the Workmen's Compensation Boards. These are limited according to particular diseases, and in half the provinces also according to dates of employment. Ontario and Quebec additionally have residential limitations. These may be somewhat restricting as in the case of carcinogens which have a 15-40 years latency period. In addition, the exact causes of most industrial diseases are very difficult to prove.

Lung diseases (particularly asbestosis, asthma, silicosis, pneumonocosis), skin problems, diseases due to radiation, certain cancers (especially those acquired by handling tar, bitumen, and so on) and industrial deafness are commonly compensated for under the Workmen's Compensation Boards' powers.

In October 1976 Ontario's Workmen's Compensation Board acknowledged the link between gastrointestinal cancer and occupational exposure of asbestos by awarding damages to the widow of an asbestos worker. This was a first in Canada. A limitation of the award is that workers must be active in the industry for at least 20 years.

Finally, the Boards in each province make requirements regarding first aid facilities. Generally, first aid kits are mandatory. Trained first aid attendants, a separate first aid room depending on a specific number of employees, and transportation to medical centres in case of emergencies are also requirements of the Board.

Federal Government

While health is a provincial matter, the federal government plays an active role. Firstly, this government is the largest employer in the country and as such must be responsible to its employees.

It also has jurisdiction over Crown Lands, and territories and is responsible for the health of those persons resident and employed in those areas. Often the federal government is called upon to liase on an international level.

Sometimes this government co-ordinates or sets down guidelines, such as the section on safety in the Canada Labour Code (1968). Many provinces have adopted the Federal Government's Model Noise Code.

The Canadian government also financially supports some activities on this subject through universities, government projects, and so on. It has also sponsored conferences such as the First National Conference on Employee Physical Fitness (Department of National Health and Welfare, 1974).

In some industries for which it is responsible, the federal government has legislative authority, and is responsible for licensing. Safety related to radiation, for example, is strongly supervised by the Federal Government's Atomic Energy Control Board (Department of Energy, Mines and Resources) and the Radiation Protection Bureau (Department of National Health and Welfare).

Specific federal government departments or agencies have initiated activities on occupational health. For example, at the meeting of the federal and provincial Deputy Ministers of Health in June 1975, it was decided that occupational health was one of three priorities. As a result, the draft of a major document describing occupational health was released in 1976, and a planning committee is to be set up. The report, in a most complete and detailed manner, examines the status of occupational health in Canada, including laws, morbidity and mortality statistics, factors affecting health, and so on. One short section deals with women, and related occupational health hazards.

Another example of federal governmental research is the work of the Science Council which is conducting an extensive study called "Policies and Poisons". Occupational and environmental hazards of asbestos, lead, oxides of nitrogen, radiation and vinyl chloride are being carefully studied. The material for this report, the first draft of which is due mid-1977, deals with medical, technical, and legal aspects of the hazardous substances and is gathered through informed Canadian people.

A third example of activities at the federal government level is this report being prepared for the Advisory Council on the Status of Women.

Legal Position

The field of occupational health is now largely controlled by regulations and statutes. Prior to 1972, Quebec was the only province which provided through its civil code, a remedy to the individual who suffered prenatal injury due to the negligence of another.

In 1972 a decision in the Ontario High Court set precedence for other Canadians. In this case[1] involving a car accident it was decided that a child should have a right to redress for injury received when it was en ventre sa mère. The decision does not set down the general rights of the fetus. Nevertheless, the child now has the right to seek compensation.

This right may have vast implications for the industry which is indirectly exposing the fetus to hazardous chemicals or conditions. If industry is fearful of such actions, they may be reluctant to hire women of child-bearing ages in potentially hazardous areas.

International Resources

International activities provide a great deal in the way of resources for us on this subject. Briefly, some examples are described.

The World Health Organization and the International Labour Organization are both bodies which have committees concerned with occupational health. Both organizations have Canadian representation. Among their activities are personnel training programs, the provision of library resources and statistics, research projects, advice on standards and suggestions for regulations. The two organizations have combined to form the Joint ILO/WHO Expert Committee on Occupational Health for some discussions.

---

[1]Duval et al. V Seguin et al. (1972), 26 Dominion Law Reports (3d), 418.

An International Labour Organization meeting of consultants on women workers' problems favoured similar protective standards for men and women, with as few differences as possible.

Some countries have held commissions of inquiry. A notable example is Britain's Committee of Inquiry into Health and Safety at Work, 1970 (known as the Robens Report).

The United States is very active this decade concerning occupational health, particularly with research. In addition, they are leading the western world on the subject of occupational health hazards of women. For all workers, two national bodies have come into existence in this decade. The first is an administrative body (OSHA) which enforces the Occupational Safety and Health Act of 1970 designed to protect all workers. The second is the National Institute of Occupational Safety and Health (NIOSH), a division of the Department of Health, Education, and Welfare, which provides information, technical, and research services.

In relation to women workers and health, recent examples of events which have taken place in the United States are:

(a) In June 1976, the highly reputable Society for Occupational and Environmental Health held a professional Conference on Women and the Workplace.

(b) The report Working for Your Life: A Woman's Guide to Job Health Hazards (1976) was written for women jointly by the Public Citizen Health Research Group (a Ralph Nader group) and the Labour Occupational Health Program, with Andrea Hricko and Melanie Brunt the authors;

(c) The report Occupational Health Problems of Pregnant Women was written by Vilma Hunt for the Department of Health, Education, and Welfare (April 1975);

(d) The report of research by Alan Palmer of NIOSH A Morbidity Survey of Respiratory Symptoms and Functions Among Utah Beauticians was completed in August 1975;

(e) In November 1975, a meeting was sponsored by NIOSH for industry, labour and government representatives and a task force made recommendations for research on occupational health of women;

(f) Labour unions and independent committees are being formed all over the country to force action on occupational health hazards. A written example is the Handbook for OCAW Women by the Oil, Chemical and Atomic Workers International Union (1973) in which a small section is devoted to health hazards.

(g) Professional organizations are becoming more interested in this subject as is evident by the American Academy of Pediatrics, who held a conference in cooperation with other groups in June 1973 at Brown's Lake, Wisconsin. The conference was entitled "The Susceptibility of the Fetus and Child to Chemical Pollutants."

Research is being conducted throughout the world on topics dealing with occupational health. Eastern European countries appear to be involved in much research. Of special interest to women is all the information becoming available on teratogenic and mutagenic substances.

Canadian Research

As mentioned above, much original research on this subject is being conducted around the world. Canada does not have a national body promoting and organizing research. A number of isolated projects are currently taking places, a few examples of which will be briefly described.

At McGill University's Department of Epidemiology and Public Health, J.C. McDonald and his colleagues and various students have taken an interest in the occupational health hazards of asbestos, (especially with respect to miners) although women have usually been excluded from their study because of sampling difficulties.

At Laval University, two people conducted a short study[1] into the occupation of a father whose children died of malignant diseases. Although more work needs to be done, the important aspect of this topic is that little research is done in respect of occupational hazards of fathers. Recommendations for this type of research have often been made.

In the Ontario Ministry of Health's Occupational Health Protection Branch, a number of longitudinal studies are being conducted. Dr. Joan McEwan is studying important occupational problems of the associations between lung cancer and nickel industry workers, lung cancer and uranium mining workers, and liver cancers and vinyl chloride workers. In the first two projects, women were not employed in the industries while in the latter there are female employees but too few to be of statistical value.

Women are included in a study being conducted by Dr. J. Connolly, a urologist, Women's College Hospital, Toronto. The study entitled "Occupational Hazards in Bladder Carcinogens" is being funded by the Ontario Cancer Treatment and Research Foundation. To be completed in 1977, the study questions all people entering some hospitals with cancer of the bladder as to their diet, drug habits, work histories, and so on. There will be approximately 300 people in the experimental group, of which about one-third may be female.

---

[1]Fabia, J. and Truong Dam Thuy. Occupation of Father at Time of Birth of Children Dying of Malignant Diseases. Br. J. Prev. Soc. Med., 28: 98-100, 1974.

A final example of current research is a project being conducted by Drs. A.B. Miller and G.R. Howe and sponsored by the National Cancer Institute. This is an epidemiological study in which some data is available for 600,000 people who were employed between 1965 and 1971. This comprises 10% of the Canadian workforce, excluding teachers and civil servants. This data will be linked with mortality and cancer incidence data maintained by Statistics Canada. A comparison will be made between different industries and occupations and rates of cancers and deaths.

Industry's Position

Apart from all the standards and regulations which govern industry's action, individual companies vary tremendously in the ways and the extent to which they provide steps to ensure the well-being of their employees.

By law, nearly all the provinces insist on medical rooms or staff for every so many employees. In addition, if a company's fees for the Workmen's Compensation Board are raised to any extent because of poor safety records, companies often decide to provide additional medical staff to take preventive actions.

Employees who are sick or who have frequent accidents cost industry enormous sums of money. Employers want people to be healthy and to continue to be in a state of well-being throughout their careers with that company, not only from a benevolent patriarchal point of view but also as a hard-nosed economic necessity.

An example of an extensive medical department exists at Bell Canada*. Their program is largely preventative in nature, and concerned with the physical, mental and social well-being of their employees. Each new employee has a medical examination, also available annually to everyone after two years of service.

---

*Where I spoke personally with Dr. R.G. Leckey, Toronto Area Medical Director.

Besides medical services, some industries conduct or sponsor medical research. It would obviously be of interest to each company to know of all positive and negative attributes of their relevant products and production processes.

Imperial Oil Company* is an example of a corporation which cooperates with research. This makes possible work such as that being conducted by two students of the University of Western Ontario, K.M. Stavraky and N. Hanis. Their work is entitled "Relationship Between Employment in the Oil Industry and Intestinal Cancer[1]." Oil refinery workers who died of cancer are being investigated. The project is not yet complete but may give us a better understanding of some carcinogens. Women are not included in this study because they did not work in this field. However the research and cooperation of the company would indicate similar research in the future, perhaps in areas of employment more open to women.

A large organization is the International Lead Zinc Research Organization Inc. (ILZRO), which began in 1958 and by 1975 comprised 30 member-companies from 12 countries. This independently incorporated body has a budget of hundreds of thousands of dollars for research, partly for the development of lead and zinc but also spent on gaining an understanding of the effects of these metals on humans and their environment.

---

[1]Ontario Cancer Treatment and Research Foundation. See Cancer in Ontario, 148, Toronto 1975.

*Where I spoke personally with Dr. Jack Fowler, Medical Director.

Companies' policies concerning occupational health hazards of women is important. Some reflect the attitude that the health of an employee is at least partly their responsibility and overrides any laws on sexual discrimination. For example, one medical director said it was his company's moral responsibility not to employ women in areas which may endanger their health.

Both Canada Metal Company Limited*, a large producer of lead, and Imperial Oil Company indicated that women have not yet applied for jobs in areas with suspected teratogenically toxic chemicals (in these cases because the jobs were too burdensome physically). Similar to any other people who may be particularly susceptible to the hazards of that product, such as smokers who may ingest lead when handling cigarettes with smeared fingers, it is doubtful women would be welcomed for employment in those fields which may have detrimental effects on the state of their health or that of their offspring.

Other companies have voiced the opinion that women should be excluded from certain areas until the chemicals involved have been fully researched for their teratogenicity and mutagenicity.

The General Motors factory in Oshawa, Ontario, made international news in 1976 when it took another form of action. Women of child-bearing age who were working in the battery factory, where they were in contact with lead, were asked to show proof of sterility or be transferred.

---

*Where I personally spoke with Mr. Carleton Smith, Chairman of the Board and ex-President.

The unknown hazards to the fetus was the decisive factor when the Medical Director advised management at INCO Ltd.* not to employ women of child-bearing potential in a large section of their nickel refinery at Sudbury, Ontario. In the case of a nickel carbonyl gas leak (for which approximately one person per month needs to be treated) a life-saving medicine which must be administered has not yet been tested for its teratogenicity. This antidote is Sodium Diethyldithiocarbamate. The Medical Director felt he could not authorize administration of this pill to a female in case she were pregnant. Because of the limited use of this medicine throughout the world it does not rank high on any list of priorities to be tested for teratogenicity. This is unfortunate because a few women had successfully been employed in this area, and the manager of the refinery had planned on about 50% of the employees being female.

