Control and Prevention of Occupational Cancer

Seventh Item on the Agenda
The designations of countries employed, which are in conformity with United Nations practice, and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the International Labour Office concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

PRINTED BY “LA TRIBUNE DE GENÈVE”, GENEVA (SWITZERLAND)
CONTENTS

INTRODUCTION ................................................. 1

CHAPTER I: General ............................................. 3

CHAPTER II: Law and Practice ................................. 6
   General Remarks ........................................ 6
   General Provisions relating to Technical Prevention ... 7
   General Provisions relating to Medical Prevention ... 9
   Medical Examinations Directed at the Prevention and Detection of Occupational Cancer . 10
   Reporting of Occupational Diseases and Compensation 11
   Provisions referring Specifically to the Cancer Hazard 12

CHAPTER III: Possibilities of International Regulation .......... 17
   Form of the Proposed International Instrument ............. 17
   General Principles ........................................ 18
   Technical Prevention .................................... 18
   Medical Supervision ..................................... 20
   Education ................................................. 21
   Special Problems ......................................... 21

Questionnaire ................................................. 22

APPENDIX: Extracts from the Report of the Meeting of Experts on Control and Prevention of Occupational Cancer ......................... 25
INTRODUCTION

The question of protecting workers against the risk of occupational cancer has been raised on several occasions in the past, either at meetings of the Governing Body of the International Labour Office or at the International Labour Conference, which at its 51st (1967) Session adopted a resolution concerning the subject.

At its 183rd (May-June 1971) Session the Governing Body decided to include the question of the control and prevention of occupational cancer in the agenda of the 58th (1973) Session of the Conference. At its 184th (November 1971) Session, the Governing Body further decided to convene a meeting of experts, chosen in consultation with the Government, Employers’ and Workers’ groups (this meeting was held in January 1972), to examine the question and to provide guidelines for the Conference.

The question is to be dealt with by the Conference under the double-discussion procedure provided for in article 39 of the Standing Orders. The Office has drawn up this preliminary report in preparation for the first discussion. Chapter I contains a general introduction to the subject, while Chapter II gives some examples of the law and practice of member States, Chapter III discusses possible forms of international regulation, and is followed by a questionnaire, drawn up with a view to the drafting of an international instrument, to which governments are requested to reply, giving reasons for their particular replies. The text of the report of the Meeting of Experts is reproduced in the appendix, in accordance with the decision of the Governing Body, in order that governments and employers’ and workers’ organisations may acquaint themselves with the Experts’ conclusions and opinions.

It has been found in the past that Members whose law and practice are in conformity with the essential provisions of an international instrument are sometimes unable to ratify or accept that instrument formally by reason of comparatively minor divergences between its precise terms and national law or practice. These divergences may relate to the general scope of the instrument: the scope of the relevant national legislation may not completely coincide with the instrument or may define differently the sector or sectors covered by it. Alternatively, they may relate to details of application of basic principles. It is clearly desirable for difficulties of this nature to be taken into account at the time of the drafting of the instrument, with a view to determining whether it can be rendered sufficiently flexible to meet these difficulties without detriment to its substantive effect. A question has accordingly been included in the questionnaire inviting member States to indicate any particularities of national law and practice concerning the subject under discussion which in their view are liable to create difficulties in the implementation of the international instrument as conceived in this report, and to make specific suggestions as to how these difficulties may be met.

On receipt of the replies, the Office will draw up a second report, summarising the replies and indicating the points that require consideration by the Conference.
In accordance with article 39 (1) of the Standing Orders of the Conference, the present report is being circulated so as to reach governments not less than twelve months before the opening of the 58th Session of the Conference in 1973. In order that the Office may have time to examine the replies to the questionnaire and to prepare and despatch the second report, which, in accordance with article 39 (3) of the Standing Orders, must reach governments not later than four months before the opening of the 58th Session, governments are requested to send their replies so as to reach the Office in Geneva not later than 30 September 1972.

In this connection the attention of governments is drawn to the recommendation addressed to them by the Governing Body at its 183rd Session, in June 1971, on the basis of the resolution concerning the strengthening of tripartism in the over-all activities of the International Labour Organisation, adopted by the Conference at its 56th Session, "that they consult the most representative organisation of employers and workers before they finalise replies to ILO questionnaires relating to items on the agenda of sessions of the General Conference". Governments are requested to indicate in their replies which organisations have been so consulted. It is assumed that the results of the consultation will be reflected in the government's reply; under the Standing Orders of the Conference only replies of governments are taken into account in the preparation of the subsequent report.
CHAPTER I

GENERAL

Occupational cancers are malignant tumours caused by exposure, generally prolonged, to various physical or chemical agents present in the working environment. In some cases these carcinogenic agents, such as certain chemical substances, ionising radiations, etc., are clearly defined and well known. In other cases they may be mixtures of various chemical substances such as mineral oils, soot, etc., the components of which are not yet clearly defined.

There are descriptions of occupational cancer reaching as far back as the second half of the eighteenth century, in particular in the case of cancer of the scrotum in chimney sweeps. Towards the end of the nineteenth century came the first descriptions of tumours of the bladder in workers engaged in the manufacture of dyestuffs. But it was not until comparatively recently, following epidemiological and experimental research, that the full extent of this hazard was realised and that the considerable number of carcinogenic substances currently employed in various industrial processes was recognised.

The occupational origin of cancer is often difficult to demonstrate since from the clinical and pathological viewpoint there is no difference between occupational cancer and other non-occupational forms. The development is generally very slow, the latent period stretching over anything from ten to thirty years or even more. Consequently, the first alert often follows only after an abnormally high number of deaths from cancer have been observed in certain occupational groups. Such observations have been followed by epidemiological surveys into the causes of death among these categories of workers with a view to determining the incidence of cancer, to ascertaining whether these forms of cancer presented special characteristics as regards their site and development, and to establishing whether the work involved exposure to specific substances or factors. These surveys were supplemented by experimental research into the carcinogenic effect of a large number of substances.

It was thus found that such carcinogenic effects can arise in various ways. In some cases they result from the direct effect of a substance on the organic tissues with which it comes into contact, as in the case of epithelioma of the skin in workers coming into contact with tar. In other cases they are due to the action of metabolic decomposition products that form in the organism following the absorption of the substance in question. This applies, in particular, to certain aromatic amines, such as beta-naphthylamine, which causes cancer of the bladder. In occupational cancer due to physical agents, such as ionising radiations, the appearance of the cancer is linked to both biochemical and genetic changes of the cell structure, the processes of which are
still largely unknown and the result of which is to trigger off a series of atypical pro-
liferative reactions which are basic to the formation of malignant tumours.

Statistical data on occupational cancer are limited. Only a few types of occupational
cancer qualify for compensation and are thus included in the data on compensation
for industrial diseases. This applies, for example, to epithelioma of the skin in workers
exposed to tar, cancer of the bladder in workers exposed to aromatic amines, cancer
caused by ionising radiations and lung cancer caused by asbestos (which has recently
been included in the legislation of some countries). Moreover, little is known as yet
about the possibility of certain substances or agents causing occupational cancer and,
consequently, cases reported are often fewer than those which actually occur. In other
cases legislation on compensation for industrial diseases groups all the pathologi-
cal symptoms due to a particular pathogenic agent under the same heading, thus
preventing the incidence of tumoral forms from being specified. This is the case,
for example, in a large number of countries as regards lesions caused by ionising
radiations.

In recent years an increasing number of substances have been tested on laboratory
animals with a view to determining whether they are carcinogenic. These experiments
have enabled a potential cancer risk to be detected in respect of a certain number of
substances. It should, however, be emphasised that this carcinogenic effect varies
according to the species of animal and that while it may be doubted that certain
carcinogenic substances are as harmful to humans as they are to certain laboratory
animals, the opposite also applies, that is to say certain substances are definitely
carcinogenic for humans but their effect on animals is uncertain.

In addition to this research, renewed interest has been aroused by epidemiological
surveys on the degree of vulnerability of certain occupational groups. These include
the surveys being carried out in the United States and the United Kingdom into the
incidence of mesothelioma of the pleura and of the peritoneum in workers exposed to
asbestos. As investigation is carried further, numerous cases are being detected in an
increasing number of occupations involving contact with substances which laboratory
research confirms to be carcinogenic.

In short, it can be said that various groups of substances are now known to have a
carcinogenic effect, varying in degree, and are capable of causing occupational cancer
among the workers exposed to them. For instance, benzene can cause leukaemia; certain aromatic amines lead to cancer of the bladder and the urinary tract; tar, soot,
mineral oils, creosote, paraffin, anthracene, etc., can give rise to cancer of the skin,
lungs and bladder; chromium, chromates, nickel and its compounds, and arsenic and
its compounds can cause cancer of the skin, lungs, maxillary and ethmoidal sinuses
and of other organs; asbestos can lead to cancer of the lungs and pleura; ionising
radiations and radioactive substances in general can give rise to cancer of the skin, the
bones, the liver and the thyroid as well as to leukaemia.

In view of the regular and striking increase in cancer cases over the last few decades
and of the considerable number of substances and products proved by recent research
to have carcinogenic properties, it is obvious that measures are needed to detect
carcinogenic agents, to determine the conditions under which they become active and
to decide on the best methods of prevention and early detection. Such measures are all the more necessary since the treatment of cancer often involves major surgery and, unfortunately, is frequently ineffective. While in favourable cases the disease can be prevented from spreading for a while, the long-term prognosis usually leaves little room for hope.

Although there is still not much that can be done to prevent most of the common cases of cancer, preventive measures should prove far more effective in the case of occupational cancer, for the two following reasons: first, there is a direct connection between the occupation and the disease, so that research can be centred on the risk factors encountered in a particular work process; and, second, certain chemical substances or certain physical or biological factors present a specific danger, as has been proved experimentally or revealed by epidemiological research.

Thus, in this particular field effective preventive measures are possible. These measures consist in avoiding all contact between the worker and the substances or agents in question, in changing or enclosing industrial processes found to be dangerous, in substituting harmless substances for carcinogenic ones and in eliminating, likewise, other risk factors.

A promising beginning as regards prevention has been made by some governments by such means as forbidding the manufacture of certain aromatic amines that cause cancer of the bladder in workers exposed to them.

In many countries there are legislative provisions concerning the medical and technical preventive measures to be taken in respect of certain substances or the use of certain types of radiations that are carcinogenic. Nevertheless it is clear, in view of the seriousness of the lesions that can be caused, that stricter measures are called for, particularly the prevention of any contact with certain substances, the replacement of the more dangerous substances whenever possible, the adoption of special technical protection measures, special medical supervision and appropriate education for workers exposed to this risk.
CHAPTER II

LAW AND PRACTICE

GENERAL REMARKS

Apart from a few exceptions, the protection of workers against the risk of occupational cancer does not come under any special regulations but is ensured under the provisions in force with respect to the prevention of occupational diseases. It entails both technical prevention, including certain environmental and personal protection measures, and medical prevention, including the reporting of such diseases and compensation.

As regards technical prevention, countries generally have more or less detailed regulations concerning the measures to be taken in connection with the manufacture or use of dangerous substances. These provisions may be general in scope, e.g. the employer may be obliged to take all possible steps to protect the health of workers exposed to such substances; or they may be more detailed and prescribe the specific steps to be taken to prevent the release of dust, fumes and smoke and to protect the persons concerned against any contact with toxic substances. In the latter case the regulations are often supplemented by provisions relating to the wearing of special protective clothing, the use of individual means of protection, the provision of appropriate sanitary and hygienic facilities to ensure personal cleanliness and decontamination, and provisions relating to occupational health. Dangerous substances may sometimes be used only under certain conditions (for example, in the form of a solution) and the legislation lays down the maximum proportion of such substances which may be included in products or solutions whose use is authorised and specifies in some cases the maximum permissible concentration of these substances in the air of the workplace. All these provisions are applicable to all carcinogenic substances or to those included in the lists of dangerous substances contained in legislation.

A few countries have legislation applying specifically to certain carcinogenic substances and prescribe the technical and medical preventive measures to be taken to guard against the hazards involved in their use. Such legislation exists, for example, in India (certain states), the USSR, the United Kingdom and the United States (Pennsylvania). The measures provided for often include a ban on the manufacture and use of certain carcinogenic substances.

A special cancer hazard—that caused by ionising radiations—is the subject of special regulations in the various countries; these regulations are generally very detailed and specify the steps to be taken as regards technical protection, monitoring, individual exposure doses, the limits of radiation permitted, etc.
Another method of technical prevention often used for dangerous substances is labelling. Certain carcinogenic substances are included in the lists of toxic and harmful substances for which the use of labels accompanied by danger symbols is prescribed. However, the danger symbol is generally used to give warning of various poisoning hazards and does not in itself indicate the special hazard created by carcinogenic substances.

As regards medical prevention, the situation is largely similar. Legislation includes general provisions concerning the medical examination of workers exposed to the effects of the dangerous substances specified and who are engaged in operations during which harmful substances may be released. These lists include certain substances which may, among other things, cause cancer. In such cases the aim of medical supervision is to prevent and detect, among other pathological symptoms, the appearance of cancerous lesions.

Legislation relating to compensation for occupational diseases generally covers certain types of occupational cancer. In countries which have a system of general coverage, compensation may be granted for cancer if its occupational origin can be proved. In consequence, the persons concerned must know that the substances with which they have been in contact are carcinogenic and the certifying physicians must be aware of these hazards. However, since the disease remains latent for a long period before the cancer actually appears, its occupational origin may be difficult to prove or the prescribed time limit for the reporting of diseases may well have expired.

In countries which have adopted a system of lists, compensation is granted for occupational cancer only when it is due to certain types of exposure. This applies in particular to primary epitheliomatous cancer of the skin among workers exposed to tar, pitch, soot, mineral oil, paraffin, etc. This disease is listed in the table in the Workmen's Compensation (Occupational Diseases) Convention (Revised), 1934 (No. 42), and in Schedule I appended to the Employment Injury Benefits Convention, 1964 (No. 121). These instruments have been ratified by many countries. Some types of cancer are listed in the tables which describe the pathological symptoms of poisoning or disease for which compensation is granted. This applies, for example, to leukaemia caused by benzene, malignant keratoses, bone sarcoma, leukaemia due to ionising radiations, cancer of the bladder due to certain aromatic amines, mesothelioma of the pleura and cancer of the lung due to asbestos, etc. In other cases, carcinogenic changes are implicitly covered by more general definitions such as "disease caused by . . .", "poisoning due to . . .".

Thus as regards technical and medical prevention, many countries have adopted general regulations which, although not designed specifically for the purpose, are nevertheless effective in combating occupational cancer. Before considering the specific provisions applicable in certain countries, a brief summary will be given of these regulations.

General Provisions relating to Technical Prevention

The national legislation of most countries contains provisions relating to general health conditions in workplaces and protection against the particular hazards of
occupational disease to which workers might be exposed by the nature of their activities. Although they do not refer specifically to the prevention of occupational cancer, all these provisions are clearly of interest, first because an unhealthy working environment may lower resistance to all diseases, including cancer, and second because certain general health measures, such as facilities for washing, changing clothes, eating in messrooms, etc., are particularly important when workers are exposed to special hazards, including that of occupational cancer.

Provisions relating to cleanliness at the workplace, the disposal of waste constituting a health hazard and ventilation are contained in the legislation of most countries, e.g. in that of Austria, Belgium, Bolivia, Brazil, Bulgaria, Burma, Cameroon, Ceylon, Chile, Colombia, Cyprus, Dahomey, Denmark, Finland, France, Federal Republic of Germany, Greece, Hungary, Israel, Italy, Japan, Kenya, Lesotho, Malawi, Mali, Mexico, Morocco, New Zealand, Nigeria, Poland, Romania, Spain, Switzerland, Tunisia, USSR, United Kingdom, United States and Yugoslavia.

Similarly, the national legislation or implementing regulations of the above-mentioned countries, inter alia, lay down standards relating to the provision of wash basins, showers, cloakrooms, messrooms, etc., which are designed to ensure that facilities are provided for maintaining personal cleanliness and limiting contamination by dangerous substances.

The wearing of special working clothes and the provision of individual protective equipment, especially when collective technical preventive measures afford inadequate protection, are prescribed by most national legislations, especially in connection with the handling of or exposure to dangerous substances, which are generally identified. Depending on the type of exposure, the regulations often specify the type of individual protective equipment which should be issued to workers and the measures to be taken for its use, storage, maintenance and cleaning. The countries whose legislation contains such provisions include: Austria, Belgium, Brazil, Cameroon, Ceylon, Costa Rica, Cyprus, Finland, France, Federal Republic of Germany, Hungary, India, Iraq, Italy, Japan, Kenya, Malawi, Mali, Mexico, New Zealand, Romania, Singapore, Spain, Sweden, Switzerland, USSR, United Kingdom, United States (federal legislation and state regulations) and Yugoslavia.

As regards actual technical measures, attention should be drawn to some which are of special interest in relation to the prevention of occupational cancer. In this connection, reference should be made to the principle, which is laid down in the legislation of certain countries, of replacing dangerous substances and processes by others which are harmless or less dangerous. This principle is laid down in the legislation of the following countries: Brazil, Costa Rica, Greece, Norway, Switzerland and the United States (Florida). Moreover, in certain countries the national authorities are empowered to prohibit the use of certain harmful substances—for example, the Ministry of Labour in Denmark and the Governor-General in New Zealand.

Another important measure designed to prevent certain types of occupational cancer is the compulsory use of enclosed apparatus for certain operations in order to avoid any contact with a dangerous substance. The countries whose legislation reflects this principle include the Federal Republic of Germany, Guinea, Hungary, Iraq, Japan, Morocco and Romania.
Another aspect of technical prevention which is relevant to protection against occupational cancer is the establishment by the competent authorities of maximum permissible concentrations of toxic substances in the air at the workplace. The methods used for fixing these maximum levels are not always comparable; moreover, the way in which they are applied often varies from one country to another. In some countries the concentration limits are indicated in the legislation relating to the manufacture or use of certain substances or to the operations during which they may be released. In other countries, the permissible limits which are legally valid or recognised and applied in practice are those fixed by professional organisations, research centres or other bodies concerned with the matter, as in the United States (American Conference of Governmental Industrial Hygienists), the Federal Republic of Germany (German Research Association) and Japan (Japanese Occupational Health Association). Lastly, other countries apply the maximum concentrations fixed by the USSR Ministry of Health or by the American Conference of Governmental Industrial Hygienists in the United States. The present trend in regard to substances with a particularly high carcinogenic effect is to reduce the maximum permissible concentration at workplaces to traces too small to be measured.

Some reference should be made to the provisions in force in various countries with respect to protection against ionising radiations. This is a relatively recent field of legislation, which has developed over the last few decades concurrently with the extension of the use of radioactive substances and other sources of ionising radiations. These provisions are generally very detailed and cover all aspects of technical protection, including methods for monitoring, decontamination, etc. They are supplemented by provisions relating to medical prevention, which are also detailed and stringent. These measures, which are designed to guard the persons exposed against pathological hazards, are considered to be sufficiently effective to protect them also against cancer hazards due to radiation. This question has already been studied at the international level and is the subject of two international instruments: the Radiation Protection Convention, 1960 (No. 115), and the Radiation Protection Recommendation, 1960 (No. 114). The Convention has been ratified by twenty-three countries.

**General Provisions relating to Medical Prevention**

In some countries all workers, whatever their age and the hazards to which they are exposed, must undergo a medical examination on taking up employment and at yearly or two-yearly intervals. This is the practice, for example, in Argentina, France, Mali, Mexico, Portugal, Spain and the Republic of Viet-Nam. Under this system the supervision of the health of workers exposed to cancer hazards and the detection of malignant changes are ensured through the general arrangements for these examinations.

Moreover, most countries prescribe periodic or special medical examinations for workers exposed to special hazards. These hazards, which are specified in their legislation or implementing regulations, cover a wide variety of cases, including that of exposure to substances likely to cause occupational cancer. The basic texts generally
empower the competent authorities to adopt implementing measures adapted to varying situations and subject to modification in the light of technological change. The regulations, which are very detailed in this regard, sometimes relate to certain occupations or operations and sometimes to certain occupational disease hazards, and they lay down the frequency and sometimes even the nature of the examinations to be made. In some countries the frequency laid down for periodic examinations is the same for all hazards (for example, every six months in Brazil, Cuba and Uruguay), but it is generally three, six or twelve months depending on the nature and the extent of the hazards. In some countries the administrative authorities may require—or the works physician may carry out—medical examinations in cases not provided for by legislation or at shorter intervals. This is the case in Austria, Belgium, Canada (Alberta and Ontario), Ceylon, Italy, Malaysia, New Zealand, Pakistan, Singapore, Syrian Arab Republic, United Kingdom and Zambia.

Several countries have adopted provisions concerning medical contra-indications in respect of jobs entailing exposure to certain serious hazards. For example in Bulgaria, France, Madagascar, Spain, the USSR, the United States (Pennsylvania) and Uruguay, legislation specifies the complaints which constitute a contra-indication for continued employment or for work entailing certain health hazards. These provisions sometimes concern exposure to substances which may produce occupational cancer.

Periodical examinations are very often prescribed in relation to occupational diseases recognised under compensation legislation. As a general rule, all workers exposed to diseases or to the forms of poisoning mentioned are thereby subject to medical examination at fixed intervals related to the gravity of the particular hazard.