In late 1976 the management at INCO Ltd. also decided to exclude women of child-bearing potential from employment in their silver refinery, also located at Sudbury. Selenium and tellurium are two metals used in this process. There is some evidence of congenital abnormalities occurring amongst domestic animals exposed to these metals in the United States.

Men with some specific medical histories are also precluded from employment with certain metals. In this, as in other places, the state of health of the employees takes precedence over the urgency to employ females.

Traditionally and currently unions show an interest in occupational health. Many have special committees set up to continually keep themselves and employees educated on relevant hazards. In general, however, these committees have concentrated on accidents rather than diseases or illnesses.

---

*At INCO Ltd., I spoke with Dr. K.H. Hedges, Medical Director of Occupational Health; and Mr. C. Dunkley, Manager of Copper Cliff Nickel Refinery, as well as some of the female employees. I also toured the Nickel Refinery.

Literature Resources

To keep up to date on current ideas and the latest research, a number of periodicals should be read regularly.

A wide variety of material is available in the libraries of the Federal Government's Health and Welfare Ministry and the Ontario Government's Ministry of Health (which has an extensive library on occupational health). The perusal of the following list gives one an insight into the extent of data on this problem. This is a sample list of periodicals. A number of books become available each year and the medical journals of larger countries are also good sources of information.

CIS Abstracts
Abstracts of Hygiene
Biological Abstracts
Abstracts of World Medicine
Index Medicus
Excerpta Medica: Occupational Health and Industrial Medicine
Excerpta Medica: Public Health & Hygiene
Industrial Hygiene Digest
Toxicology Research Projects Directory
American Industrial Hygiene Association Journal
American Journal of Diseases of Children
American Journal of Public Health
American Review of Respiratory Disease
Annals of Occupational Hygiene
Archives of Environmental Health
British Journal of Industrial Medicine
Canadian Journal of Public Health
Canadian Medical Association Journal
Canadian Occupational Safety
Bulletin of Canadian Tuberculosis and Respiratory Diseases Association
Bulletin of World Health Organization
Environmental Health and Safety News

Environmental Research
Environmental Science and Technology
Industrial Health
Industrial Hygiene News Report
Job Health News Service
Job Safety and Health
Job Safety and Health Report
Journal of Environmental Health
Journal of Environmental Quality
Journal of Environmental Sciences
Journal of Hazardous Materials
Journal of Occupational Medicine
Journal of Safety Research
Journal of Occupational Medicine
Lead
Noise Control Engineering
OSHA (Occupational Safety and Health Act, USA) Report
Occupational Hazards
Occupational Health
Occupational Health and Safety
Occupational Health in Ontario
Occupational Health in Nursing
Occupational Safety and Health Reports
Professional Safety
Radiological Protection Bulletin
Safety Canada
Workmen's Compensation Board Report
World Health

Professional Activities

Besides published material and research, a number of national professional organizations in Canada have shown interest in, or been formed because of concern about, the subject of occupational health and safety. A list of the associations, some of which were formed in the last five years follows.*

Association of Canadian Registered Safety Professionals
Canada Safety Council
Canadian Chamber of Commerce
Canadian Chemical Producers Association
Canadian Conference of Teamsters
Canadian Construction Association
Canadian Council of Occupational Medicine
Canadian Labour Congress
Canadian Life Insurance Medical Officers' Association
Canadian Medical Association
Canadian Nurses' Association
Canadian Public Health Association
Canadian Society of Aviation Medicine
Canadian Society of Safety Engineering
Canadian Standards Association
Canadian Trucking Association
The Conference Board of Canada
Industrial Relations and Social Affairs
The Order of St. John
The Railway Association of Canada
St. John Ambulance Association

*This list is adapted from the draft document by Health and Welfare Canada. Occupational Health in Canada, 175-194, Ottawa, September 1976. This document describes each of the associations.

Section VIII

SUMMARY AND CONCLUSION

Being an enormous topic, this report is merely a synopsis of some of the problems, as found from an inconclusive search of relevant literature and by interviewing informed people.

Health hazards can be found in all occupations. They have been categorized according to type. Thousands of chemicals are encountered in industrial processes. Biological hazards come to us from plants, humans and animals. Physical hazards include noise, vibration, heat radiation, accidents. These are dangers which may affect all workers regardless of sex.

Hazards in some traditionally female-dominated occupations have been specified. For example, the risks of being a dental nurse may be exposure to anesthetic gases, mercury, and radiation; hairdressers may be at risk to respiratory problems; nurses and teachers and laboratory workers may have increased incidences of viral infections. Textile workers are susceptible to a wide variety of chemical and biological hazards.

When a pregnant woman remains in the work force, the fetus must be considered in the context of the health hazards to which the mother is exposed. There are hundreds of substances or conditions which have the potential to jeopardize the health of the potential mother or her fetus. Anesthetic gases, beryllium, carbon monoxide, carbon disulfide, synthetic hormones, hydrocarbons, heat, infection, lead, methylated mercury, pesticides, ionizing radiation and vinyl chloride are a few of the suspected hazards. People of child-bearing potential should be especially cautious regarding possible excessive exposure to the foregoing.

About 20% of Canadian deaths annually are due to cancer and it has been estimated that 60 to 90 per cent of these cancers are occupationally related. For this reason carcinogens have been dealt with to some extent. The problems here pose similar dangers for both men and women.

There are other problems peculiar to women, some of which are physiological in nature, and affect menstruating and lactating women.

Fatigue and safety rates may have sociological and partly mythical backgrounds.

As for many medically related topics, most of the research on this subject is inconclusive. Research must be given priority of staff and funds to ever attempt to keep up with the number of hazards being developed.

Women will continue to increase their exposure to occupational hazards, as they enter the workforce in greater numbers and to a wider variety of jobs. Examples of this are lung diseases (cancer, bronchitis, asthma, emphysema) which at present are more prevalent among men. However, there is a continuous upward trend in female mortality rates due to lung problems. The exact cause

is a currently controversial issue. Increased cigarette smoking among women may be the contributing factor but the cause may also be the increased number of women employed in stressful occupations. Thirdly, there is evidence of an increased susceptibility to lung diseases among those who are exposed both to hazardous dusts and materials and who smoke. There may be a multiple effect as in the case of asbestos workers who smoke.

As women continue to enter industrial occupations which to date have poor health records, a decline in the state of their health will result.

In Canada, health is a provincial responsibility. Laws relating to controls are directed to specific problems (such as noise) or whole industries (such as mining).

During this decade more interest has been shown in the whole topic of occupational health. In 1975 the federal and provincial Deputy Ministers of Health declared occupationally acquired diseases and injuries to be a priority health problem among Canadians. Researchers and industry have concentrated more on the subject.

In Canada, however, specific reference to women has not yet been the topic of attention that it has in other countries, such as the United States.

The positive aspect of this report is that hazards can be described because of specific medical knowledge. Responsible governments, industry and individuals themselves can work toward the prevention of unsafe conditions generally, only to the extent that scientific research advances.

In especially hazardous industries and occupations where dangers are known, controls are enforced voluntarily or by law. In many cases, the amount of a chemical in the employee's body is measured by relatively simple procedures. The frequent medical examinations given employees working in hazardous areas could mean the surveillance of their general health puts them in a better position than other citizens.

The economic, legal, educational, political and social forces concerning occupational health hazards of women are in a certain equilibrium. Change one component and the others must alter. If women are permitted to make their own choices as to the hazards to which they subject themselves and their fetuses, then these choices must at least be educated ones. If persistent demands are made upon the legal system and compensation boards to recompense people for damage done negligently to them before birth, then employees will be reticent to hire women for fear of legal suits costing money and reputation. Further, pressure upon employers to provide completely safe working conditions may result in fewer jobs being made available to women. The factors are interrelating - pushing any of the forces will cause reactions elsewhere. It is necessary to work out priorities.

Beyond scientific knowledge, a number of points for discussion arise out of this report. For example:

(a) Obviously, the onus for occupational health should be on both the workers and the employer. But how much responsibility does each have?

(b) Why does most research concentrate on males, when two-fifths of the workforce is female?

(c) Who does a child hold responsible for defects incurred through occupational hazards of the mother before that child was born? Does the mother have full responsibility for the health of the fetus? Can the mother release a company or government from liability on behalf of her offspring?

(d) If a woman becomes pregnant and is working among substances which may be hazardous to a fetus, should she be transferred on full pay to a job for which she is not trained? Should the company be financially liable for her temporary unsuitability to do the job for which she was hired?

(e) Is health the responsibility of an individual or society? Should legislation protect workers against hazards, or is it enough to adequately educate people and permit them to choose whether or not they wish to subject themselves to those hazards?

(f) Are the unconceived children of men also at risk? If a chemical has been found to have mutagenic effects, should both fertile men and women of child-bearing ages be excluded from occupational exposure?

(g) If an industry feels morally obligated not to hire fertile women of child-bearing ages to work with a chemical which has known teratogenic effects, how does this conflict with laws against sexual discrimination?

(h) What is the ethical responsibility of the company physician?

Undoubtedly as this report is read, many more difficult and complex questions will come to mind.

The prevention of industrial injuries and diseases is possible only if we have adequate scientific knowledge and employ the combined forces of legislation, education and social responsibility to the benefit of those in the work force.

BIBLIOGRAPHY

Ad Hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, American Society of Anesthesiologists. Occupational Disease Among Operating Room Personnel: A National Study. Anesthesiology, 41(4): 321-340, October 1974.

Ad Hoc Committee on the Effect of Trace Anesthetics on the Health of Operating Room Personnel, American Society of Anesthesiologists. A Survey of Anesthetic Health Hazards Among Dentists. JADA, 90: 1291-1296, June 1975.

Alberta Labour. The Poisonous Nature of Lead with Special Reference to the Danger to the Human Fetus, April 1976. Occupational Health and Safety Division, Alberta Labour, April 1976.

American Conference of Industrial Hygienists. Threshold Limit Values for Chemical Substances in Workroom Air. Cincinnati, 1975 (published annually).

American Academy of Pediatrics Committee on Environmental Standards. Effects of Cigarette Smoking on the Fetus and Child. Pediatrics, 57: 411-413, March 1976.

American Academy of Pediatrics. The Susceptibility of the Fetus and Child to Chemical Pollutants. Proceedings on Conference held at Brown's Lake, Wisconsin, June 1973. Pediatrics, 53(5): Part II, May 1974.

Ames, B. Hair Dyes are Mutagenic: Identification of a Variety of Mutagenic Ingredients. Proc. Nat. Acad. Sc., 72: 2423-2427, June 1975.

Angle, C.R., and McIntire, M.S. Lead Poisoning during Pregnancy: Fetal Tolerance of Calcium Disodium Edetate. Amer. J. of Diseases of Children, 108(4): 436-439, October 1964.

Astrup, P. et al. Effect of Moderate Carbon-Monoxide Exposure on Fetal Development. Lancet, 1220-1222, December 9, 1972.

Berlin, M. and Ullberg, S. Accumulation and Retention of Mercury in the Mouse. Arch. Envir. Health, 6: 589-595, 1963.

Bleich, A.R. The Story of X-rays from Rontgen to Isotopes. Dover Publications, New York, 1960.

Boyd, J.T. et al. Chromosome Studies on Women Formerly Employed as Luminous-dial Painters. Br. Med. Journal, 377-382, February 12, 1966.

Boyland, E. Occupational Carcinogenesis. The Practitioner, 199: 277-284, September 1967.

Bridbord, K. National Institute of Occupational Safety and Health. Review of Lead Toxicity. Paper presented at the Conference on Women and the Workplace, sponsored by the Society for Occupational and Environmental Health, held in Washington, June 1976.

Bruce, D.L. et al. Causes of Death Among Anesthesiologists: A Twenty-year Survey. Anesthesiology, 29: 565-569, 1968.

Buchwald, H. Exposure of Dental Workers to Mercury. Am. Ind. Hyg. Assoc. J., 33: 492, July 1972.

Cantarow, A. and Trumper, M. Lead Poisoning. Williams and Wilkins, Baltimore, 1944.