**MEDICAL EXAMINATIONS DIRECTED AT THE PREVENTION AND DETECTION OF OCCUPATIONAL CANCER**

As regards the various types of occupational cancer, the criteria applied are essentially as follows.

*Cancer of the skin.* The periodic medical examinations for persons exposed to pitch, bitumen, soot, etc., must generally be carried out every six months. In some countries additional examinations are prescribed for workers with symptoms suggesting a neoplasm (for example, Italy).

*Lung cancer.* This may occur following exposure to various agents. Those most often suspected are nickel salts, chromates, ionising radiations, asbestos, products containing arsenic, and mineral oil. The frequency of the medical examinations prescribed generally varies from three months (for chromates, arsenic and ionising radiations) to six months (for nickel and mineral oil) and one year (for asbestos). Shorter intervals are sometimes provided for, depending on the exposure. In some countries the tests to be carried out are specified either in legislation or by the bodies responsible for making the medical examination (Bulgaria, Italy, Romania, United Kingdom, etc.).
Cancer of the bladder. Among the substances likely to cause this type of cancer, the most important are those of the aromatic amines group: benzidine, beta-naphthylamine, alpha-naphthylamine (because it normally contains a certain amount of beta-naphthylamine), 4-aminodiphenyl, 4-nitrodiphenyl, orthotolidine, dianisidine, dichlorobenzidine, auramine, etc. The frequency of the examinations varies from three to six or twelve months, depending on the substance to which the workers are exposed, the nature of their work and the conditions of exposure. In some countries the regulations or provisions adopted by the bodies responsible for carrying out these examinations also specify the conduct of the examination and the tests to be made (Bulgaria, Italy, Romania, United Kingdom, etc.).

Leukaemia and other malignant blood diseases. These diseases are caused in particular by benzene and ionising radiations. In this case, too, the frequency of the examinations varies from three to twelve months (one month in Mexico), according to the nature of the exposure and the extent of the hazard. In some countries more frequent examinations are provided for when the examining physician deems it necessary (Belgium, Egypt, France, Spain, etc.). In some countries the legislation provides for special supervision of workers according to the results of medical or laboratory examinations (France, Morocco, Spain, etc.).

Other types of occupational cancer. Other types of occupational cancer have been described, for example bone sarcoma following exposure to ionising radiations, cancer of the upper respiratory tract and cancer of the maxillary and para-nasal sinuses due to chromates, cancer of the liver due to arsenic compounds and a variety of other types of cancer caused by organic or inorganic products. These possible cancer agents are sometimes mentioned in the legislation on compensation, and medical examinations are prescribed at intervals varying from three to twelve months according to the extent of the hazard.

REPORTING OF OCCUPATIONAL DISEASES AND COMPENSATION

The legislation of most countries makes it mandatory, especially in the case of industrial workers, to report recognised or suspected cases of occupational diseases so that preventive measures may be taken at the workplaces and compensation granted. As indicated above, countries may have a system of general coverage or a list system or a mixed system whereby the legislation includes a list of occupational diseases but provides also for compensation in respect of any disease which can be proved to be due to occupational causes. The countries which provide general coverage include Argentina, Australia, Indonesia, New Zealand, the Philippines and certain states in the United States. The countries with a mixed system include Brazil, certain provinces in Canada, Cuba, Japan, Mexico, Spain, Sweden, Turkey and certain states in the United States.

In countries which have a list system compensation is provided only in respect of diseases mentioned in the list and it is often subject to certain limitations relating to the pathological symptoms and to the work assignment or industry entailing the hazards covered. The legislator has commonly not had particularly in mind the cancer
hazards of most of the substances in the lists. Consequently, the time limit for the grant of compensation in respect of the diseases listed does not always take account of the long latent period characteristic of occupational cancer. The cancer risk is, however, generally borne in mind in regard to benzene (leukaemia), ionising radiations (skin cancer, bone sarcoma and leukaemia), and bitumen, pitch, mineral oil and paraffin (epitheliomatous cancer of the skin). Moreover, when the lists specify the pathological symptoms entailing entitlement to compensation, cancer is mentioned only in certain cases, including those indicated above.

**Provisions Referring Specifically to the Cancer Hazard**

As previously stated, the risk of cancer is, in most, if not all, cases, only one of the health hazards resulting from exposure to substances or factors which have other harmful effects on the body. In consequence, the provisions designed to guard against these other hazards are effective in varying degrees for cancer prevention. When the risk of cancer is specifically envisaged, the measures provided for are much more stringent and detailed. This is true, for example, of the provisions in force in the following countries.

**United States**

*Pennsylvania.* This state adopted provisions in 1961 banning the manufacture, use, introduction into the state and stocking of beta-naphthylamine. These provisions were amended in 1968 and now list nine carcinogenic substances which may not be used without the prior authorisation of the Health Department, viz.: 2-acetylamino-fluorene, 4-aminodiphenyl, benzidine and its salts, dichlorobenzidine, 4-dimethylaminoazobenzene, beta-naphthylamine, 4-nitrodiphenyl, n-nitrosodimethylamine and beta-propiolactone. Any industry, institution or person wishing to use any of these substances must apply to the Occupational Health Division of the Health Department, specifying how the substance is to be used and giving a detailed description of the medical and technical preventive measures provided for. An authorisation is granted only if the use of the product is justified and the measures proposed provide a reasonable assurance of prevention of any injury to health. Products containing less than 1 per cent of the regulated substance are exempt from the procedure.

**India**

India has adopted provisions prohibiting the import and manufacture of beta-naphthylamine. The import of benzidine has also been prohibited as from 1970. Moreover, in 1961 the Ministry of Industry and Commerce established a committee to study the technical and medical measures needed to safeguard against the health hazards inherent in certain aromatic amines. Three Indian states have adopted special provisions relating to the prevention of occupational cancer in the manufacture and use of certain chemical compounds.

*Gujarat.* Schedule XI to Rule 102 of the 1963 Factory Regulations lays down a series of technical and medical preventive measures which are to be taken when
para-nitralinine, benzidine, alpha-naphthylamine and beta-naphthylamine are used. These measures include the installation of a local exhaust system capable of preventing any liberation of fumes, gas, etc., into the air at the workplace; prohibition of the mixing or filling of the substances by hand; the wearing of protective clothing and breathing apparatus; the daily cleaning of floors, which must be impermeable and smooth; the provision of washing facilities where soap, towels and nail brushes must be made available to workers, who are obliged to wash before eating and at the end of the shift. A 10 per cent sodium sulphate solution must be available for decontaminating hands and gloves. There are also detailed provisions relating to messrooms and cloakrooms. As regards medical prevention, a medical examination of workers on taking up employment and periodic examinations are prescribed. The latter must be repeated at intervals not exceeding three months. Women and young workers may not be assigned to work entailing exposure to these substances, nor visit the premises where they are used. Cautionary notices in a form approved by the Chief Inspector of Factories must be posted up in the work premises and their content must be clearly explained to illiterate workers.

_Mysore._ Schedule III to Rule 85 of the 1965 Factory Regulations contains the same provisions as those in force in the state of Gujarat.

_Maharashtra._ Schedule XI to Rule 114 of the 1963 Factory Regulations contains detailed provisions applicable to the manufacture and use of nitro- or amino-compounds. These compounds are classified in two groups. One includes alpha- and beta-naphthylamine, benzidine and its salts, dianisidine, toldidine and dichlorobenzidine. The other includes a whole series of substances, including in particular nitro-compounds of benzene and its homologues and of naphthalenes, as well as aniline and its homologues, anisidine, etc. These provisions are similar to those in force in the two states mentioned above but are more detailed. They specify among other things the minimum cubic space required for each worker, the use of enclosed apparatus or of a local exhaust system during certain operations, the measures to be taken at the workplace to ensure disposal of waste and decontamination of containers and the wearing of protective clothing and personal protective apparatus; they also prescribe the characteristics of washing facilities, messrooms and cloakrooms. Eating, drinking and smoking are forbidden on the work premises. The worker must wash regularly and work clothes must be cleaned and changed each day. A bath register to record the use of baths and showers is prescribed. The substances in the first group may be used only on work premises separated from other parts of the workplace. The air in workplaces must be analysed to determine the concentration of these amines at least once a week and the results of these analyses must be made available to labour inspectors. As regards medical prevention, there are detailed provisions relating to medical examination of workers taking up employment and periodical examinations at intervals of three months. Women and workers under 40 years of age may not be assigned to work with substances in the first group. An appendix further specifies the text of the cautionary notice to be posted up in a prominent place on the work premises.
Special provisions have been adopted for the prevention of certain types of occupational cancer. The Patent Fuel Manufacture (Health and Welfare) Special Regulations, 1946, apply to the manufacture of fuel bricks in which pitch is used as a binding agent. They lay down the measures to be taken at the workplace to protect workers exposed to coal dust and pitch, in particular the enclosure of apparatus used for the transport, crushing, sifting, drying, etc., of these substances, the provision of local exhaust ventilation, the removal of dust and the cleaning of premises. Appropriate facilities for washing and changing (with separate lockers for working clothes) must be provided, as well as messrooms. The employer must also provide workers with barrier creams for protection of the skin. Workers must undergo a medical examination on taking up employment and every six months thereafter. The results of these examinations must be recorded.

The Mule Spinning (Health) Special Regulations, 1953, lay down that the oil used as a lubricant for spindles of self-acting mules must be animal or vegetable oil. No mineral oil may be used if it does not conform to certain criteria relating to colour and viscosity. The workers exposed must undergo a medical examination on taking up employment and subsequent periodic examinations every six months. The employer must provide suitable premises for such examinations and maintain a register showing the names of the persons examined.

The 1967 regulations relating to carcinogenic substances prohibit the employment of workers in the manufacture of any of the following substances or in any operation exposing them to these substances: beta-naphthylamine, benzidine, 4-aminodiphenyl, 4-nitrodiphenyl and their salts. Products containing less than 1 per cent of these substances are excluded from the scope of this provision. Exceptions are also provided for when the substances are used in a closed apparatus. The same regulations prescribe special supervision for work entailing the use of alpha-naphthylamine, orthotolidine, dianisidine, dichlorbenzidine and their salts, as well as auramine and magenta, in order to avoid any exposure. These substances must be kept in a closed and clearly labelled receptacle. Workers must undergo a medical examination on taking up employment and subsequent periodic examinations at intervals not exceeding six months. These examinations must include a cytological urine test. The employer must provide the examining physician with appropriate premises for these examinations, which must be recorded, together with details relating to the worker’s assignment, in a special register. When the worker ceases to be employed on work entailing exposure to these substances, the employer must give him a copy of the approved cautionary card warning him against the possible after-effects of such exposure and containing instructions for the continuation of periodic examinations.