Carpenter, S.J. Placental Permeability of Lead. Environmental Health Perspectives, 129-131, May 1974.

Carson, T.L. et al. Slowed Learning in Lambs Prenatally Exposed to Lead. Arch. Environ. Health, 29: 154-156, September 1974.

Chaffin, D.B. and Park, K.S. A Longitudinal Study of Low-Back Pain as Associated with Occupational Weight Lifting Factors. Amer. Ind. Hygiene Ass. J., 513-525, December 1973.

Cohen, E.N., Belville, J.W., Brown, B.W. Anesthesia, Pregnancy and Miscarriage. A Study of Operating Room Nurses and Anesthetists. Anesthesiology, 35: 343-347, 1971.

Corbett, T.H. Anesthetics as a Cause of Abortion. Fertility and Sterility, 23(11): 866-870, November, 1972.

Corbett, T.H. Cancer, Miscarriages and Birth Defects associated with Operating Room Exposure. Paper presented at the Conference on Women and the Workplace, sponsored by the Society for Occupational and Environmental Health, held in Washington June 1976.

Corbett, T.H., Cornell, R.G., Endres, J.L., Lieding, K. Birth Defects Among Children of Nurse-anesthetists. Anesthesiology, 41 (4): October 1974.

Corbett, T.H., Cornell, R.G., Lieding, K., Endres, J.L. Incidence of Cancer Among Michigan Nurse-anesthetists. Anesthesiology, 38 (3): 260-263, March 1973.

Cralley, L.V. et al.(editors). Vol. I. Industrial Hygiene Highlights. Industrial Hygiene Foundation of America, Inc. 1968.

Cralley, L.V. et al.(editors). Industrial Environmental Health. The Worker and the Community. Academic Press 1972.

Cumming E. et al. Suicide as an Index of Role Strain Among Employed and Not Employed Married Women in British Columbia. Rev. Can. Soc. and Anth., 12(4) Part I, 1975

Curtis, G.W., Algeri, E.J., McBay, A.J., Ford, R. The Transplacental Diffusion of CO. A Review and Experimental Study. Arch. Path., 59: 677-690, 1955

Dalrymple, G.V. et al. (editors) Medical Radiation Biology. W.B. Saunders Company. Philadelphia, 1973.

Dalton, K. The Premenstrual Syndrome. William Heinnemann Medical Books, London, 1964.

Diddle, A.W. Gravid Women at Work: Fetal and Maternal Morbidity, Employment Policy and Medicolegal Aspects. J.Occ. Med., 12: 10-15, 1970.

Dominion Law Reports. 26D.L.R. (3d). Duval et al. V Seguin et al. (1972) 418.

Ehrhardt, W. Experiences with Employment of Women Exposed to CS_2. International Symposium on Toxicology of CS_2. Prague, 1966. Excerpta Medica Fdn. 1967. (As reprinted in Hunt, V. Appendix 5)

Fabia, J. and Thuy Truong Dam. Occupation of Father at Time of Birth of Children Dying of Malignant Diseases. Brit. J. Prev. Soc. Med. 28: 98-100, 1974.

Fraumeni, J.F. Chemicals in Human Teratogenesis and Transplacental Carcinogenesis. Pediatrics, 53(5): Part II, 807-812, May 1974.

Gauvain, S. Women in Employment. TVC Centenary Institute of Occupational Medicine, London School of Hygiene and Tropical Medicine, Keppel Street, London WCI. (Unpublished material).

Gibson, E.S., Martin, R.H. and Haynes, R.B. Mortality and Morbidity in an Employed Population. Can. Fam. Physician, 22: 293-302, March 1976.

Government of Canada

- Economic Council of Canada. People and Jobs. A Study of the Canadian Labour Market. Ottawa, 1976.

- Health and Welfare Canada. The Testing of Chemicals for Carcinogenicity, Mutagenicity, Teratogenicity. Ottawa, 1975.

- Health and Welfare Canada. Occupational Health in Canada. Draft Report. Ottawa, 1976. (As yet unpublished)

- Health and Welfare Canada, Marc Lalonde, April 1974. A New Perspective on the Health of Canadians - A Working Document.

- Labour Canada. Women's Bureau. The Law Relating to Working Women. Ottawa, 1975.

- Labour Canada. Model Noise Code. Ottawa, 1974

- Labour Canada. Occupational Safety and Health. A Bibliography. Ottawa, 1976.

Government of Canada continued...

- Labour Canada. Women's Bureau. Women in the Labour Force. Facts and Figures. Ottawa, 1975.

- Treasury Board. Occupational Health and Safety. Policies, Standards, Guides. Ottawa, 1974.

Haldrane, E.V. Search for Transmittable Birth Defects of Virolic Origin in Members of the Nursing Profession. Amer. J. of Obstetrics and Gynecology, 105: 1032, 1969.

Hall, J.C., Wood, C.H., Stoeckle, J.D., Tepper, L.P. Case Data from the Beryllium Registry. A.M.A. Arch. Ind. Hyg. 19: 100-103, 1959. (not seen)

Hamilton, Alice. Industrial Poisons in the United States. MacMillan 1925.

Hamilton, A. and Hardy, H.L. Industrial Toxicology. 3rd Edition, Publishing Sciences Group Inc., Massachusetts, 1974.

Hardy, H.L. Beryllium Poisoning. Lessons in Control of Man-Made Disease. NEJM 273: 1188-1199, 1965. (not seen)

Hardy, H.L., Bartter F.C., Jaff, A.E. Metabolic Study of a Case of Chronic Beryllium Poisoning Treated with ACTH. A.M.A. Arch. Ind. Hyg. Occ. Hyg. 3: 579, 1951.

Hardy, H.L., Stoeckle, J.D. Beryllium Disease. J. Chron. Dis., 9: 152-160, 1959.

Henschel, A. Women in Industry - The Difference. Presented 33rd Annual Meeting. Am. Conf. Gov. Ind. Hyg. Toronto, 1971.

Hilton, M.N. The National Scene. J. Occup. Med. 16(8): 535-538, August 1974.

Holden, H. and Razantzes, G. (ed.) Society of Occupational Medicine. Proceedings of the Symposium on the Early Detection of Occupational Hazards, held at the University of Newcastle-upon-Tyne, April 1970. London, 1971.

Howe, M. et al. Transfer of Inorganic Mercury to Milk of Goats. Nature, 237: 516-518, 1972.

Hricko, A. with Brunt, M. Working for your Life: A Woman's Guide to Job Health Hazards. Labour Occupational Health Program and Public Citizen's Health Research Group. California, 1976.

Hricko, A.M. and Marrett, C.B. Women's Occupational Health: The Rise and Fall of a Research Issue. Paper presented at the Amer. Assoc. for Advancement of Science, New York, January 28, 1975.

Infante, Peter. Genetic Risks of Vinyl Chloride. Lancet, April 3, 1975, pp. 734-735.

International Labour Organization. Women in Employment. Encyclopaedia of Occupational Safety and Health, Volume II, Geneva, 1973.

International Labour Organization. Making Work More Human - Working Conditions and Environment. Geneva, 1975

International Social Security Assoc. XVth General Assembly. Washington, D.C. September - October 1964. Occupational Diseases, Toxic Substances, Corresponding Trades, Industries or Processes Listed in the Legislation of 49 Countries. Geneva, 1965

Job Health News Service Special Report. Women Workers and Job Health Hazards. Job Health News Service, 1(13): 7-10, June 11, 1976.

John, J.A. et al. The Effects of Maternally Inhaled Vinyl Chloride on Embryonal and Fetal Development in Mice, Rats and Rabbits. Dow Chemical Corp., USA, Michigan, March 1976 (as yet unpublished).

Kaiser, I.H. Pregnancy Wastage in Operating Room Personnel. Obstetrics and Gynecology 41:(6), 930, June 1973.

Kasowski, M.A. and Kasowski, W.J. The Burden of Lead: How Much Is Safe? CMA Journal. 114: 573-574, 1976.

Kearns, J. Women Under Pressure. Occupational Health, 135-140, April 1973.

Kessel, N. and Walton, H. Alcoholism Penguin Books. Hammondsworth, Eng. 1965.

Kinnersly, P. The Hazards of Work: How to Fight Them. Pluto Press, 1973.

Kline, E.M., Inkley, S.R., Pritchard, W.H. Five Cases from the Fluorescent Lamp Industry. A.M.A. Arch. Ind. Hyg. Occ. Hyg. 3: 549-564, 1951.

Kuntz, W.D. The Pregnant Woman in Industry. Am. Industrial Hygiene Assoc. Journal., 423-426, July 1976.

Lancranjan, I. Reproductive Ability of Workmen Occupationally Exposed to Lead. Archives of Environmental Health, 30: 396-401, August 1975.

Lead Development Association, European Lead Development Committee. Report on Meeting held in The Hague, October 13-15, 1975.

Lehman, P. Women Workers: Are They Special? Job Safety and Health Magazine. 3(4): April 1975.

Lencz, L., Nemes C. Morbidity of Hungarian Anesthetists in Relation to Occupational Hazards. 3rd European Congress of Anesthetists. Prague, August 31, 1970, (not seen).

Li, F. et al. Cancer Mortality Among Chemists. J. of National Cancer Inst., 43: November 1969, (not seen).

Longo, L.D. Carbon Monoxide in the Pregnant Mother and Fetus and its Exchange Across the Placenta. Annals N.Y. Acad. Sc. 174: 313-341, 1970.

Margolis, Bruce, et al. Job Stress: An Unlisted Occupational Hazard. Journal of Occupational Medicine, 16(10): 659-661, October 1974.

Markham, J. Occupational Chest Problems. Can. Fam. Physician, 22: 270-273, March 1976.

McDonald, H.D. Women at Work. Maternal Health and Congenital Defect: A Prospective Investigation. NEJM, 258: 767-773, 1958.

McKiever, M.E. The Health and Safety of Women Who Work. National Safety News, 24-27, November 1965.

Meyer, M.A., Tonascia, J.A., Buck, C. Interrelationship of Maternal Smoking and Increased Perinatal Mortality with other Risk Factors. Further Analysis of the Ontario Perinatal Mortality Study. 960-61. Am. J. Epid. 100: 443-452, 1975.

Monson, R.R. and Peters, J.M. and Johnson, M.N. Proportional Mortality Among Vinyl-chloride Workers. The Lancet, August 17, 1974.

Morgan, K.Z. The Need for Radiation Protection. Radiol. Technol. 44: 385-395, 1973.

Morley, P.R. et al. Botanical Trash Present in Cotton Before and After Saw-type Lint Cleaning. Am. Ind. Hyg. Assoc. J., 321-328, June 1976.

Moya, F., Smith, B.E. Uptake, Distribution and Placental Transport of Drugs and Anesthetics. Anesthesiology 26: 465-476, 1965.

Newhouse, Muriel. The Medical Risks of Exposure to Asbestos. The Practitioner, 199: September 1967.

Newhouse, Muriel et al. A Study of Mortality of Female Asbestos Workers. Br. J. Indust. Medicine, 29: 134-141, 1972.

New York Times, March 14, 1976, pp. 1, 42.

Occupational Health and Safety. The Pregnant Worker, May/June 1976.

Occupational Safety and Health Reporter. Bureau of National Affairs Inc., Vol. 5, No. 28, December 11, 1975 and Vol. 6, No.4, June 24,1976.

Oil, Chemical and Atomic Workers Union. (Kathy Stone) Handbook for OCAW Women. 1636 Champa Street, Denver, Colorado, USA.

Ontario Cancer Treatment and Research Foundation. Cancer in Ontario. Toronto, 1975.

Ontario Ministry of Health. Occupational Diseases. Occupational Health Protection Branch. Toronto.

Ontario Perinatal Mortality Committee. 2nd Report of the Perinatal Study in Ten University Teaching Hospitals. Ontario Dept. of Health. Toronto, 1967.

Palmisano, P.A. et al. Untaxed Whiskey and Fetal Lead Exposure. J. of Pediatrics, 75(5): 869-872, November 1969.

Patterson, T.H. Occupational Cancer. Occupational Health Bulletin, 26, Nos. 3-4, 1971.

Pattison, C.P., Maynard, J.E. et al. Epidemiology of Hepatitis B in Hospital Personnel. Am. J. Epid.,101: 59-64, 1975.