An order of 1967 prohibits the import into the United Kingdom of beta-naphthylamine, benzidine, 4-aminodiphenyl, 4-nitrodiphenyl and their salts and of any other substance which contains them. The import of benzidine mono- and dihydrochloride is also prohibited unless they are in the form of a liquid containing one part of water to two parts of the product and are used only in closed apparatus. In that case, the
same special supervision as is laid down in the carcinogenic substances regulations is prescribed, as regards technical and medical preventive measures. As regards cancer hazards arising from the inhalation of asbestos dust, in 1966 regulations were adopted adding to the list of occupational diseases which are subject to compensation, mesothelioma of the pleura or peritoneum in workers employed in the manufacture and handling of products containing asbestos, in the cleaning of machinery or on any other work exposing them to asbestos dusts. The recognition of the fact that such types of cancer were due to occupational causes was followed by the adoption in 1969 of regulations setting out the preventive measures to be taken in any establishment or workplace where operations entailing the use of asbestos or products containing asbestos are carried out. The employer must provide adequate exhaust ventilation equipment, the characteristics of which are specified, in order to prevent any spreading of asbestos dust at the workplace. This installation must be inspected weekly by the undertaking and checked by an expert at least once every fourteen months. The results of these checks must be recorded in a special register. When such apparatus is inadequate or inapplicable, workers must be provided with protective clothing and protective respiratory equipment providing complete protection against the inhalation of asbestos dust. The cleaning and maintenance of this protective clothing and equipment, as well as cleanliness of premises and plant, are covered by regulations. The assignment of young workers to such work is prohibited. A table appended to the regulations lists the operations subject to their provisions. The Department of Employment and Productivity has recently published standards for the determination of asbestos dust concentrations by the Inspectors of Factories, in relation to the application of certain provisions for technical prevention prescribed under the 1969 regulations. These standards refer to methods of sampling, analysis of samples and maximum permissible concentrations of asbestos fibres in the working atmosphere. With regard to the latter, limits have been set at 2 fibres per cc (or 0.1 mg. per cubic metre) for asbestos dust in general and at 0.2 fibres per cc (or 0.01 mg. per cubic metre) for crocidolite (blue asbestos).

Many measures have been taken, both officially and by certain employers' organisations, to inform the persons concerned of the occupational cancer hazards inherent in the use of certain substances or likely to arise during certain work processes. Thus the Ministry of Labour, the Department of Employment and Productivity and the labour inspectorate have published instructions, circulars and notices concerning the prevention of such hazards. The Rubber Manufacturing Employers' Association and the Association of British Chemical Manufacturers have also published studies on the matter which indicate the technical and medical measures to be adopted with a view to guarding in particular against cancer of the bladder.

USSR

Following a decision taken by the Ministry of Health, the production of betanaphthylamine, 3,3'-dichlorobenzidine, orthoaminotoluene and dimethylaminonitrobenzene has been prohibited. Special provisions specify the technical preventive
measures to be applied for the manufacture and use of benzidine and its homologues, alpha-naphthylamine and orthotolidine, with a view to minimising exposure to these substances. Hours of work for such workers have been reduced to six a day, and an extra annual holiday of thirty-six days, divided into two periods, has been granted. Protective clothes and underwear should be changed every day. Workers under 40 years of age should not be engaged in the manufacture of these substances. The names of workers exposed to the above substances should be recorded in a register for medical supervision (including urinary tests). Moreover, measures have been taken for replacing dye-stuffs containing carcinogenic substances by less dangerous compounds.
CHAPTER III

POSSIBILITIES OF INTERNATIONAL REGULATION

As was stated in the preceding chapter, only few countries have adopted regulations specifically covering the risk of occupational cancer. At present, most countries provide a certain degree of protection by means of their general laws and regulations on occupational hazards or of special provisions adopted for other purposes (such as regulations on the use of toxic substances).

FORM OF THE PROPOSED INTERNATIONAL INSTRUMENT

The first general problem raised by this situation concerns the form that should be taken by international standards on protection against occupational cancer. In view of the seriousness of the risk, it might be desirable to adopt an instrument laying down specific obligations, such as a Convention; ratifying countries would thus be required to take a series of common measures that would ensure a minimum of protection. Nevertheless, a certain number of practical considerations would seem to argue in favour of a more flexible form of instrument. The preventive methods likely to be defined by the Conference could be based only on the present characteristics of the operations, equipment, substances and processes involving exposure to cancer hazards. However, in the chemical industry in particular, rapid advances are now being made, accompanied by developments in protective measures to keep abreast of the changes. Rigid international standards are, therefore, likely to become rapidly out of date. Moreover, since the legal provisions now existing on the prevention of occupational cancer are few and have been adopted only fairly recently, for the purpose of drafting binding international standards insufficient information is available as to the practical possibilities of applying such preventive measures as may be advocated or as to their likely effectiveness. Consequently, it would appear desirable to leave member States the possibility of supplementing the international standards by any other effective provisions that might be applicable under the local technical, social and economic conditions, or of adapting them to the existing machinery for prevention and control. Lastly, the seriousness of the risk and the conditions under which symptoms of cancer appear (particularly the long latent period) seem to urge caution as regards the results that might be obtained by measures based on present experience. Whatever the effectiveness of the measures laid down today in an international instrument, there is no guarantee that these measures alone will ensure full protection against particularly dangerous exposure or against new substances that might be employed in industry in the future.
For these reasons the Office has deemed it advisable to envisage, at this stage in the questionnaire at the end of the report, the adoption by the International Labour Conference of an instrument in the form of a Recommendation (questions 1 and 2).

GENERAL PRINCIPLES

A second question of a general nature concerns the approach to be taken to the international standards. To judge from the example of the few existing national regulations, the suggestions of the Meeting of Experts (see Appendix, paragraph 58) and modern trends in the prevention of risks presented by toxic substances, it seems that the problem of protection should first be dealt with as a whole, followed by more detailed provisions concerning certain types of risks. Consequently, the general measures that can reduce as far as possible the risk of exposure to carcinogenic substances and factors will be mentioned first and then those that should be applied in particular cases. This approach also serves to emphasise that the instrument does not concern only the substances referred to in Part III of the questionnaire and to stress the general scope of the provisions in Parts IV and V.

For these reasons, Part II outlines the general aims of preventive regulations: the substitution of carcinogenic by less harmful substances (question 3); reduction of the number of persons exposed (question 4); the control of environmental pollution (question 5); general regulations (questions 6 and 7).

The Meeting of Experts pointed out repeatedly in its report that the regulations should be sufficiently flexible to allow of adaptation to variations in conditions of work and in technical processes, while being, nevertheless, sufficiently precise as regards prescriptions of a technical nature to ensure truly effective prevention and protection. This double objective is very difficult to achieve. From the practical point of view it would appear desirable to lay down general principles by means of legislation and to issue thereunder implementing orders containing detailed regulations that could be brought up to date as further progress is made in industrial technology and health. With this in mind, the Meeting of Experts recommended that the ILO should prepare, as it has already done for other fields of prevention, a code of practice or manuals containing a detailed description of methods of cancer prevention applicable to the various types of occupational exposure and which could serve as a guide to member States in drafting national regulations and in keeping them up to date (see Appendix, paragraphs 39, 57 and 61). The Office, acting on this suggestion, has decided to include in the questionnaire a provision on the periodic review of regulations in the light of the directives that might be drawn up by the ILO (question 7).

TECHNICAL PREVENTION

Traditionally, there are two ways of combating occupational hazards and of providing safeguards against their effects: technical prevention and medical supervision. In the case of occupational cancer, there can be no doubt that emphasis must
be laid on technical measures, which play a fundamental role since what is most important in the case of this disease is to prevent its appearance altogether. This statement of principle in no way means that medical supervision of workers exposed to risk is not indispensable. Cancer is too serious a disease for the chances of the earliest possible detection and therapy to be neglected. However, preventive measures should relate primarily to the effective control of industrial processes and equipment and the working environment in order to eliminate all exposure to carcinogenic substances or agents. Both types of action—technical prevention and medical supervision—are, therefore, included, in this order, in the questionnaire (Parts III and IV).

As regards technical prevention, the first important question to be decided was whether or not to include a provision whereby the manufacture and use of certain specified substances which are believed to entail particularly high risks would be forbidden. A provision of this kind is included in the regulations now in force in the United Kingdom, India and the USSR. In the United States, however, the state of Pennsylvania, which, in 1961, had adopted provisions of this kind replaced them in 1968 by regulations making the use of certain substances subject to special authorisation from the Department of Health. The Meeting of Experts discussed this matter at length; some Experts advocated a ban on the manufacture and use of certain substances, while others, on the contrary, considered that a ban would be in the interests of neither technical nor social progress and that a more constructive attitude was called for, requiring the taking of the necessary preventive and protective measures (see Appendix, paragraphs 37 and 38). Finally, the Experts were of the opinion that certain substances and industrial processes that present an exceptionally high risk should be used only with the authorisation of the competent authority and that, where the risk is less serious, special standards determined by national regulations should be applied (see Appendix, paragraphs 55 and 56).

In view of the present situation of rapid development of industrial techniques and processes, the Office considered that the question should be approached in the manner suggested by the Meeting of Experts. In order to follow a logical sequence, after Part II, concerning general principles, Part III deals first with the carcinogenic substances and agents which are subject to control, then with the substances and agents for which authorisation is required.

In both cases it had to be decided whether or not the instrument should include an annex listing the substances and agents concerned. The Office considers that it would be most helpful for member States to be able to refer to an international list of substances and agents the manufacture or use of which should be accompanied by special protective measures. This would ensure that the provisions adopted in different countries in connection with specific substances or hazards would correspond to a certain degree. Moreover, such a list would help national technical services to establish the nature of the risks and the strictness of the preventive measures required; on the basis of analogy of risks, they could classify other substances into one of the two categories. As recommended by the Meeting of Experts (see Appendix, paragraph 57) the questionnaire envisages a list of substances and agents that should be subject to control (questions 9 and 10) and a list of substances and agents that should be subject
to authorisation (questions 18 and 20). Furthermore, the Office considered it desirable, in view of the rapid advances in knowledge, to make provision for a method whereby the lists could periodically be brought up to date (questions 12 and 21).

Part III mentions the principle of the determination by the competent authority of the maximum permissible concentrations of carcinogenic substances or agents subject to control in the atmosphere of workplaces (question 14). The Meeting of Experts considered this question and emphasised all the difficulties encountered either from the scientific point of view (as a result of inadequate data) or from the methodological point of view (as regards sampling) (see Appendix, paragraph 44). The purpose of technical prevention, however, is to reduce the exposure of workers to carcinogenic substances or agents to a level where it becomes harmless; for practical reasons it therefore appears indispensable to be able to assess the degree of environmental pollution against specific criteria in order to verify the effectiveness of the technical means of prevention and to fix the standards which they should meet. Since it is left to the competent authority to determine the maximum permissible concentrations, it should be possible for the values to be reviewed periodically in order to keep pace with advances in knowledge.