Petrov, M.V. Course and Termination of Pregnancy in Women Working in the Viscose Industry. Pediatr.Akush.Ginekol.,3: 50-52, 1969(not seen).

Pool, J.E. Female Reproductive Behaviour. University of Ottawa, Ottawa, February 1975 (unpublished material).

Rieke, F.E. Thirty-two Million Women at Work - How Different are They? J. Occ. Med.,15(9): 729-732, 1973.

Robens, Lord (Chairman). Safety and Health at Work. Report of the Committee, 1970-72. Her Majesty's Stationery Office, London, July 1972.

Rozonsky, L.E. Rights Before Birth. Canadian Hospital, March 1973.

Saffrotti, U. and Wagoner, J.K. (editors) Occupational Carcinogenesis Annals of the N.Y. Academy of Sciences, 271: New York, 1976.

Scanlon, J.W. Dangers to the Human Fetus from Certain Heavy Metals in the Environment. Reviews on Envir. Health II(1), 1975.

Schneider, M. An Environmental Study of Mercury Contamination in Dental Offices. JADA, 89: 1092-1098, November 1974.

Schweitzer, I.L., Dunn, A.E.G., Peters, R.L. Viral Hepatitis B in Neonates and Infants. Am. J. Med., 55: 762-771, 1973.

Schwetz et al. Embryo and Fetotoxicity of Inhaled Chloroform in Rats. Toxicology and Applied Pharmacology, 28: 442-451, 1974.

Shepard, T.H. Catalog of Teratogenic Agents. Johns Hopkins University Press, 1973.

Smithurst, B.A. and Williams, G.M. A Study of Chronic Bronchitis in Brisbane in Two Groups of Workers: The Effects of Cigarette Smoking, Pollution and Industrial Exposure on the Disease. Public Health, London 90: 149-156, 1976.

Snook, S.H. and Ciriello, V.M. Maximum Weights and Work Loads Acceptable to Female Workers. J. of Occup. Medicine, 16(8): 527-534, August 1974.

Spence, A.A., Knill-Jones, R.P., Newman, B.J. Studies of Morbidity in Anesthetists with Special Reference to Obstetric History. Proc. Roy. Soc. Med., 67: 989, October 1974.

The Spokeswomen, The Workplace, 7(1): July 15, 1976.

Spyker, J.M. Assessing the Impact of Low Level Chemicals on Development: Behavioural and Latent Effects. Federation Proc., 34(9): 1835-1844, 1975.

Stark, A. Policy and Procedural Guidelines for the Health and Safety of Workers in Virus Laboratories. Am. Ind. Hyg. Assoc. J. 36: 234-240, 1975.

Stavraky, K.M. and Hanis, N. Relationship between Employment in the Oil Industry and Intestinal Cancer. Cancer in Ontario, Toronto,1975, 148.

Stellman, J.M. and Daum, S.M. Work is Dangerous to Your Health. Vintage Books, New York, 1973.

Sterling, T.D. Additional Comments on the Critical Assessment of the Evidence Bearing on Smoking as a Cause of Lung Cancer. AJPH 66(2): 161-164, February 1976.

Stewart, A. A Note on the Obstetric Effects of Work During Pregnancy. Brit. J. Prev. Soc. Med. 9: 159-161, 1955.

Stokinger, H.E. and Scheel, L.D. Hypersusceptibility and Genetic Problems in Occupational Medicine - A Consensus Report. J. of Occup. Medicine, 15(7): 564, July 1973.

Time Magazine. The Disease of the Century. Time, October 20, 1974.

U.S. Government

- Baetjer, Anna. Women in Industry: Their Health and Efficiency. Prepared in the U.S. Army Industrial Hygiene Laboratory. Philadelphia, 1946.

- Boulos, B.M. Special Problems of Lead in Women Workers. Health Effects of Occupational Lead and Arsenic Exposure - A Symposium. National Institute of Occupational Safety and Health, U.S. Dept. of Health, Education, and Welfare, Chicago, Illinois, Feb. 1976.

- Council on Environmental Quality. Environmental Quality, Washington, December 1975.

- Hunt, V. Occupational Health Problems in Pregnant Women. A Report and Recommendations for the Office of the Secretary. Department of Health, Education, and Welfare, April 1975.

- National Institute on Alcohol Abuse and Alcoholism. Alcohol and Health. Report from the Secretary of Health, Education, and Welfare. Charles Scribner's Sons, New York.

- National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. Critical Document of Toluene.

- National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. Suspected Carcinogens - Subfile of Toxic Substances. Washington (Published annually).

- Occupational Safety and Health Administration, Department of Labour. LEAD, Occupational Exposure; Proposed Standard. Federal Register, 40(193), October 3, 1975.

- Occupational Safety and Health Administration, Department of Labour. Lead. Job Health Hazards Series Pamphlet. June 1975.

- Palmer, Alan. A Morbidity Survey of Respiratory Symptoms and Functions Among Utah Beauticians. National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. August 1975.

- Sleight, R.B. et al. Problems in Occupational Safety and Health: A Critical Review of Select Worker Physical and Psychological Factors. Vol. I. National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. Cincinnati, 1974

U.S. Government continued...

- Spyker, J.M. Occupational Health Hazards and the Pregnant Worker in Behavioural Toxicity: Early Detection of Occupational Hazards. National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. Cincinnati, 1974.

- Xintaras, C. et al. (editors), Behavioural Toxicity: Early Detection in Occupational Hazards. National Institute of Occupational Safety and Health, Department of Health, Education, and Welfare. Cincinnati, 1974.

Viadana, E. and Bross, I.D.J. Leukemia and Occupations. Prev. Medicine 1(4), 513-521, 1972.

Vaisman, A.I. Working Conditions in Surgery and their Effect in the Health of Anesthesiologists. Eksp. Khir, Anest., 3: 44, 1967 (not seen).

Walts, L.F. et al. Critique: Occupational Disease Among Operating Room Personnel. Anesthesiology, 42(5): 608, May 1975.

Warkany, J. and Kalter, H. Congenital Malformations. NEJM, 265 pp. 993-1001 and 1046-1052 (Nov. 16, 23) 1961.

Warkany, J. Toxic Substances and Congenital Malformations. Paper presented at the Conference on Women and the Workplace, sponsored by the Society for Occupational and Environmental Health, held in Washington, June 1976.

Weiss, B. and Laties, V.G. (ed.) Behavioural Toxicology. Plenum Press, New York, 1975.

Weiss, B. and Spyker, J.M. Behaviour Implications of Prenatal and Early Postnatal Exposure to Chemical Pollutants. Pediatrics, 53(5): Supplement 851-856, May 1974.

Wilson, J.G. Environmental Effects on Development - Teratology in Pathophysiology of Gestation Vol. 2. N.S. Assali (editor) Academic Press, New York. 1972, pp. 269-320.

Wofford, S. Flight Attendant Health and Safety Speech, a Paper presented at the Conference on Women and the Workplace, sponsored by the Society for Occupational and Environmental Health, held in Washington, June 1976.

Yager, J.W. Congenital Malformations and Environmental Influence: The Occupational Environment of Laboratory Workers. J. Occ. Med., 15: 724-728, 1974.

ANNEX A

Table 148

Women in the Labour Force

Facts and Figures

1975 Edition

Labour Canada

TABLE 148. – Number of full-time[a], full-year[b] women and men for selected occupations, 1971 Census of Canada.

Table 148 shows the number of women and men employed in 147 selected occupations on a full-time[a], full-year[b] basis in 1970[c], and also women as a percentage of the total persons employed in each occupation.

The number of women in these 147 occupations represents 65.1% of women in all occupations; in other words, nearly two-thirds of the full-time, full-year female labour force is accounted for here. The number of men in these 147 occupations represents 38.9% of men in all occupations.

In 33 of the 147 occupations listed, women comprise over 50% of the total number of persons employed; 74.6% of women employed in the listed occupations are concentrated in these 33. Only 15.0% of the women included in the listing are employed in occupations where men composes more than 60% of the total.

[a]Persons who reported working "mainly full-time" in 1970.

[b]49-52 weeks in 1970.

[c]1971 Census of Canada.

TABLE 148. – Number of full-time[a], full-year[b] women and men in 147 selected occupations, showing women as percentage of the total in each occupation, 1971 Census of Canada

Occupation	Women	Men	Women as percentage of the total
			%
General managers and other senior officials	925	35,800	2.5
Management occupations: social sciences and related fields	445	1,205	27.0
Administrators in medicine and health	1,805	2,185	45.2
Financial management occupations	420	6,590	6.0
Personnel and industrial relations management occupations	305	3,235	8.6
Sales and advertising management occupations	285	10,940	2.5
Purchasing management occupations	225	2,775	7.5
Services management occupations	85	1,495	5.4
Production management occupations	145	6,600	2.1
Accountants, auditors and other financial officers	11,400	76,385	13.0
Personnel and related officers	3,975	16,895	19.0
Purchasing officers and buyers, except wholesale and retail trade	805	9,465	7.8
Chemists	445	4,825	8.4
Physicists	25	575	4.2
Architects	35	3,095	1.1
Civil engineers	115	16,830	0.7
Electrical engineers	125	12,410	1.0
Draughtsmen	1,155	19,375	5.6
Systems analysts, computer programmers and related occupations	2,095	14,895	12.3
Economists	370	3,730	9.0
Sociologists, anthropologists and related social scientists	25	140	15.2
Psychologists	895	1,180	43.1
Social workers	3,360	3,375	49.9
Occupations in welfare and community services	2,705	4,715	36.5
Lawyers and notaries	510	11,810	4.1
Librarians and archivists	2,960	955	75.6
Educational and vocational counsellors	490	1,380	26.2
Ministers of religion	485	13,935	3.4
University teachers	1,900	13,715	12.2
Elementary and kindergarten teachers	75,270	18,660	80.1
Secondary school teachers	31,830	48,160	39.8
Community college and vocational school teachers	1,140	4,155	21.5
Fine arts school teachers	945	1,545	38.0
Physicians and surgeons	1,325	15,850	7.7
Dentists	80	2,460	3.1
Veterinarians	25	1,325	1.9
Supervisors: nursing occupations	8,905	865	91.1
Nurses, graduate, except supervisors	40,430	2,710	93.7
Nursing assistants	13,650	1,630	89.3
Nursing aides and orderlies	25,250	12,230	67.4
Physiotherapists, occupational and other therapists	2,210	660	77.0
Pharmacists	985	5,675	14.8
Dietitians and nutritionists	880	70	92.6
Optometrists	55	925	5.6
Dispensing opticians	135	935	12.6

TABLE 148 (cont'd)

Occupation	Women	Men	Women as percentage of the total
			%
Radiological technologists and technicians	2,775	1,250	68.9
Medical laboratory technologists and technicians	8,085	3,025	72.8
Dental hygienists, assistants and technicians	3,845	1,800	68.1
Painters, sculptors and related artists	130	830	13.5
Product and interior designers	2,035	6,430	24.0
Advertising and illustrating artists	770	4,465	14.7
Photographers and cameramen	230	3,380	6.4
Musicians	220	1,485	12.9
Radio and television announcers	90	1,380	6.1
Writers and editors	2,340	7,325	24.2
Translators and interpreters	475	540	46.8
Supervisors: stenographic and typing occupations	1,715	385	81.7
Secretaries and stenographers	150,035	4,655	97.0
Typists and clerk-typists	44,260	2,585	94.5
Supervisors: bookkeeping, account-recording and related occupations	4,580	5,695	44.6
Bookkeepers and accounting clerks	77,770	47,565	62.0
Tellers and cashiers	35,905	4,810	88.2
Insurance, bank and other finance clerks	10,550	2,840	78.8
Statistical clerks	2,495	1,680	59.8
Supervisors: office machine and electronic data processing equipment operators	1,070	2,380	31.0
Office machine operators	9,715	3,045	76.1
Telephone operators	14,925	740	95.3
Adjusters: claim	2,105	2,305	47.7
Hotel clerks	960	1,385	40.9
Sales clerks, commodities	41,315	42,510	49.3
Insurance salesmen and agents	2,905	22,850	11.3
Real estate salesmen	2,085	11,980	14.8
Salesmen and traders: securities	365	5,215	6.5
Advertising salesmen	285	2,840	9.1
Buyers: wholesale and retail trade	1,005	3,950	20.3
Chefs and cooks	14,110	18,930	42.7
Waiters, hostesses and stewards: food and beverage	20,425	8,215	71.3
Managers: hotel, motel and other accommodation	7,545	9,425	44.5
Barbers, hairdressers and related occupations	15,860	15,010	51.4
Babysitters	1,465	55	96.4
Laundering and dry cleaning occupations	4,750	2,885	62.2
Pressing occupations	4,715	2,770	63.0
Janitors, charworkers and cleaners	15,580	66,475	19.0
Elevator operating occupations	365	1,385	21.8
Farmers	5,160	194,865	2.6
Farm management occupations	375	15,455	2.4
Farm workers	6,500	20,570	24.0
Nursery and related workers	260	9,495	2.7
Foremen: chemicals, petroleum, rubber, plastics and related materials processing occupations	180	4,580	3.8
Foremen: food, beverage and related processing occupations	570	10,090	5.3
Baking, confectionery-making and related occupations	2,885	8,975	24.3