In view of the high risk that the substances and agents subject to authorisation entail, the competent national authorities should impose very strict preventive measures. With this in mind the questionnaire mentions not only the types of apparatus that should be used, thus introducing the question of the actual planning of technical processes (question 23) but also the manner of ensuring complete decontamination of the atmosphere of working places in order to avoid any form of pollution (question 24).

**Medical Supervision**

Although, in the case of occupational cancer, medical supervision cannot prevent the appearance of the disease, it plays a fundamental part in protecting the workers’ health. Upon recruitment, in particular, such supervision makes it possible to avoid exposing persons who, because of certain physiological deficiencies, might be predisposed to the types of cancer in question, and it enables the effectiveness of the technical prevention measures to be checked by testing for biological signs of absorption of carcinogenic substances; furthermore, it ensures early detection of cancer. There are now comprehensive provisions in national regulations, and in several international instruments, concerning medical examination (pre-employment examination and subsequent periodic examinations). For that reason the Office does not consider it necessary to provide for detailed standards concerning the manner of conducting such examinations and has confined itself to mentioning the biological examinations whereby the degree of exposure can be controlled and a check kept on the workers’ health (question 26).

The Office considered it necessary to raise the question of continued medical supervision after the worker has been reassigned from a job which entailed exposure to the risk of cancer. As already pointed out, the latent period between exposure to the risk and the appearance of a clinically detectable form of cancer can be very long. For
epidemiological reasons, to keep a long-term check on the effect of preventive measures and to allow for early action in cases where cancer is detected, the Meeting of Experts—in accordance, moreover, with modern views on medical supervision in combating occupational cancer—recommended that this supervision should be continued even after the worker has ceased to be exposed to the risk. The Office considers that such a provision is necessary to supplement the protective measures and has therefore included it in the questionnaire (question 27).

**Education**

Objective knowledge of the risks, education and training in safe working methods are essential aspects of prevention. Employers should inform themselves in detail concerning the risks of cancer connected with the substances or agents used in their undertakings and, where necessary, should instruct the workers exposed to these risks as to the measures to be applied in order to avoid them (questions 29 and 30).

**Special Problems**

As is customary, the last part of the questionnaire relates to difficulties that might arise in applying the proposed instrument because of particularities in the law and practice of member States (question 32).
QUESTIONNAIRE

In accordance with article 39 of the Standing Orders of the International Labour Conference, governments are requested to send their replies to the following questionnaire, indicating their reasons for each reply, so as to reach the International Labour Office in Geneva by 30 September 1972 at the latest.¹

I. Form of the International Instrument

1. Do you consider that the International Labour Conference should adopt an international instrument concerning the prevention of hazards caused by carcinogenic substances or agents?

2. If so, do you consider that the instrument should take the form of a Recommendation?

II. General Principles

3. Do you consider that national laws or regulations should provide for all recognised carcinogenic substances or agents to be replaced, to the greatest extent possible, by less harmful substances or agents?

4. Do you consider that employers should strive to reduce, to the greatest extent possible, both the number of persons exposed to carcinogenic substances or agents and the duration of such exposure?

5. Do you consider that employers should take all appropriate measures to reduce as far as possible the levels of exposure to carcinogenic hazards and that they should make arrangements for the systematic supervision of concentrations of carcinogenic substances or agents in the working environment?

6. Do you consider that the instrument should make provision for the competent national authority to prescribe, by means of regulations, the measures that should be taken to protect workers against the hazards of exposure to carcinogenic substances or agents?

7. If so, do you consider that the regulations should be reviewed periodically in the light of technical progress and advances in medical knowledge, account being taken of relevant technical guidelines that might be drawn up by the ILO?

8. Have you any other suggestions to make as regards the general principles?

¹ The attention of governments is drawn to the recommendation on p. 2 of this report concerning the consultation of the most representative organisations of employers and workers.
III. Technical Measures for the Prevention of Hazards

A. SUBSTANCES AND AGENTS SUBJECT TO CONTROL

9. Do you consider that an annex to the instrument should contain a list of the carcinogenic substances and agents subject to control?

10. If so, do you consider that this list should include chromates, nickel carbonyl, asbestos, tar and mineral oils?

11. Have you any other suggestions regarding the substances and agents to be included in this list?

12. Do you consider that this list should be brought up to date periodically by a committee of experts representing all concerned?

13. Do you consider that the competent national authority should prescribe the general technical methods of prevention to be applied, the hygiene facilities to be provided and the personal protective clothing and devices to be used during the manufacture or use of substances or agents subject to control?

14. Do you consider that the competent national authority should fix the maximum permissible concentrations of the substances or agents subject to control in the atmosphere of workplaces?

15. Have you any other suggestions to make regarding the substances and agents subject to control?

B. SUBSTANCES AND AGENTS SUBJECT TO AUTHORISATION

16. Do you consider that national laws or regulations should provide that no undertaking may manufacture, use or import highly carcinogenic substances or agents without the specific authorisation of the competent national authority?

17. Do you consider that, before taking a decision in the matter, the competent national authority should secure the necessary technical advice, particularly as regards the existence of substitute products, the technical methods of prevention applied and the hygiene facilities provided as well as medical supervision during and after assignment to work with the substances or agents in question?

18. Do you consider that the substances and agents subject to authorisation should include beta-naphthylamine, benzidine, 4-aminodiphenyl and ionising radiations?

19. Do you consider that the substances and agents subject to authorisation should include other substances or agents? If so, which?

20. Do you consider that the substances and agents subject to authorisation should be listed in an annex to the instrument?

21. Do you consider that this list should be brought up to date periodically by a committee of experts representing all concerned?
22. Do you consider that the competent national authority should prescribe the technical preventive measures to be applied during the manufacture or use of substances or agents subjects to authorisation?

23. Do you consider that these measures should include the use of closed apparatus?

24. Do you consider that the work in question should, moreover, be carried out under conditions of negative pressure?

25. Have you any other suggestions to make regarding the substances and agents subject to authorisation?

IV. Medical Supervision

26. Do you consider that national laws or regulations should provide for all workers engaged in the manufacture or use of substances or agents that might involve exposure to the hazard of cancer to undergo a pre-employment medical examination and periodic examinations at suitable intervals, as well as the biological tests which may be necessary to control the degree of exposure and supervise their state of health?

27. Do you consider that national laws or regulations should provide for the continuation of the medical supervision envisaged in Question 26 even after workers are no longer assigned to the work in question?

28. Have you any other suggestions to make as regards medical supervision?

V. Education

29. Do you consider that employers should investigate, with respect to any new substance or agent introduced in the undertaking, whether it may entail carcinogenic hazards?

30. Do you consider that employers should be required to instruct their workers as to the measures to be taken to prevent contamination by substances or agents that might expose them to the hazard of cancer?

31. Have you any other suggestions to make regarding education?

VI. Special Problems

32. (1) Please indicate whether there are any particularities of national law or practice which, in your view, are liable to create difficulties in the practical application of the international instrument as conceived in this report?

(2) If so, how would you suggest that these difficulties be met?
APPENDIX

Extracts from the Report of the Meeting of Experts on Control and Prevention of Occupational Cancer

(Geneva, 10-17 January 1972)

1. Following the decision taken by the Governing Body of the ILO at its 184th Session (Geneva, November 1971), a Meeting of Experts on the Control and Prevention of Occupational Cancer was held in Geneva from 10 to 17 January 1972.

2. The agenda was as follows:
   (1) Problems relating to the definition of occupational cancer hazards.
   (2) Criteria for classifying carcinogenic substances and agents with a view to prevention.
   (3) Technical and medical control and prevention.
   (4) Other related matters.

4. Mr. Astapenko, Assistant Director-General of the ILO, opened the meeting. He recalled the work of the ILO in relation to standard setting, to research and education and in the field of technical assistance. He mentioned in particular the early concern of the Office with the subject of occupational cancer which dated back to 1921, when a report described for the first time suspicions which then existed that beta-naphthylamine and benzidine were causes of occupational cancer of the bladder, suspicions which have been shown to be well founded. Another study dealt with the role of tar by-products in epithelioma of the skin. These questions were discussed by the International Labour Conference in 1934 and in 1964 when a list of occupational compensable diseases was adopted. Mr. Astapenko referred also to the important social and economic problems that arise within the framework of modern industry when considering control of and protection against occupational risks.

6. The representative of the WHO referred to WHO activities in this field and particularly to a consultation, held in October-November 1971, which had dealt with the problems of control and early detection of cancer. Reference was also made to a report by a WHO expert committee on the Prevention of Cancer in 1964 which contains useful information. The representative of the International Agency for Research on Cancer (IARC) referred to the IARC programme on the evaluation of carcinogenic risk of chemicals to men, the objective of which is to achieve a balanced evaluation of data through the deliberations of an international group of experts on chemical carcinogens. The Agency, with the help of experts, prepares monographs on individual chemicals, summarising the evidence for their carcinogenicity in a condensed uniform manner for easy comparison. These data are compiled, reviewed and evaluated by a working group of experts and re-evaluation takes place as appropriate information becomes available. The monographs are distributed to international and governmental agencies and will be available to industries and scientists dealing with these chemicals. They will form the basis of advice from IARC on occupational carcinogenesis from these substances.

---

7. The subject of cancer in general was recognised as one of the most important public health priorities. The disease is widespread throughout the world, takes many different forms, affects various organs and tissues and in the majority of countries takes second place only to cardio-vascular diseases as a cause of death. While in some cases there is a recognised or suspected cause, in most cases the precise cause is still unknown.

8. In recent years improved methods of investigation have led to the recognition of an increasing number of agents and occupations involving a cancer risk. Many important and complex factors have been recognised, including:
   — the wide variety of chemical and physical agents incriminated;
   — the different routes of entry into the body according to the physical and chemical properties of the agents;
   — the long latent period between exposure and the appearance of the disease;
   — the cumulative effect of repeated exposures;
   — the processes involved in absorption, metabolism and excretion;
   — the fact that certain agents tend to affect particular target organs or tissues;
   — the role of individual susceptibility in carcinogenesis;
   — the synergistic or inhibitory effects of simultaneous or successive exposures to other carcinogenic or non-carcinogenic agents.

9. Cancer-producing agents are not only diverse in nature but widespread in their occurrence. Atmospheric pollutants are in some cases carcinogenic, while the evidence of the role of cigarette smoking as a cause of cancer of the lung continues to accumulate throughout the world and the combustion of other organic materials gives rise in some cases to carcinogenic substances. Many materials in common use contain carcinogens. Even excessive exposure to sunlight can constitute a risk. The occurrence of carcinogenic impurities in products not generally considered to be carcinogenic raises the question of the dose-response relationship in carcinogenesis, which required additional expert deliberation.

10. The chain of biological events leading to the ultimate development of cancer is still imperfectly understood, but there is probably a period of biochemical change followed by morphological effect at the level of the cell. This results in tissue changes which may be visible by microscopy and, finally, in the clinical manifestations of cancer. All of these processes take time and, as with biological data in general, the laws of probability apply at every stage. Even when the cancer is clearly recognisable, those cases with a putative cause are not yet distinguishable microscopically from those where there is no known cause.

11. Cancer as an occupational hazard has been recognised since 1775, when the first observation was made of an undue incidence of cancer of the scrotum in chimney sweeps. Since that time, experience has incriminated many industrial agents including ionising radiations. In view of the circumstances relating to cancer in general, however, the attribution of cases of cancer to a particular occupation presents a number of difficulties. On the one hand, the occupational origin of some cases of cancer may not be recognised for lack of sufficient epidemiological information, while on the other, cases may be wrongly ascribed to an occupational exposure. The usual sequence of events in the recognition of occupational cancer is the detection of a group of cases in a particular industry leading to suspicion on the part of a doctor who then makes epidemiological investigations. These may point to a particular process, from which the related occupational exposures can be submitted to animal experiment to identify the agent responsible. Only at this stage can the most effective methods of prevention be applied.

12. A complicating factor is the long latent period between exposure to the offending agent or process and the development of cancer. Several decades may elapse between the last exposure to a carcinogen and the development of the tumour. During this period the
worker may have had many different jobs and a wide variety of occupational and non-
occupational exposures. It is not surprising therefore that there is still a great deal of un-
certainty and many gaps in current knowledge which only time will remove.

13. Improvements and developments in animal experimentation have now reached the
stage when a suspicion of human carcinogenesis may arise as a result of such experiments.
They may also constitute an early warning sign. Caution is necessary in interpreting the
findings, as there are sometimes differences in effects as between animals and man and be-
tween different species of animals. Such evidence is therefore not necessarily a basis for the
recommendation of strict precautionary measures. In some instances it is possible to resolve
the anomalies and give more weight to the positive results by comparative studies on the
metabolism of the substances. On the other hand there are obvious dangers in waiting for
human evidence, since in view of the latent period, this involves an unknown legacy of cases
of the disease. It was generally agreed that, whilst accepting the doubts, uncertainties and
gaps in present knowledge, every effort should be made through scientific observation,
experiment and deduction to develop an early warning system for human carcinogenesis
and to take the measures most appropriate to each particular substance or process, bearing
in mind the relative social utility of certain substances and agents which carry some degree
of cancer risk.

14. Occupational cancer has a number of features in common with other hazards to
industrial populations such as chemical intoxication, mental disorder, infections, accidents
and cardio-vascular disease. Several different factors may be involved; the effects may not
be apparent until the cause has been operating for a long time; individual sensitivity and
biochemical individuality play a part; over-all, the laws of probability exercise their role
in the apparently random choice of victim.

15. With special reference to the function of the ILO, it was stressed that its mandate
for advising about the protection of workers against occupational hazards clearly includes
protection against the serious risks arising from the widespread production and use of
carcinogenic substances. The report of this meeting would be considered in connection
with the possible formulation of international instruments by the International Labour
Conference.

CRITERIA FOR CLASSIFYING CARCINOGENIC SUBSTANCES AND AGENTS
WITH A VIEW TO PREVENTION

16. There was unanimous agreement on the need for a classification, but considerable
discussion on the criteria upon which it could be effectively based. The objective is clearly
that of prevention, but the same measures are not necessarily effective against all carcino-
gens and different standards and methods of protection may apply to different members of
the same group of chemical substances. Carcinogens enter the body in several different ways
and the prevention of cancer depends not only on the biological activity of a particular
agent, but on its physical and chemical properties, its physical state, and the circumstances
of its use. For some carcinogens there are effective substitutes; for others there are none
and a socially acceptable risk may have to be taken in such cases. In a dynamic situation of
improved conditions and new methods of investigation no list of carcinogens could ever be
complete.

17. The evidence for a risk of occupational cancer is of several different kinds. For
example, certain defined chemical substances, including some of the aromatic amines, have
been shown to cause bladder cancer in man. Cases of cancer of the skin have also been
reported in the handling of mineral oils, tars and pitch. These mixtures contain polycyclic
aromatic hydrocarbons, a large group of chemicals of which certain members have been
shown to cause cancer in experimental animals. Asbestos in several of its forms has been
shown to cause lung cancer in man. Other groups of cases have been reported from a variety
of industries. In these cases only the fact of an increased incidence of cancer is known. The
precise agent or its mode of action have not yet been identified.

18. Human cases have also been reported following contact with a number of substances
where the epidemiological evidence is as yet inadequate to establish the relationship with
any certainty. Nevertheless, this group of substances is under suspicion as a cause of human cancer.

19. The greatest volume of evidence of carcinogenicity has come from animal experiments and many chemicals have been tested, including food additives, pesticides, and industrial chemicals. The first evidence of carcinogenic risk to men from exposures to chemical or physical agents arose from epidemiological observations, and subsequently those agents were shown experimentally to be carcinogenic, at least in some species of animals. This substantiates the weight to be given to positive results of experiments in animals of agents for which no human data are available. With many compounds carcinogenic activity has been clearly demonstrated by such experiments, yet there has been no evidence that their use in industry has led to an incidence of cancer greater than that occurring in the general population. Problems arise in the extrapolation of laboratory data on industrial exposure, because of variations in response in different animal species and in man, in respect of both tumour induction and the target organ. The problem is enhanced in so far as in most experiments it has not been possible to replicate industrial exposure in respect of either dose level or route of entry into the body. Nevertheless, the results of animal experiments, when considered together with experience acquired in man in relation to substances belonging to a particular group, have made it possible to have suspicions that certain chemical structures and functional groups, even before they are introduced into industry, might present a carcinogenic hazard in conditions of industrial exposure.

20. The meeting felt it was worth while to make comments on some examples of recognised hazards of defined agents, mixtures and industrial operations and also on examples of potential hazards on the basis either of suspect human carcinogenesis, from case reports, or of experimental carcinogenesis in which there is only data from animal experiments. In addition it was considered useful to point to some examples of suspect chemical structures or functional groups.

**Recognised Hazards**

**Defined Agents**

21. There is a long history, dating back to 1895, of cases of bladder cancer in the manufacture of dyestuffs. These were originally attributed to aniline, but subsequent investigation showed that the main substances responsible for the disease in this industry were beta-naphthylamine and benzidine. A related substance, 4-aminodiphenyl, had also been shown to produce bladder cancer in man.

22. Human cancer from exposure to ionising radiations has been known for an equally long time. Cases of skin cancer were described shortly after the discovery of X-rays by Röntgen in 1895, while cancer of the bones was noted in women exposed to radioactive substances in the luminising of instruments during the early 1920s. These two types of cancer hazard are still recognised in radiation workers. A number of cases of lung cancer occurred among workers in the mining and milling of radioactive ores. The responsible agents are radon and radioactive dust. Penetrating radiation external to the body can produce cancer of the skin or other tissues, notably leukaemia, while radioactive substances taken into the body can produce a carcinogenic effect, especially bone sarcoma and leukaemia.

23. Surveys of the incidence of skin cancer in white-skinned people exposed to large amounts of solar ultraviolet radiation in tropical countries have shown a significant excess. The affected persons have usually been sailors or agricultural workers.

24. Crocidolite (blue asbestos) has been implicated as the substance mainly responsible for occupational mesothelioma of the pleura and peritoneum, a type of cancer which may occur in the absence of any other sign of asbestos damage to the lung. Other forms of asbestos (especially chrysotile and amosite) have been known for many years to produce a form of pneumoconiosis, asbestosis, but it was only later that the suspicions of its carcinogenic action on the lung were verified by epidemiological evidence. The cancer arises in the larger bronchial tubes and occurs, so far as is known, only in workers whose lungs already show signs of pneumoconiosis. The epidemiology of lung cancer has been complicated by the well-recognised carcinogenic effect on the lung of cigarette smoking, though some evidence has been produced that the effect of asbestos exposure combined with cigarette
smoking is additive if not multiplicative. Cases of lung cancer have been described in one group of workers manufacturing sulphur mustard gas.

**Mixtures**

25. After the original observation of scrotal cancer in chimney sweeps, the next group of workers shown to be exposed to the same kind of risk were mule spinners in the cotton industry. This work involved close contact with Scottish shale oil used to lubricate the mule spindles. Although this oil had been used since 1861, the medical evidence of its carcinogenic effect was not published until 1922. Meanwhile skin cancer had been detected in workers exposed to wax pressing in the shale oil industry and to coal tar, and experimental cancers had been produced in animals by painting the skin with coal tar. The processes of coal gas manufacture, tar distilling, coke ovens, and later the catalytic cracking of petroleum are recognised to produce, or involve contact with, many fractions such as creosote, anthracene oil and pitch, containing unsaturated polycyclic aromatic hydrocarbons. The processes of distillation tend to concentrate them in the higher-boiling fractions of the tar or oil.

26. A variety of tars, pitches, bitumens and asphalts are employed for road surfacing, building operations, brush making and electric accumulators. The content of polycyclic aromatic hydrocarbons in such materials may vary considerably depending on sources and methods of processing. Using modern laboratory methods it is possible to minimise the carcinogenic hazard and to establish standards.

27. Apart from shale oils, mineral oils used for lubrication did not originally arouse great suspicion, but it has been apparent for some time that the use of cutting oils, made very often from the unrefined fractions of petroleum, carries with it a risk of scrotal or other skin cancer. In the mule spinning industry in one country, special regulations were passed in 1953 by which it became obligatory to use only technical white oil, i.e. an acid-refined mineral oil with certain strict specifications, for the lubrication of mule spindles. This oil was said not to be suitable for cutting oils and it is only within the last few years that the recognition of the hazard in automatic machine operators has led to pressure for cutting oils to be made from a base of solvent-refined mineral oil. Modern cutting oil manufacturers now frequently use solvent-refined oil exclusively for this purpose, plus a variety of additives. Other industries involving exposure to mineral oils include brickmaking, the batching of jute and the shuttering of concrete. It should be noted that some of these oils now appear as aerosols and the risk may change.

28. One form of "soot" used extensively in the rubber industry and in the manufacture of printing inks is carbon black. Former methods of manufacture resulted in the presence of polycyclic aromatic hydrocarbons in the product, but modern processing by the "channel black" process does not introduce this problem. No cancer cases have been definitely attributed to carbon black exposure.