TABLE 148 (cont'd)

Occupation	Women	Men	Women as percentage of the total
			%
Fish canning, curing and packing occupations	545	1,640	24.9
Fruit and vegetable canning, preserving and packing occupations	475	705	40.3
Milk processing occupations	180	2,985	5.7
Foremen: textile processing occupations	360	2,870	11.1
Textile fibre preparing occupations	155	480	24.4
Textile spinning and twisting occupations	795	840	48.6
Textile winding and reeling occupations	865	420	67.3
Knitting occupations	855	1,000	46.1
Textile bleaching and dyeing occupations	60	1,020	5.6
Textile finishing and calendering occupations	300	695	30.2
Inspecting, testing, grading and sampling occupations: textile processing	1,140	770	59.7
Tobacco processing occupations	1,040	775	57.3
Hide and pelt processing occupations	160	875	15.5
Machinist and tool setting up occupations	740	25,550	2.8
Machine tool operating occupations	745	17,280	4.1
Planing, turning, shaping and related wood machining occupations	245	3,515	6.5
Cutting and shaping occupations: clay, glass and stone	60	955	5.9
Engravers, etchers and related occupations	75	385	16.3
Motor vehicle fabricating and assembling occupations, not elsewhere classified	855	7,115	10.7
Aircraft fabricating and assembling occupations, not elsewhere classified	105	2,555	3.9
Business and commercial machines, fabricating and assembling occupations, not elsewhere classified	160	260	38.1
Precision instrument and related equipment fabricating and assembling occupations, not elsewhere classified	330	860	27.7
Electrical equipment fabricating and assembling occupations	4,390	6,190	41.5
Electrical and related equipment installing and repairing occupations, not elsewhere classified	265	14,750	1.8
Electronic equipment fabricating and assembling occupations	3,245	1,610	66.8
Inspecting, testing, grading and sampling occupations: fabricating, assembling, installing and repairing electrical, electronic and related equipment	1,470	2,335	38.6
Radio and television service repairmen	125	6,470	1.9
Cabinet and wood furniture makers	310	6,240	4.7
Tailors and dressmakers	6,550	4,195	61.0
Furriers	370	540	40.7
Milliners, hat and cap makers	85	85	50.0
Shoemaking and repairing occupations	2,670	3,900	40.6

TABLE 148 (concl'd)

Occupation	Women	Men	Women as percentage of the total
			%
Upholsterers	560	4,330	11.5
Sewing machine operators: textile and similar materials	24,655	3,590	87.3
Inspecting, testing, grading and sampling occupations: fabricating, assembling and repairing, textiles, fur and leather products	1,050	255	80.5
Bonding and cementing occupations: rubber, plastic and related products	140	3,060	4.4
Moulding occupations: rubber, plastic and related products	445	1,370	24.5
Cutting and finishing: rubber, plastic and related products	110	425	20.6
Inspecting, testing, grading and sampling occupations: fabricating, assembling and repairing, rubber, plastic and related products	320	750	29.9
Business and commercial machine mechanics and repairmen	105	6,235	1.7
Watch and clock repairmen	35	1,780	1.9
Precision instrument mechanics and repairmen	25	2,050	1.2
Jewellery and silverware fabricating, assembling and repairing occupations	390	1,505	20.6
Painting and decorating occupations, except construction	490	6,515	7.0
Carpenters and related occupations	135	32,225	0.4
Pipefitting, plumbing and related occupations	95	22,135	0.4
Bus drivers	240	16,535	1.4
Taxi drivers and chauffeurs	325	12,620	2.5
Truck drivers	795	109,615	0.7
Typesetters and compositors	895	8,690	9.3
Printing press occupations	470	7,835	5.7
Printing engravers, except photo-engravers	120	2,275	5.0
Photo-engravers and related occupations	75	1,030	6.8
Bookbinders and related occupations	2,420	1,395	63.4
Radio and television broadcasting equipment operators	90	2,495	3.5
Telegraph operators	115	1,190	8.8
Sub-total: all occupations listed above	831,260	1,378,640	37.6
Total: all occupations	1,276,525	3,541,100	26.5
Persons in occupations listed above as a percentage of persons in all occupations (sub-total as a percentage of total)	65.1%	38.9%	–

[a]Persons who reported working "mainly full-time" in 1970.

[b]49 to 52 weeks in 1970.

Source: Unpublished data from Statistics Canada, Census Field, 1971 Census of Canada.

ANNEX B

Standards Adopted by

American Conference of

Governmental Industrial Hygienists

for 1975

THRESHOLD LIMIT VALUES FOR CHEMICAL SUBSTANCES IN WORKROOM AIR, 1975

ADOPTED VALUES

See Documentation for Basis of TLVs (1974)

Substance	ppm[a]	mg/m³[b]
Abate	—	10
Acetaldehyde	100	180
Acetic acid	10	25
C Acetic anhydride	5	20
Acetone	1,000	2,400
Acetonitrile	40	70
Acetylene	F	—
Acetylene dichloride, see 1, 2-Dichloroethylene	—	—
Acetylene tetrabromide	1	14
Acrolein	0.1	0.25
Acrylamide — Skin	—	0.3
Acrylonitrile — Skin	20	45
Aldrin — Skin	—	0.25
Allyl alcohol — Skin	2	5
Allyl chloride	1	3
Allyl glycidyl ether (AGE) — Skin	5	22
Allyl propyl disulfide	2	12
Alundum (Al_2O_3)	—	E
4-Aminodiphenyl—Skin	—	A1b
2-Aminoethanol, see Ethanolamine	—	—
2-Aminopyridine	0.5	2
Ammonia	25	18
Ammonium chloride, fume	—	10
Ammonium sulfamate (Ammate)	—	10
n-Amyl acetate	100	525
sec-Amyl acetate	125	650
Aniline — Skin	5	19
Anisidine (o-, p-isomers) — Skin	0.1	0.5
** Antimony & compounds (as Sb)	—	(0.5)
ANTU (alpha naphthyl thiourea)	—	0.3
Argon	F	—
** Arsenic & compounds (as As)	—	(0.5)
Arsine	0.05	0.2
Asbestos (all forms)		A1a
Asphalt (petroleum) fumes	—	5
Azinphos methyl — Skin	—	0.2
Baygon (Propoxur)	—	0.5
Barium (soluble compounds)	—	0.5
**C Benzene — Skin	(25)	(80)
Benzidine production — Skin	—	A1b

Capital letters refer to Appendices. Footnotes (a thru h) see Page 224.
*1975 Addition.
**See Notice of Intended Changes.
†See 1974 Revised Documentation.

Substance	ppm[a]	mg/m³[b]
p-Benzoquinone, see Quinone	—	—
Benzoyl peroxide	—	5
Benzyl chloride	1	5
* Beryllium	—	0.002
Biphenyl	0.2	1
Bismuth telluride	—	10
Bismuth telluride (Se-doped)	—	5
Boron oxide	—	10
Boron tribromide	1	10
C Boron trifluoride	1	3
Bromine	0.1	0.7
Bromine pentafluoride	0.1	0.7
Bromoform — Skin	0.5	5
Butadiene (1, 3-butadiene)	1,000	2,200
** Butane	(500)	(1200)
Butanethiol, see Butyl mercaptan	—	—
2-Butanone	200	590
* 2-Butoxy ethanol (Butyl Cellosolve) — Skin	50	240
Butyl acetate (n-butyl acetate)	150	710
sec-Butyl acetate	200	950
tert-Butyl acetate	200	950
** n-Butyl alcohol — Skin	(100)	(300)
sec-Butyl alcohol	150	450
tert-Butyl alcohol	100	300
C Butylamine — Skin	5	15
C tert-Butyl chromate (as CrO_3) — Skin	—	0.1
n-Butyl glycidyl ether (BGE)	50	270
** Butyl lactate	(1)	(5)
Butyl mercaptan	0.5	1.5
p-tert-Butyltoluene	10	60
** Cadmium (Metal dust and soluble salts, as Cd)	—	(0.2)
C Cadmium oxide fume (as Cd)	—	0.05
Calcium carbonate	—	E
Calcium arsenate, as As	—	1
Calcium oxide	—	5
Camphor (Synthetic)	2	12
Caprolactam Dust	—	1
Vapor	5	20
Carbaryl (Sevin®)	—	5
Carbon black	—	3.5
Carbon dioxide	5,000†	9,000
Carbon disulfide — Skin	20	60
Carbon monoxide	50	55
* Carbon tetrabromide	0.1	1.4
Carbon tetrachloride — Skin	10	65

Substance	ppm[a]	mg/m³[b]
Cellulose (paper fiber)	—	E
* Cesium hydroxide	—	2
Chlordane — Skin	—	0.5
Chlorinated camphene — Skin	—	0.5
Chlorinated diphenyl oxide	—	0.5
Chlorine	1	3
Chlorine dioxide	0.1	0.3
C Chlorine trifluoride	0.1	0.4
C Chloroacetaldehyde	1	3
α-Chloroacetophenone (phenacylchloride)	0.05	0.3
Chlorobenzene (monochlorobenzene)	75	350
o-Chlorobenzylidene malononitrile (OCBM) — Skin	0.05	0.4
Chlorobromomethane	200	1,050
2-Chloro-1, 3-butadiene see Chloroprene	—	—
Chlorodifluoromethane	1,000	3,500
Chlorodiphenyl (42% Chlorine) — Skin	—	1
Chlorodiphenyl (54% Chlorine) — Skin	—	0.5
1-Chloro, 2, 3- epoxy-propane, see Epichlorhydrin	—	—
2-Chloroethanol, see Ethylene chlorohydrin	—	—
Chloroethylene, see Vinyl chloride	—	—
Chloroform (Trichloromethane)	25	120
bis-Chloromethyl ether	0.001	A1a
1-Chloro-1-nitropropane	20	100
Chloropicrin	0.1	0.7
Chloroprene (2-chloro-1, 3-butadiene) — Skin	25	90
* Chlorpyrifos (Dursban®) — Skin	—	0.2
* o-Chlorostyrene	50	285
o-Chlorotoluene	50	250
* 2-Chloro-6-(trichloromethyl) pyridine (N-Serve®)	—	10
Chromates, certain insoluble forms	—	A1a
Chromic acid and chromates (as CrO_3)	—	0.1

Capital letters refer to Appendices. Footnotes (a thru h) see Page 224.
*1975 Addition.
**See Notice of Intended Changes.
m) see p. 226.