**Industrial Operations**

29. As already indicated, the observation that an undue incidence of cancers of particular sites has arisen in groups of workers engaged on particular types of work has often led, sometimes over the course of many years, to the identification of the precise aetiological agent, for example in chimney sweeps and workers engaged in the manufacture of dyestuffs. There remain however operations where unquestionably a cancer hazard has been recognised but in which the responsible agent is not know. The fact that the relevant exposure lies in the distant past adds to the difficulty of identification of the cause. The particular processes may no longer be in operation. Recognition that a risk has been present may rest solely on clinical and epidemiological observations, and confirmation by animal tests may therefore not be possible. Improvements or changes in technical processes may remove the risk despite the absence of precise knowledge of the cause.

Examples of operations that entail a risk are:

- In earlier years refining of nickel by the nickel carbonyl process was the source of cancers of the ethmoid and paranasal sinuses, and of bronchial carcinoma.
- In a similar way, the treatment of chrome ores in the production of bichromates has been associated with an increased incidence of bronchial carcinoma though the precise agent...
has not yet been identified. There has been no report of carcinogenesis attributable to the use of trivalent salts of chrome in the widespread industrial practices of chrome plating and tanning but precise information on this point is lacking.

- Mining operations sometimes involve exposure to radioactive dusts and gases. This occurs in the mining not only of uranium but also of nickel, silver, fluorspar and haematite.
- In the manufacture of isopropyl alcohol (which itself is not carcinogenic) in which exposure to the oily residues left after distillation produced tumours of the nasal cavities.
- In the dyestuffs industry, tumours of the bladder have been recorded in chemical operatives engaged in the manufacture of auramine and magenta.
- The pressing of paraffin wax from petroleum has been associated with cases of skin cancer as a result of regular and prolonged contact.
- In the rubber and culemaking industries, certain carcinogenic aromatic amines have been used as antioxidants and accelerators and cases of bladder cancer have been attributed to their use.
- The value of medical record systems was demonstrated in one hospital when a particular system was used to follow up the observation by a specialist surgeon that cancer of the nasal sinuses appeared to be occurring with unusual frequency among workers in the furniture industry. It was revealed that an excess of this tumour had arisen in workers entering the industry up to 1930, although the precise agent still remains unspecified. Other countries have also reported cases in the furniture industry.

30. There is no reason to believe that such incidents will not occur in the future. Without doubt, and especially with the development of epidemiological studies and computer-based record systems, epidemics of particular types of tumour will be discerned in particular occupational groups. Scientific advance may identify the aetiology in increasingly great proportion but, as mentioned above, the causative exposure may be lost in the mists of time.

**Potential Hazards**

**Suspect Human Carcinogens**

31. In this category those chemicals are cited for which there are case reports suggesting an association with cancer but for which no conclusive epidemiological study is available. In no instance is there clear-cut animal data. In the case of benzene there is evidence of frequent contamination of the technical product with known carcinogenic polycyclic aromatic hydrocarbons and in the case of alpha-naphthylamine, beta-naphthylamine is often present as an impurity. For inorganic arsenicals there is additional evidence of carcinogenicity from medical case reports but a number of negative animal studies are on record.

**Experimental Carcinogens**

32. It has been widely stated that current experimental methods in use in toxicology are not adequate to determine "no effect" levels of carcinogenic chemicals with confidence. This may be compared with many other forms of chemical intoxication where the purist would not accept a "no effect" level, but where practical decisions can be made with reasonable confidence. It is generally agreed that carcinogenic chemicals cannot be dealt with in a similar manner by public health authorities without particular regard to their specific usage. For example, it is broadly accepted that food additives found to be carcinogenic in animals should not be permitted at any dose; on the other hand drugs that are carcinogenic may still be used provided that a balance of benefit and risks can be evaluated. In the case of occupational hazards it is clear that total elimination from the manufacturing process, as in the instance of food additives, is not always practicable.

33. The following selective examples of compounds used or manufactured in industry have been demonstrated to be carcinogenic in animals. These compounds are listed here as examples to draw attention to potential hazards. The majority consists of compounds considered by the IARC Working Group on Monographs which have been thoroughly evaluated. A few additional compounds generally agreed to be carcinogenic are also included:

- 4,4' Methylene-bis-ortho-chloroaniline is carcinogenic in rats by oral administration;
auramine has been demonstrated to be carcinogenic in rats and mice;

ortho-tolidine in purified form is carcinogenic in rats, although an experiment using the oral route in the rat is of doubtful significance;

beryllium oxide and salts are carcinogenic in several species by various routes of administration;

propane sultone is carcinogenic in rats;

dimethylnitrosamine is carcinogenic in all species tested;

diethylnitrosamine is carcinogenic in all species tested;

nitrosomethylurea is carcinogenic in several species;

diethylstilbestrol has been demonstrated to be carcinogenic in animals and appears to be an iatrogenic carcinogen when administered to pregnant women, being associated with cancer in the female offspring;

1.2. dimethyl hydrazine (unsymmetrical) is carcinogenic in rats and mice.

Lead acetate and lead phosphate have been shown to be carcinogenic in rats and mice. The IARC group concluded that it was most unlikely to be of significance in man since acute effects in the human occurred at lower levels than in experimental animals and would preclude chronic, cumulative effects as seen in rodents.

**Suspect Chemical Structures or Functional Groups**

34. Although carcinogenicity cannot be predicted with precision from chemical structure alone, a high degree of suspicion can be engendered. A primary approach to prevention may involve the replacement of a suspect chemical structure by another prior to full development of a new product. Certain structures and functional groups such as aromatic amines and N-nitroso compounds are cited as examples because of their known activity but these are only representative of many others that must be considered. Advice to management on the carcinogenic potency of a new product for which a patent may have been taken out demands a high level of expertise on the part of the doctor working in industry. It should be added that there are certain acute biological effects that are frequently, although not always, correlated with carcinogenicity. These include the induction of blood dyscrasias, mutagenicity and cytotoxicity. The occurrence of such adverse effects should engender suspicion of carcinogenesis.

**Technical and Medical Control and Prevention**

35. The object of the discussion under this item of the agenda was to provide information for the purposes of prevention and to present general principles to assist governments in deciding upon the types of measures to be adopted to achieve control of the cancer risk. These include substitution of dangerous substances, general control of the manufacturing and use processes and the working conditions and, in particular, occupational hygiene and occupational medicine provisions along lines similar to those already adopted in many countries for the control of toxic substances. A number of administrative or organisational measures are also indicated. The methods of prevention depend on the degree of hazard involved, cancer risks varying considerably from a high probability to a remote possibility, and it is therefore essential in the case of each agent or process under consideration to have the most up-to-date information from human epidemiological or animal experimental sources in order to make an accurate assessment of the hazard. Some consideration was given to the important question of the criteria for compensation of occupational cancer, but these were considered to be outside the terms of reference of the meeting.

36. As a basis for discussion it was decided to use the same approach as applied to preventive measures in general and to adapt it to the particular problems of occupational cancer. For this purpose the following headings were considered:

— substitution of dangerous product;

— selection of workers;

— protection: at the plant level; at the personal level;

— inspection: of the process (hygiene standards); of the personnel (medical supervision);
— Cleanliness: of the process; of personnel;
— Education: of management, designers, chemists, engineers, industrial physicians, etc.; of workers;
— legislation, regulations.

Substitution of Dangerous Substances

37. The manufacture and use of carcinogenic products must be minimised. To the greatest extent possible other, less harmful products must be used instead. The question of an outright ban gave rise to a long debate between, on the one hand, those who believe that it is necessary to prohibit the manufacture of certain carcinogenic substances as has already been done in a number of countries and, on the other hand, those who disapprove of prohibition on the grounds that advances in modern technology are such that it is possible to design processes so as to provide complete protection. Much of the discussion centred on the particular difficulties of those aromatic amines which carry a risk of cancer of the bladder, especially beta-naphthylamine.

38. The “prohibitionists” argued that despite the use of the most modern plant and the most sophisticated means of protection available, it had not been found possible to eliminate the risk completely. The same technical results in the dyestuffs and rubber industries can be achieved by other substances or other chemical routes not involving exposure to the dangerous aromatic amines; the uses for which the carcinogenic aromatic amines are essential are limited; there is therefore no reason to attempt the almost prohibitively high cost of the precautions that would be necessary. The argument on the other side was that, while fully convinced of the need to prohibit exposure and therefore to have an extremely high level of precautions, it is possible with modern techniques to achieve this; and that, although the present uses are indeed limited, there may be in the future some socially desirable use which in circumstances of absolute prohibition would not be available. The opinion was expressed that to select certain aromatic amines and leave out others would presuppose a level of knowledge of relative carcinogenic potency which the experts do not have. Those who held this opinion pointed to the atomic energy industry, where a considerable risk exists which has been brought under control by the use of modern industrial methods. Equally effective techniques can be and are sometimes being used in the manufacture and use of the carcinogenic aromatic amines.

Selection of Workers

39. Participants with experience of the chemical industry, where carcinogenic aromatic amines have been or are being used, indicated the criteria used for selection of workers on these processes. In view of the toxic, as distinct from the carcinogenic, nature of many of the substances used in the chemical industry, some form of selection in terms of cleanliness, skill, carefulness and experience is necessary according to the degree of hazard. The Committee felt that these were important factors which, they recommended, should be set out in greater detail in a code of practice.

Protection

40. It was generally agreed in respect of all carcinogens that protection should be at the level of the process rather than at the level of the worker. Modern industrial technology has demonstrated how automated and remote control measures can be used to protect workers against a potentially severe hazard. Complete enclosure of the process is not always possible but much can be achieved according to the degree of hazard by using partial enclosure combined with effective ventilation. It was considered particularly important that control measures should take into account airborne and waterborne effluents and that precautions should be taken to avoid contamination of the general environment. Where possible, the locations of manufacture and use of a carcinogenic chemical should be in immediate proximity, to facilitate transfer by pipeline, thereby eliminating exposures during packing and subsequent recharging.

41. Nevertheless, and especially in the case of maintenance workers, some form of personal protection is frequently necessary. This may involve complete personal protection,
including arrangements for an independent air supply, as in atomic energy factories, and involving strict decontamination procedures after exposure. At the other end of the scale, personal protection may be limited to the avoidance of skin contamination and the provision of washing facilities such as showers at the end of the working spell.

42. The suggestion was made that one form of personal protection might be to rotate workers on hazardous processes but this was universally condemned. As small a number as possible should be employed in contact with potential carcinogens. The names of such workers, their medical records and the nature of their work should be recorded so that they can be kept under supervision even after they have left the plant and to enable the records of their employment to be used for subsequent clinical supervision and epidemiological purposes. These records should be kept for a sufficiently long period of time and medical confidence should be carefully observed.

43. Special attention should be paid not only to persons working in the process, but also to storekeepers, tanker drivers, analytical chemists, effluent tank attendants, bricklayers, vat builders, demolition workers, filter operators and any person who might come into contact with contaminated material. In certain cases, workers employed on other tasks in adjacent locations who may be exposed to environmental contamination must receive the same protection and be subject to the same supervision procedures as workers directly performing potentially hazardous operations.

_Inspection_

44. There are two aspects of inspection, one concerning the process and the other the personnel. So far as the process is concerned, this is the domain of the occupational hygienists who can make an assessment of the atmospheric contamination. A number of difficulties are, however, apparent in this approach. In the first place, no permissible atmospheric limits for carcinogens as such have been established; the figures for known or suspected carcinogens such as asbestos, beryllium, nickel carbonyl and ionising radiations have been based on their fibrogenic properties or their chemical toxicity or mutagenic action. Secondly, environmental measurements, unless personal samplers are used, give a measurement of the situation at one point in time and space and thus are not necessarily representative of the true exposure, though the experienced occupational hygienist can overcome this difficulty and make a valid assessment of the hazard. Thirdly, there are other routes of entry including absorption through the skin, although the problems of devising effective direct measurements of skin absorption are still not fully resolved.

45. Consequently, with certain chemicals there is some value in using the worker as his own indicator. Some substances are excreted in the faeces or the exhaled air, where they can be measured. The urine can be a useful guide to levels of absorption by any route as in the case of exposure to benzene, where urinary phenol is a good guide, or in the case of aromatic amines where analytical and, particularly, chromatographic methods give a useful indication of absorption. A number of practical analytical problems arise in dealing with samples for investigation and in tracing the metabolites of carcinogens.

46. There is still a great lack of information concerning the relationship between environmental exposure and the risk of cancer, due to the technical difficulties of assessing the environment. Reference was made to the studies on asbestos currently in progress which are attempting to establish the relationship between asbestos and lung cancer by measuring present levels of asbestos in the environment and following the subsequent history of the workers concerned.

47. The inspection of personnel concerns not only the examinations mentioned above, but also a number of additional tests for the purposes of early diagnosis. The earlier cancer is detected, the more effective is treatment likely to be. On the skin an early cancer is clearly visible or palpable and so the possibilities of cure are greater. Nevertheless, as skin cancer often occurs on the scrotum, measures have to be taken to inform the worker about the nature of the earliest signs so that he can report immediately. Effective protection in high risk groups is best achieved by self-examination and reporting combined with routine medical examination.
48. Exfoliative cytology as a diagnostic technique is being increasingly used for the detection of early cancers. At a stage before the patient has any symptoms, cells shed from the surface of the tumour in the lung or bladder can be detected in the sputum or the urine. The technique has been refined to reduce the number of false positives and false negatives. It represents a useful procedure for regular screening of workers for cancer.

49. Radiography of the chest is a common screening procedure which often reveals cases of lung cancer. Unfortunately by the time the tumour is visible by this method the chances of survival are often diminished.

50. Cystoscopy is necessary for those cases in which exfoliative cytology is positive or where there are suggestive clinical signs, and is also being used in routine examinations. For obvious reasons this procedure is not popular, but it is possible in the right circumstances to make it successful. Reference was also made to new methods of urine examination which may eventually offer further possibilities of early detection.

Cleanliness

51. The cleanliness of the plant is an essential part of protection. The process has to be designed in such a way as to prevent contamination and this may involve special arrangements for transport, delivery and for the control of effluents. Preventive measures may have to be of a highly sophisticated nature. The construction of the plant may have to avoid the use of wood to prevent impregnation; impermeable and durable floors are often necessary. Special attention has to be devoted to problems of ventilation, build-up of material in pipes and trunking, process sampling, and in some cases it is necessary to design the process so that the material is manipulated in slurry form rather than as a dry powder. A particular point which is often forgotten is that contaminated components of the plant should not be sent to repair shops unless special instructions for decontamination are given.

52. Personal cleanliness has to be of a very high order. This concerns not only the washing facilities available to the worker, but also the provision and maintenance of protective clothing. This has to be of the right materials and it is necessary to give thought to the desirability of having special laundry facilities at the plant in order to prevent contamination elsewhere. At the same time, the point was made that in special circumstances in modern chemical factories, the worker is remote from contact with the materials and may not require special protection. In the case of the maintenance worker, however, the utmost care may be necessary depending on the nature of the potential exposure. Disposable garments offer a convenient answer in some instances.

Education

53. Education of all persons concerned—employers, chemists, chemical engineers, designers, architects, workers and doctors—is of paramount importance. It is necessary to have the best possible exchange of information at all levels from the factory floor right up to the international level. Manufacturers have a special responsibility to inform the users of their products about any possible carcinogenic effect, while manufacturers and users have a responsibility to inform workers.

54. This led to a discussion on labelling. It was recalled that the ILO, the Council of Europe and the United Nations had adopted a system of international symbols and the question was raised about the desirability of a symbol for cancer. While it would be easy to design such a symbol, it was considered unwise to attempt this type of labelling. The risk of cancer from any product is relative, and the tragic aura surrounding the word cancer makes it a highly emotional subject for the average individual. Moreover, it is not possible to label many carcinogens such as tar, pitch and oil. It was suggested that, from the point of view of labelling, carcinogens should be included in the "toxic" category. The label should specify the name of the agent or active principle and indicate briefly, as in the directive adopted by the Council of Europe, the appropriate measures of individual or group protection.
Legislation, Regulations

55. The Meeting recognised the difficulties of drawing up legislation on a subject like occupational cancer where there are not only gaps in our knowledge but constant changes. On the one hand, general legislation might be too vague, while on the other, specific regulations might be too rigid. The ideal, difficult to achieve, is that it should be at the same time adequate and flexible. The best that could be done was to give general guidelines to the ILO for the development of international instruments.

56. After considerable discussion, it was agreed that certain chemicals and industrial processes constitute such a hazard that they should be permitted only under licence by the competent authority, whose decision to grant or withhold a licence should be made only after careful consideration both of the possibilities of substitution and of the adequacy of the protective measures. Such situations may arise either in respect of hazards clearly recognised because of actual industrial experience, or potential hazards suspect on the basis of experimental data suggesting a high degree of risk. Where the hazard is less serious, it may be sufficient to require preventive measures and medical supervision. Each case should be considered on its own merits. Additional measures to be taken include further study to establish standards of permissible atmospheric limits, permissible limits of carcinogenic impurities in compounds not themselves carcinogenic, and specifications for particular products such as mineral oils. The Meeting was fully aware that such regulations would necessitate continued supervision and administration by appropriate authorities provided with all necessary technical advice.

57. In this connection the participants felt that a number of examples would serve to illustrate the degrees of stringency of precautionary measures applicable to the various types of risk. In so far as recognised hazards are concerned, the principle of licensing, as appropriate to the most severe risks, was recommended. Examples of agents within this category were ionising radiations, beta-naphthylamine, benzidine, 4-aminodiphenyl and nickel carbonyl. The next degree of stringency regarding implementation of special measures of prevention and surveillance was exemplified in the cases of asbestos, chromate ore refining, tars and mineral oils. The Meeting further considered a series of substances for which it would be necessary to make a provisional decision as to the degree of protective requirements to be adopted, recognising, however, that with the accumulation of further knowledge (including that from IARC monographs) periodic re-evaluation might be needed. This series might include the carcinogenic hazards to man. The Meeting recognised the difficulties in constructing the relevant administrative machinery. Codes of practice were proposed to embody the protective requirements appropriate to particular occupational exposures.

58. The Meeting considered that the regulations should aim at securing:
— the substitution, whenever possible, of any product known to be a potential carcinogen;
— the greatest possible decrease in the number of exposed persons;
— the design and construction of safe installations and their preservation in optimum working order;
— the effective reduction of personnel exposure to the lowest possible level, or its total elimination;
— the introduction of regular and systematic exposure control by methods based on environmental monitoring of workplaces and/or biological analyses of the staff;
— the introduction of early diagnosis using the most sensitive methods;
— due awareness of these hazards and of the techniques for preventing them, on the part of the staff of the undertaking (management, supervisors, operatives, plant physicians) and of the authorities responsible for decision-making in this field.

Suggestions for Further Action

59. The Meeting recognised that there is a world-wide need for adequate laboratory facilities and trained personnel to test new chemicals proposed for industrial use, and recommended that the authorities take this into consideration with a view to providing the
necessary facilities. It suggested the establishment of national cancer institutes and cancer registries and the notification of cases of occupational cancer. The follow-up of persons who have been exposed to occupational carcinogens involves considerable administrative effort on the part of employers and the competent authorities.

60. Having reviewed the main aspects of the problem of control and prevention of occupational cancer, the participants felt that some positive action should be taken by the ILO so as to contribute to a more widespread knowledge, particularly in industry, of the problems related to the prevention of occupational cancer. With these aims in view, the participants made the following recommendations.

61. Governments and industries should be provided with detailed descriptions of methods of control and prevention. These should apply to technical and industrial hygiene measures as well as to medical measures. The experts therefore recommended that the ILO should supplement the general principles which would be set out in any possible international standards by the early preparation of a code of practice or manuals.

62. These publications should also take into account the various carcinogenic agents, their mode of action, and the type of occupational exposure involved. In this respect the ILO should take advantage of the important work already carried out by IARC on the evaluation of the carcinogenic risk of chemicals to man and it was recommended that the monographs on this subject prepared by IARC with the help of experts should form the scientific basis for practical recommendations on prevention which the ILO would elaborate on individual substances. In the light of new criteria for an evaluation of the possible hazard and new data regarding individual chemicals, these recommendations should be revised periodically through close collaboration between the ILO and IARC.

63. The ILO should make every effort to collect from industry data on: (a) production and use of potential carcinogenic agents; (b) case reports, if any.

64. The ILO in co-operation with WHO and IARC should also assist in planning and organising epidemiological inquiries in different industries with a view especially to elucidating the problem of suspect hazards. Such research work, carried out on a world-wide scale, with carefully planned and standardised methods of recording and evaluation, would give valuable results and represents a fundamental contribution to a better knowledge of the problems of occupational cancer. The participants recognised, moreover, that through its tripartite structure, the ILO was in a particularly good position to ensure the active co-operation of employers and workers in carrying out epidemiological studies at the plant level. Such inquiries, if made under the aegis of an international organisation such as the ILO, would ensure that the collected data were properly used and that anonymity regarding personal and industrial information was preserved.

65. It is recommended that an additional expert committee be convened jointly with WHO and IARC in order to consider the problem of dose-response relationships.

66. The experts agreed that a special effort should be made to intensify the collection and dissemination of information on methods of prevention of occupational cancer within the appropriate sectors of all branches of economic activity. They noted the various modes of action used by the ILO, and in particular the activity of the International Information Centre on Occupational Safety and Health (CIS). They recommended that the ILO should intensify its action in this field.