Substance	ppm[a]	mg/m³[b]
Chromium, sol. chromic, chromous salts as Cr	—	0.5
* Clopidol (Coyden®)	—	10
Coal tar pitch volatiles (see Particulate Polycyclic Organic Matter (PPOM)	—	—
** Cobalt, metal fume & dust	—	(0.1)
* Copper fume	—	0.2
Dusts and Mists	—	1
Corundum (Al_2O_3)	—	E
Cotton Dust (raw)	—	0.2[m]
Crag® herbicide	—	10
Cresol (all isomers) — Skin	5	22
Crotonaldehyde	2	6
* Crufomate (Ruelene®)	—	50
Cumene — Skin	50	245
Cyanide (as CN) — Skin	—	5
Cyanogen	10	20
Cyclohexane	300	1,050
Cyclohexanol	50	200
Cyclohexanone	50	200
Cyclohexene	300	1,015
Cyclohexylamine—Skin	10	40
Cyclopentadiene	75	200
2, 4-D	—	10
DDT	—	1
DDVP, see Dichlorvos	—	—
Decaborane — Skin	0.05	0.3
Demeton® — Skin	0.01	0.1
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	50	240
1, 2-Diaminoethane, see Ethylenediamine	—	—
Diazinon — Skin	—	0.1
Diazomethane	0.2	0.4
Diborane	0.1	0.1
1, 2-Dibromoethane (ethylene dibromide) — Skin	20	145
Dibrom®	—	3
2-N Dibutylaminoethanol — Skin	2	14
Dibutyl phosphate	1	5
Dibutylphthalate	—	5
C Dichloracetylene	0.1	0.4
C o-Dichlorobenzene	50	300
p-Dichlorobenzene	75	450
Dichlorobenzidine — Skin	—	A1b
Dichlorodifluoromethane	1,000	4,950
1, 3-Dichloro-5, 5-dimethyl hydantoin	—	0.2

See Documentation for Basis of TLVs (1974) (continued)

Substance	ppm[a]	mg/m³[b]
1, 1-Dichloroethane	200	820
1, 2-Dichloroethane	50	200
1, 2-Dichloroethylene	200	790
Dichloroethyl ether — Skin	5	30
Dichloromethane, see Methylene chloride	—	—
Dichloromonofluoromethane	1,000	4,200
C 1, 1-Dichloro-1-nitroethane	10	60
1, 2-Dichloropropane, see Propylenedichloride	—	—
Dichlorotetrafluoroethane	1,000	7,000
Dichlorvos (DDVP) — Skin	0.1	1
*Dicyclopentadienyliron	—	10
Dieldrin — Skin	—	0.25
Diethylamine	25	75
Diethylamino ethanol — Skin	10	50
Diethylene triamine — Skin	1	4
Diethylether, see Ethyl ether	—	—
Diethylphthalate	—	5
Difluorodibromomethane	100	860
C Diglycidyl ether (DGE)	0.5	2.8
Dihydroxybenzene, see Hydroquinone	—	—
Diisobutyl ketone	25	150
Diisopropylamine — Skin	5	20
Dimethoxymethane, see Methylal	—	—
Dimethyl acetamide — Skin	10	35
Dimethylamine	10	18
Dimethylaminobenzene, see Xylidene	—	—
Dimethylaniline (N-dimethylaniline) — Skin	5	25
Dimethylbenzene, see Xylene	—	—
Dimethyl 1, 2-dibromo-2-dichloroethyl phosphate, see DiBrom	—	—
Dimethylformamide — Skin	10	30

Capital letters refer to Appendices. Footnotes (a thru h) see Page 224
*1975 Addition
**See Notice of Intended Changes

Substance	ppm[a]	mg/m³[b]
2, 6-Dimethylheptanone, see Diisobutyl ketone	—	—
1, 1-Dimethylhydrazine — Skin	0.5	1
Dimethylphthalate	—	5
** Dimethyl sulfate — Skin	(0.01)	(A2)
Dinitrobenzene (all isomers) — Skin	0.15	1
Dinitro-o-cresol — Skin	—	0.2
*3,5-Dinitro-o-toluamide (Zoalene®)	—	5.0
Dinitrotoluene — Skin	—	1.5
Dioxane, technical grade Skin	50	180
Diphenyl, see Biphenyl	—	—
Diphenyl amine	—	10
Diphenylmethane diisocyanate, see Methylene bisphenyl isocyanate (MDI)	—	—
Dipropylene glycol methyl ether — Skin	100	600
Diquat	—	0.5
Di-sec, octyl phthalate (Di-2-ethylhexyl-phthalate)	—	5
Disyston — Skin	—	0.1
*2,6-Ditert-butyl-p-cresol	—	10
Emery	—	E
Endosulfan (Thiodan®) — Skin	—	0.1
Endrin — Skin	—	0.1
Epichlorhydrin — Skin	5	19
EPN — Skin	—	0.5
1, 2-Epoxypropane, see Propylene oxide	—	—
2, 3-Epoxy-1-propanol, see Glycidol	—	—
Ethane	F	—
Ethanethiol, see Ethylmercaptan	—	—
Ethanolamine	3	6
2-Ethoxyethanol — Skin	100	370
2-Ethoxyethylacetate (Cellosolve acetate) — Skin	100	540
Ethyl acetate	400	1,400
Ethyl acrylate — Skin	25	100
Ethyl alcohol (ethanol)	1,000	1,900
Ethylamine	10	18
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	25	130
Ethyl benzene	100	435
Ethyl bromide	200	890
Ethyl butyl ketone (3-Heptanone)	50	230

Substance	ppm[a]	mg/m³[b]
Ethyl chloride	1,000	2,600
Ethyl ether	400	1,200
Ethyl formate	100	300
Ethyl mercaptan	0.5	1
Ethyl silicate	100	850
Ethylene	F	—
** Ethylene chlorohydrin — Skin	(5)	(16)
Ethylenediamine	10	25
Ethylene dibromide, see 1, 2-Dibromoethane	—	—
Ethylene dichloride, see 1, 2-Dichloroethane	—	—
Ethylene glycol, particulate	—	10
Ethylene glycol, vapor	100	260
C Ethylene glycol dinitrate and/or Nitroglycerin — Skin	0.2[d]	—
Ethylene glycol monomethyl ether acetate (Methyl cellosolve acetate) — Skin	25	120
Ethylene oxide	50	90
Ethylenimine — Skin	0.5	1
Ethylidine chloride, see 1, 1-Dichloroethane	—	—
C Ethylidene norbornene	5	25
N-Ethylmorpholine — Skin	20	94
Ferbam	—	10
Ferrovanadium dust	—	1
Fluoride (as F)	—	2.5
Fluorine	1	2
Fluorotrichloromethane	1,000	5,600
C Formaldehyde	2	3
* Formamide	20	30
Formic acid	5	9
Furfural — Skin	5	20
Furfuryl alcohol	5	20
Gasoline	—	B[g]
Germanium tetrahydride	0.2	0.6
Glass, fibrous[e] or dust	—	E
Glycerin mist	—	E
Glycidol (2, 3-Epoxy-1-propanol)	50	150
Glycol monoethyl ether, see 2-Ethoxyethanol	—	—
Graphite, (Synthetic)	—	E
Guthion,® see Azinphosmethyl	—	—
Gypsum	—	E

Capital letters refer to Appendices. Footnotes (a thru h) see Page 224.
*1975 Addition.
**See Notice of Intended Changes.

Substance	ppm[a]	mg/m³[b]
Hafnium	—	0.5
Helium	F	—
Heptachlor — Skin	—	0.5
** Heptane (n-heptane)	(500)	(2,000)
Hexachlorocyclopentadiene	0.01	0.11
Hexachloroethane — Skin	1	10
Hexachloronaphthalene — Skin	—	0.2
Hexafluoroacetone	0.1	0.7
** Hexane (n-hexane)	(500)	(1,800)
** 2-Hexanone (Methylbutyl ketone) — Skin	(100)	(410)
Hexone (Methyl isobutyl ketone) — Skin	100	410
sec-Hexyl acetate	50	300
**Hydrazine — Skin	(1)	(1.3)
Hydrogen	F	—
Hydrogen bromide	3	10
C Hydrogen chloride	5	7
Hydrogen cyanide — Skin	10	11
Hydrogen fluoride	3	2
Hydrogen peroxide	1	1.4
Hydrogen selenide	0.05	0.2
Hydrogen sulfide	10	15
Hydroquinone	—	2
Indene	10	45
Indium and compounds, as In	—	0.1
C Iodine	0.1	1
* Iron oxide fume	B[f]	5
Iron pentacarbonyl	0.01	0.08
Iron salts, soluble, as Fe	—	1
Isoamyl acetate	100	525
Isoamyl alcohol	100	360
Isobutyl acetate	150	700
** Isobutyl alcohol	(100)	(300)
** Isophorone	(10)	(50)
Isopropyl acetate	250	950
Isopropyl alcohol — Skin	400	980
Isopropylamine	5	12
Isopropyl ether	250	1,050
Isopropyl glycidyl ether (IGE)	50	240
Kaolin	—	E
Ketene	0.5	0.9
Lead, inorg., fumes and dusts, as Pb	—	0.15
Lead arsenate, as Pb	—	0.15
Limestone	—	E
Lindane — Skin	—	0.5
Lithium hydride	—	0.025
L.P.G. (Liquified petroleum gas)	1,000	1,800
Magnesite	—	E
Magnesium oxide fume	—	10

ADOPTED VALUES

See Documentation for Basis of TLVs (1974) (continued)

Substance	ppm[a]	mg/m³[b]
Malathion — Skin	—	10
Maleic anhydride	0.25	1
C Manganese and compounds, as Mn	—	5
Manganese cyclopentadienyl tricarbonyl (as Mn) — Skin	—	0.1
Marble	—	E
Mercury (Alkyl compounds) Skin, as Hg	0.001	0.01
Mercury (All forms except alkyl) as Hg	—	0.05
Mesityl oxide	25	100
Methane	F	—
Methanethiol, see Methyl mercaptan	—	—
Methoxychlor	—	10
2-Methoxyethanol—Skin (Methyl cellosolve)	25	80
Methyl acetate	200	610
Methyl acetylene (propyne)	1,000	1,650
Methyl acetylene-propadiene mixture (MAPP)	1,000	1,800
Methyl acrylate — Skin	10	35
Methyl acrylonitrile — Skin	1	3
Methylal (dimethoxymethane)	1,000	3,100
Methyl alcohol (methanol) — Skin	200	260
Methylamine	10	12
Methyl amyl alcohol, see Methyl isobutyl carbinol	—	—
Methyl 2-cyanoacrylate	2	8
Methyl isoamyl ketone	100	475
Methyl n-amyl ketone (2-Heptanone)	100	465
Methyl bromide — Skin	15	60
Methyl butyl ketone, see 2-Hexanone	—	—
Methyl cellosolve — Skin see 2-Methoxyethanol	—	—
Methyl cellosolve acetate — Skin, see Ethylene glycol monomethyl ether acetate	—	—
Methyl chloride	100	210
Methyl chloroform	350	1,900
** Methylcyclohexane	(500)	(2000)
Methylcyclohexanol	50	235
o-Methylcyclohexanone — Skin	50	230
Methylcyclopentadienyl manganese tricarbonyl (as Mn) — Skin	0.1	0.2
Methyl demeton — Skin	—	0.5
Methyl ethyl ketone (MEK), see 2-Butanone	—	—
C Methyl ethyl ketone peroxide	0.2	1.5
Methyl formate	100	250
Methyl iodide — Skin	5	28
Methyl isobutyl carbinol — Skin	25	100
Methyl isobutyl ketone, see Hexone	—	—
Methyl isocyanate — Skin	0.02	0.05
Methyl mercaptan	0.5	1
Methyl methacrylate	100	410
Methyl parathion — Skin	—	0.2
Methyl propyl ketone, see 2-Pentanone	—	—
C Methyl silicate	5	30
Cα-Methyl styrene	100	480
C Methylene bisphenyl isocyanate (MDI)	0.02	0.2
** Methylene chloride (dichloromethane)	(100)	(360)
4,4'-Methylene bis (2-chloraniline) — Skin	0.02	A2
C Methylene bis (4-cyclohexylisocyanate)	0.01	0.11
Molybdenum, as Mo Soluble compounds	—	5
Insoluble compounds	—	10
Monomethyl aniline — Skin	2	9
C Monomethyl hydrazine — Skin	0.2	0.35
Morpholine — Skin	20	70
Naphthalene	10	50
β-Naphthylamine	—	A1b
Neon	F	—
** Nickel carbonyl	(0.001 A1a)	(0.007)
Nickel, metal and insoluble compounds (as Ni)	—	1
Nicotine — Skin		0.5
Nitric acid	2	5
Nitric oxide	25	30
p-Nitroaniline — Skin	1	6
Nitrobenzene — Skin	1	5
p-Nitrochlorobenzene — Skin	—	1
4-Nitrodiphenyl	—	A1b
Nitroethane	100	310
C Nitrogen dioxide	5	9
Nitrogen trifluoride	10	29
Nitroglycerin[d] — Skin	0.2	2
Nitromethane	100	250
1-Nitropropane	25	90
2-Nitropropane	25	90
N-Nitrosodimethylamine (dimethylnitrosoamine) — Skin	—	A2
Nitrotoluene — Skin	5	30
Nitrotrichloromethane, see Chloropicrin	—	—
Nitrous oxide	F	—
Octachloronaphthalene — Skin	—	0.1
** Octane	(400)	(1,900)
Oil mist, particulate	—	5[f]
Oil mist, vapor	[e]B[3]	—
Osmium tetroxide, as Os	0.0002	0.002
Oxalic acid	—	1
Oxygen difluoride	0.05	0.1
Ozone	0.1	0.2
* Paraffin wax fume	—	2
Paraquat — Skin	—	0.5
Parathion — Skin	—	0.1
Particulate polycyclic organic matter (PPOM) as benzene solubles	—	0.2
Pentaborane	0.005	0.01
Pentachloronaphthalene — Skin	—	0.5
Pentachlorophenol — Skin	—	0.5
Pentaerythritol	—	E
** Pentane	(500)	(1,500)
2-Pentanone	200	700
Perchloroethylene—Skin	100	670
Perchloromethyl mercaptan	0.1	0.8
Perchloryl fluoride	3	14
Petroleum Distillates (naphtha)	[e]B[3]	—
Phenol — Skin	5	19
Phenothiazine — Skin	—	5
p-Phenylene diamine — Skin	—	0.1
Phenyl ether (vapor)	1	7
Phenyl ether-Diphenyl mixture (vapor)	1	7
Phenylethylene, see Styrene	—	—
Phenyl glycidyl ether (PGE)	10	60
Phenylhydrazine — Skin	5	22
C Phenylphosphine	0.05	0.25
Phorate (Thimet®) — Skin	—	0.05
Phosdrin (Mevinphos®) — Skin	0.01	0.1
** Phosgene (carbonyl chloride)	(0.10)	(0.4)
Phosphine	0.3	0.4
Phosphoric acid	—	1
Phosphorus (yellow)	—	0.1
Phosphorus pentachloride	—	1
Phosphorus pentasulfide	—	1
Phosphorus trichloride	0.5	3
** Phthalic anhydride	(2)	(12)
* Picloram (Tordon®)	—	10
Picric acid — Skin	—	0.1
Pival® (2-Pivalyl-1, 3-indandione)	—	0.1
Plaster of Paris	—	E
Platinum (Soluble Salts) as Pt	—	0.002
Polychlorobiphenyls, see Chlorodiphenyls	—	—
Polytetrafluoroethylene decomposition products	—	B[1]
C Potassium hydroxide	—	2
Propane	F	—
β Propiolactone	—	A2
Propargyl alcohol—Skin	1	2
n-Propyl acetate	200	840
Propyl alcohol —Skin	200	500
n-Propyl nitrate	25	110
Propylene dichloride (1, 2-Dichloropropane)	75	350
Propylene glycol monomethyl ether	100	360
Propylene imine — Skin	2	5
Propylene oxide	100	240
Propyne, see Methylacetylene	—	—
Pyrethrum	—	5
Pyridine	5	15
Quinone	0.1	0.4
RDX — Skin	—	1.5
Rhodium, Metal fume and dusts (as Rh)	—	0.1
Soluble salts	—	0.001
Ronnel	—	10
Rosin Core Solder pyrolysis products (as formaldehyde)	—	0.1
Rotenone (commercial)	—	5
Rouge	—	E
Selenium compounds (as Se)	—	0.2

Capital letters refer to Appendices.
Footnotes (a thru h) see Page 224.
**See Notice of Intended Changes.

Capital letters refer to Appendices.
Footnotes (a thru h) see Page 224.
*1975 Addition.
**See Notice of Intended Changes.

Substance	ppm[a]	mg/m³[b]
Selenium hexafluoride, as Se	0.05	0.4
Sevin® (see Carbaryl)	—	—
Silane (see Silicon tetrahydride)	—	—
Silicon	—	E
Silicon carbide	—	E
Silicon tetrahydride (Silane)	0.5	0.7
Silver, metal and soluble compounds, as Ag	—	0.01
Sodium fluoroacetate (1080) — Skin	—	0.05
C Sodium hydroxide	—	2.0
Starch	—	E
Stibine	0.1	0.5
** Stoddard solvent	(200)	(1150)
Strychnine	—	0.15
Styrene, monomer (Phenylethylene)	100	420
*C Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme)	—	0.00006[e]
Sucrose	—	E
Sulfur dioxide	5	13
Sulfur hexafluoride	1,000	6,000
Sulfuric acid	—	1
Sulfur monochloride	1	6
Sulfur pentafluoride	0.025	0.25
Sulfur tetrafluoride	0.1	0.4
Sulfuryl fluoride	5	20
Systox, see Demeton®	—	—
2, 4, 5-T	—	10
Tantalum	—	5
TEDP — Skin	—	0.2
Teflon® decomposition products	—	B[f]
Tellurium	—	0.1
Tellurium hexafluoride, as Te	0.02	0.2
TEPP — Skin	0.004	0.05
C Terphenyls	1	9
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	500	4,170
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	500	4,170
1, 1, 2, 2-Tetrachloroethane — Skin	5	35
Tetrachloroethylene, see Perchloroethylene	—	—
Tetrachloromethane, see Carbon tetrachloride	—	—
Tetrachloronaphthalene — Skin	—	2
Tetraethyl lead (as Pb) — Skin	—	0.100[h]
Tetrahydrofuran	200	590
Tetramethyl lead (as Pb) — Skin	—	0.150[h]
Tetramethyl succinonitrile — Skin	0.5	3
Tetranitromethane	1	8
Tetryl (2, 4, 6-trinitrophenylmethylnitramine) — Skin	—	1.5
Thallium (soluble compounds) — Skin (as Tl)	—	0.1
Thiram®	—	5
Tin (inorganic compounds, except SnH_4 and SnO_2) as Sn	—	2
Tin (organic compounds) — Skin (as Sn)	—	0.1
Tin oxide	—	E
Titanium dioxide	—	E
Toluene (toluol) — Skin	100	375
C Toluene-2, 4-diisocyanate (TDI)	0.02	0.14
o-Toluidine	5	22
Toxaphene, see Chlorinated camphene	—	—
Tributyl phosphate	—	5
1, 1, 1-Trichloroethane, see Methyl chloroform	—	—
1, 1, 2-Trichloroethane — Skin	10	45
Trichloroethylene	100	535
Trichloromethane, see Chloroform	—	—
Trichloronaphthalene — Skin	—	5
1, 2, 3-Trichloropropane	50	300
1, 1, 2-Trichloro 1, 2, 2-trifluoroethane	1,000	7,600
Triethylamine	25	100
*Tricyclohexyltin hydroxide (Plictran®)	—	5
Trifluoromonobromomethane	1,000	6,100
Trimethyl benzene	25	120
2, 4, 6-Trinitrophenol, see Picric acid	—	—
2, 4, 6 — Trinitrophenylmethylnitramine, see Tetryl	—	—
Trinitrotoluene — Skin	0.2	1.5
Triorthocresyl phosphate	—	0.1
Triphenyl phosphate	—	3
Tungsten & compounds, as W		
Soluble	—	1
Insoluble	—	5
Turpentine	100	560
Uranium (natural) soluble & insoluble compounds, as U	—	0.2
Vanadium (V_2O_5), as V		
Dust	—	0.5
C Fume	—	0.05
Vinyl bromide	250	1,100
**Vinyl chloride	(200)	(510)
Vinyl acetate	10	30
Vinyl cyanide, see Acrylonitrile	—	—
Vinylidene chloride	10	40
Vinyl toluene	100	480
Warfarin	—	0.1
Wood dust (nonallergenic)	—	5
Xylene (o-,m-,p-isomers) — Skin	100	435
Xylidine — Skin	5	25
Yttrium	—	1
Zinc chloride fume	—	1
Zinc oxide fume	—	5
Zinc stearate	—	E
Zirconium compounds (as Zr)	—	5

Capital letters refer to Appendices.
Footnotes (a thru h) see Page 224.
*1975 Addition.
**See Notice of Intended Changes.

a) Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm. Hg. pressure.
b) Approximate milligrams of substance per cubic meter of air.
d) An atmospheric concentration of not more than 0.02 ppm, or personal protection may be necessary to avoid headache.
e) <7 μm in diameter.
f) As sampled by method that does not collect vapor.
g) According to analytically determined composition.
h) For control of general room air, biologic monitoring is essential for personnel control.

Radioactivity

For permissible concentrations of radioisotopes in air, see U.S. Department of Commerce, National Bureau of Standards Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," June 5, 1969. Also, see U.S. Department of Commerce National Bureau of Standards, Handbook 59, "Permissible Dose from External Sources of Ionizing Radiation," September 24, 1954, and addendum of April 15, 1958. A report, Basic Radiation Protection Criteria, published by the National Committee on Radiation Protection, revises and modernizes the concept of the NCRP standards of 1954, 1957 and 1958; obtainable as NCRP Rept. No. 39, P.O. Box 4867, Washington, D.C. 20008.

THRESHOLD LIMIT VALUES FOR
CHEMICAL SUBSTANCES IN WORKROOM AIR, 1975

MINERAL DUSTS

Substance	
SILICA, SiO_2	
Crystalline	
Quartz	TLV in mppcf[i]: $\frac{300^{j}}{\%\ \text{quartz} + 10}$ / TLV for respirable dust in mg/m^3: $\frac{10\ mg/m^{3\,k}}{\%\ \text{Respirable quartz} + 2}$ / TLV for "total dust," respirable and nonrespirable: $\frac{30\ mg/m^3}{\%\ \text{quartz} + 3}$
Cristobalite	Use one-half the value calculated from the count or mass formulae for quartz.
Tridymite	Use one-half the value calculated from formulae for quartz.
Silica, fused	Use quartz formulae.
Tripoli	Use respirable[p] mass quartz formula
**Amorphous	20 mppcf[i]
SILICATES (< 1% quartz)	
Asbestos, all forms†	5 fibers/cc > 5 μm in length[n]; A1a
Graphite (natural)	15 mppcf
Mica	20 mppcf
Mineral wool fiber	10 mg/m^3
Perlite	30 mppcf
Portland Cement	30 mppcf
Soapstone	20 mppcf

**See Notice of Intended Changes.

ANNEX C

Prepared by

Legislative Research

Library and Information Services

Labour Canada

June 1, 1976

MAIN OCCUPATIONAL HEALTH LEGISLATION IN CANADA

Federal

Administrative Authority	Acts and Regulations
Department of Labour	Canada Labour Code (Part IV - Safety of Employees) (R.S.C. 1970, c.L-1 as amended) - Canada Confined Spaces Regulations - Canada Dangerous Substances Regulations - Canada Noise Control Regulations - Canada Protective Clothing and Equipment Regulations - Canada Safe Illumination Regulations - Canada Sanitation Regulations - Coal Mines (C.B.D.C.) Safety Regulations
Department of Transport	Canada Shipping Act (R.S.C. 1970, c.S-9 as amended - Safe Working Practices Regulations - Dangerous Goods Shipping Regulations
Canadian Transport Commission	Railway Act (R.S.C. 1970, c.R-2 as amended - Regulations for the transportation of dangerous commodities by rail
Atomic Energy Control Board	Atomic Energy Control Act (R.S.C. 1970, c.A-19) - Atomic Energy Control Regulations
Department of National Health and Welfare	Public Works Health Act (R.S.C. 1970, c.P-39) - Public Works Health Regulations

	Radiation Emitting Devices Act (R.S.C. 1970, 1st supplement, c.34) - Radiation Emitting Devices Regulations
Department of Indian and Northern Affairs	Territorial Lands Act (R.S.C. 1970, c.T-6 as amended) and Public Lands Grants Act (R.S.C. 1970, c.P-29) - Canada Oil and Gas Drilling and Production Regulations
Department of Consumer and Corporate Affairs	Hazardous Products Act (R.S.C. 1970, c.H-3 as amended) - Hazardous Products (Hazardous Substances) Regulations
Department of Agriculture	Pest Control Products Act (R.S.C. 1970, c.P-10 as amended) - Pest Control Products Regulations
Department of the Environment	Environmental Contaminants Act (S.C. 1974-75 c.72) - Clean Air Act (S.C. 1970-71-72, c.47).

Newfoundland

Administrative Authority	Acts and Regulations
Workmen's Compensation Board	Workmen's Compensation Act (R.S.N. 1970, c.403 as amended) - Workmen's Compensation Board (Dust Exposure Occupations) Regulations - Accident Prevention Regulation
Department of Mines and Energy	The Regulations of Mines Act (R.S.N. 1970, c.330 as amended) - Mines (Safety of Workmen) Regulations
Department of Health	Health and Public Welfare Act (R.S.N. 1970, c.151 as amended) - Public Health (Sanitation) Regulations
Department of Provincial Affairs and Environment	Pesticides Control Act (R.S.N. 1970, c.292 as amended)

Prince Edward Island

Administrative Authority	Acts and Regulations
Worker's Compensation Board	Worker's Compensation Act (R.S.P.E.I. 1974, c.W-10 as amended) - Industrial Safety Regulations
Department of Agriculture and Forestry	Agricultural Chemicals Act (R.S.P.E.I. 1974, c.A-4).

Nova Scotia

Administrative Authority	Acts and Regulations
Department of Labour	The Construction Safety Act (R.S.N.S. 1967, c.52 as amended)
	- Construction Safety Regulations
	Industrial Safety Act (R.S.N.S. 1967, c.141 as amended)
	- Industrial Safety Regulations
Department of Mines	Coal Mines Regulation Act (R.S.N.S. 1967, c.36 as amended)
	- Regulations respecting the use, care and maintenance of gas testers.
	Metalliferous Mines and Quarries Regulation Act (R.S.N.S. 1967, c.183)
Workmen's Compensation Board	Workmen's Compensation Act (R.S.N.S. 1967, c.343 as amended)
Department of Public Health	Public Health Act (R.S.N.S. 1967, c.247 as amended)
	- Regulations respecting ionizing devices
Department of the Environment	Pest Control Products Act (S.N.S. 1970, c.12)

New Brunswick

Administrative Authority	Acts and Regulations
Department of Labour and Manpower	Industrial Safety Act (R.S.N.B. 1973, c.I-5) - Industrial Safety Council - Industrial Safety Code
Department of Health	Health Act (R.S.N.B. 1973, c.H-2)
Department of Natural Resources	Mining Act (R.S.N.B. 1973, c.M-14) - Operation of Coal Mines Regulations - Operation of Mines and Quarries
Department of Agriculture and Rural Development	Pesticides Control Act (R.S.N.B. 1973, c.P-8)

Québec

Administrative Authority	Acts and Regulations
Department of Labour and Manpower	Industrial and Commercial Establishments Act (R.S.Q. 1964, c.150 as amended) - Regulation concerning industrial and commercial establishments - Construction Safety Code - Regulation respecting safety and health in foundry works - Regulation concerning foresting operations
Workmen's Compensation Commission	Workmen's Compensation Act (R.S.Q. 1964, c.159 as amended) - Regulation concerning the institution of the Advisory Committee on Industrial Accidents

Québec continued...

Department of Municipal Affairs	Environment Quality Act (S.Q. 1972, c.49) - Regulation respecting hot mix asphalt plants - Regulation concerning industrial establishments - Regulation prohibiting the use of D.D.T. save in certain circumstances
Department of Natural Resources	Mining Act (S.Q. 1965, c.34 as amended) - Regulation concerning the medical certificate of workmen employed in mining operations - Regulation concerning mine rescue stations - Regulation respecting safety and protection of workmen in mines and quarries
Department of Social Affairs	Public Health Protection Act (S.Q. 1972, c.42 as amended)

1. The Construction Safety Code is administered by the Office de la Construction du Québec.

Ontario

Administrative Authority	Acts and Regulations
Ministry of Labour	Construction Safety Act, 1973 (S.Q. 1973, c.47) - Regulation made under the Act (safety and health requirements) Industrial Safety Act, 1971 (S.Q. 1971, c.43 as amended) - General Regulations - Grain Elevators Regulations

Ontario continued...

Workmen's Compensation Board	Workmen's Compensation Act (R.S.O. 1970, c.505 as amended)
Ministry of Health	Public Health Act (R.S.O. 1970, c.377 as amended) - X-ray Safety Silicosis Act (R.S.O. 1970, c.438 as amended) - General Regulations
Ministry of Natural Resources	Mining Act (R.S.O. 1970, c.274 as amended)
Ministry of the Environment	The Pesticides Act (R.S.O. 1970, c.346 as amended) - General Regulations.

Manitoba

Administrative Authority	Acts and Regulations
Workers' Compensation Board	Workers' Compensation Act (R.S.M. 1970, c.W-200 as amended) Employment Safety Act (R.S.M. 1970, c.E-90 as amended) - Employment Safety Regulations - Regulations respecting spray painting in factories and garages

Manitoba continued...

Department of Health and Social Development	Public Health Act (R.S.M. 1970, c.P-210 as amended) - Regulation respecting sanitation - Regulation respecting certain industrial establishments including industries in which silicosis may be contracted and factories, offices and office buildings - Regulation respecting the protection of persons engaged in any industrial process involving the use or manufacture of lead or benzol
Department of Mines, Resources and Environmental Management	Mines Act (R.S.M. 1970, c.M-160 as amended) - Regulation governing the operation of mines
Department of Agriculture	Pesticides Control Act (R.S.M. 1970, c.P-40) - Regulation respecting licences and the use of pesticides.

1. Bill 83 "The Workplace Safety and Health Act" is presently before the legislature of Manitoba. When brought into force, the new Act will replace the Employment Safety Act and will be administered by the Lieutenant-Governor in Council (probably Labour).

Saskatchewan

Administrative Authority	Acts and Regulations
Department of Labour	Occupational Health Act, 1972 (S.S. 1972, c.86 as amended) - Accident Prevention Regulation - Forest Accident Prevention Regulations - Petroleum Accident Prevention Regulations - Asbestos Regulations

Saskatchewan continued...

Administrative Authority	Acts and Regulations
	Factories Act (R.S.S. 1965, c.370 as amended) (repealed by S.S. 1973-74, c.38, not yet proclaimed in force) - Regulations respecting the prevention of accidents in garages, automobile service stations and motor vehicle repair shops Radiation Health and Safety Act (R.S.S. 1965, c.262, as amended) - Radiological Health Regulation
Department of Mineral Resources	Mines Regulations Act (R.S.S. 1965, c.373 as amended) - Regulations governing the operation of mines.
Department of Agriculture	Pest Control Products (Saskatchewan) Act, 1973 (S.S. 1973, c.72; to be put into force by proclamation).

Alberta

Administrative Authority	Acts and Regulations
Workers' Compensation Board[1]	Workers' Compensation Act (S.A. 1973, c.87 as amended) - General Safety Regulations - Construction Safety Regulations - Safety regulations governing grain elevators, flour mills, feed mills, seed mills and seed cleaning plants - Lumber Regulations - Petroleum and Natural Gas Regulations

Alberta continued...

Administrative Authority	Acts and Regulations
Department of Social Services & Community Health	Public Health Act (R.S.A. 1970, c.294 as amended) - Regulations respecting fibrosis of the lungs - Regulations respecting notification of industrial disease - Regulations respecting the protection of workers from lead and lead compounds - Regulations respecting the protection of workers from the effects of noise - Regulations respecting occupational health
Department of Labour	Radiation Protection Act (R.S.A. 1970, c.309 as amended) - Regulations respecting the installation and use of medical, dental, veterinary and paramedical X-ray equipment - Regulations respecting protection from laser operation
Energy Resources Conservation Board	Quarries Regulation Act (R.S.A. 1970, c.305 as amended) - Quarries Regulations Coal Mines Safety Act (S.A. 1974, c.18) - Coal Mine Safety Regulations
Department of the Environment	Agricultural Chemicals Act (R.S.A. 1970, c.4 as amended) - Regulations respecting the use and handling of agricultural chemicals - Regulations respecting the use and application of pesticides.

Alberta continued...

[1] Presently, Bill 39 "The Occupational Health and Safety Act" is before the legislature of Alberta. The bill brings the Accident Prevention Branch of the Workers' Compensation Board within a special division of the Department of Labour. Eventually, occupational safety and health regulations will probably be made under the new Occupational Health and Safety Act.

British Columbia

Administrative Authority	Acts and Regulations
Workers' Compensation Board	Workers' Compensation Act (S.B.C. 1968, c.59 as amended) - Accident Prevention Regulations - Compressed Air - Submarine Diving - Asbestosis - Pneumoconiosis - Tuberculosis
Department of Labour	Factories Act, 1966 (S.B.C. 1966, c.14) - Occupational Environment Regulations
Department of Mines and Petroleum Resources	Coal Mines Regulation Act (S.B.C. 1969, c.3 as amended) Mines Regulation Act (S.B.C. 1967, c.25 as amended)
Department of Health Services and Hospital Insurance	Health Act (R.S.B.C. 1960, c.170 as amended)

Yukon Territory

Administrative Authority	Ordinances and Regulations
Commissioner of the Yukon Territory	Mining Safety Ordinance (R.O.Y.T. 1971, c.M-9 as amended)
	- Mining Safety Regulations
	Workmen's Compensation Ordinance (O.Y.T. 1973 (3rd Sess.) c.6)
	- Accident Prevention Regulation
	Public Health Ordinance (R.O.Y.T. c.P-8 as amended)

Northwest Territories

Administrative Authority	Ordinances and Rules
Commissioner of the Northwest Territories	Safety Ordinance (R.O.N.W.T. 1974, c.S-1)
	Mining Safety Ordinance (R.O.N.W.T. 1974, c.M-13)
	- Mining Safety Rules
	Pesticide Ordinance (R.O.N.W.T. 1974, c.P-4)
	Public Health Ordinance (R.O.N.W.T. 1974, c.P-10).

SELECTED STATUTORY OCCUPATIONAL HEALTH ACTIVITIES OF PRINCIPAL GOVERNMENT DEPARTMENTS AND AGENCIES IN CANADA

Activities	Fed.	Nfld	P.E.I.	N.S.	N.B.	Qué.	Ont.	Man.[1]	Sask	Alta	B.C.	Yukon	N.W.
Standards Setting	L H AECB Trans CCA PW TB	WCB M	WCB	L M H	L M	L M MA	L M H	WCB M H	L M	L ERCB H	WCB L M	Com INA	Com INA
Enforcement	L H AECB Trans	WCB M	WCB	L M H	L M H	L OCQ M MA	L M H	WCB M H	L	L ERCB	WCB L M H	Com INA	Com INA
Research	H AECL NRC M			L		H	H	WCB	L	L	WCB		Com
Education	L Trans H	WCB		L WCB	ISC	WCB IAPA L	WCB IAPA MAPA L H	WCB	L	L	WCB		Com
Studies & Surveys	L H NRC SCC			WCB			L H	WCB	L	L H	L WCB		

AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada Ltd.
CCA	Consumer and Corporate Affairs
Com	Commissioner
ERCB	Energy Resources Conservation Board
H	Department responsible for health
IAPA	Industrial Accident Prevention Association
INA	Indian and Northern Affairs (federal)
ISC	Industrial Safety Council
L	Department responsible for labour
M	Department responsible for mines
MA	Municipal Affairs
MAPA	Mines Accident Prevention Association
NRC	National Research Council
OCQ	Office de la Construction du Québec
PW	Public Works
SCC	Science Council of Canada
TB	Treasury Board
Trans	Transport
WCB	Workmen's Compensation Board

[1]When the Workplace Safety and Health Act is brought into force, the powers now vested in the Workers' Compensation Board will be conferred upon a department designated by the Lieutenant-Governor in Council (probably Labour).

June 1, 1976
Legislative Research
Library & Information Services
Labour Canada