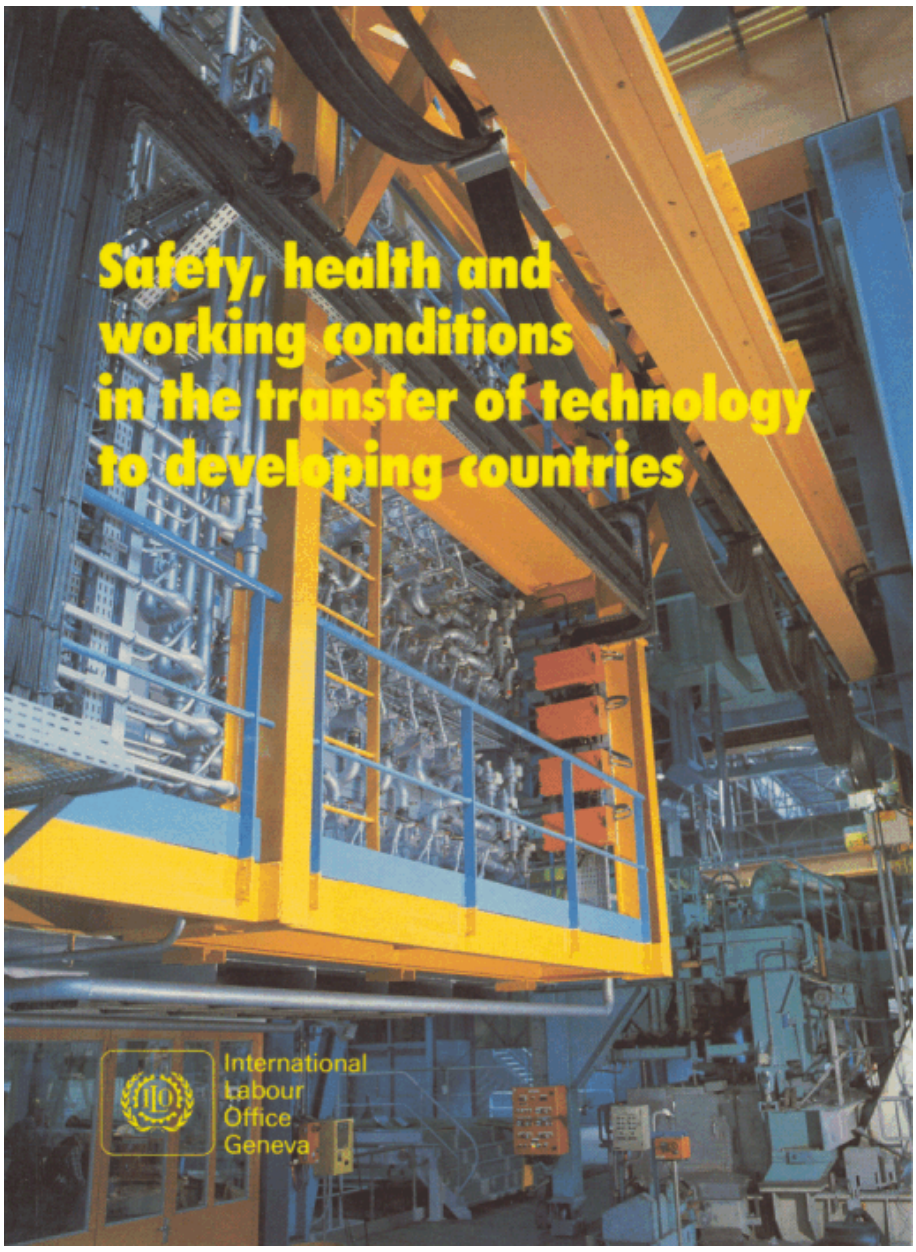
Safety, health and
working conditions
in the transfer of technology
to developing countries
International
Labour
Office
Geneva

The International Programme for the Improvement of Working Conditions and Environment (PIACT) was launched by the International Labour Organisation in 1976 at the request of the International Labour Conference and after extensive consultations with member States.

PIACT is designed to promote or support action by member States to set and attain definite objectives aiming at "making work more human". The Programme is thus concerned with improving the quality of working life in all its aspects: for example, the prevention of occupational accidents and diseases, a wider application of the principles of ergonomics, the arrangement of working time, the improvement of the content and organisation of work and of conditions of work in general, a greater concern for the human element in the transfer of technology. To achieve these aims, PIACT makes use of and co-ordinates the traditional means of ILO action, including:

- the preparation and revision of international labour standards;
- operational activities, including the dispatch of multidisciplinary teams to assist member States on request;
- tripartite meetings between representatives of governments, employers and workers, including industrial committees to study the problems facing major industries, regional meetings and meetings of experts;
- action-oriented studies and research; and
- clearing-house activities, especially through the International Occupational Safety and Health Information Centre (CIS) and the Clearing- house for the Dissemination of Information on Conditions of Work.

This publication is the outcome of a PIACT project.

Cover photograph: Len Sirman Press, Geneva.

Safety, health and working conditions in the transfer of technology to developing countries

An ILO code of practice

Safety, health and working conditions in the transfer of technology to developing countries

International Labour Office Geneva

ISBN 92-2-106122-1

First published 1988

Published in French under the title:
Sécurité, santé et conditions de travail dans les transferts de technologie aux pays en développement (ISBN 92-2-206122-5)

Also published in Spanish under the title:
Seguridad, salud y condiciones de trabajo en la transferencia de tecnología a los países en desarrollo (ISBN 92-2-306122-9)

Printed in Switzerland IRL

Preface

The transfer of technology has throughout history been essential to economic development and the improvement of social conditions. Today there is a constant flow of machinery, chemicals and processes from developed to developing countries. However, this is now accompanied by a concern not to limit the transfer to knowledge about how the machinery, chemicals or processes function but to extend it to knowledge about the effect such machinery, chemicals or processes may have upon the safety and health and the working life of those who operate or work with them.

The ILO has initiated various activities in this field, including an Inter-regional Tripartite Symposium on Occupational Safety, Health and Working Conditions and the Transfer of Technology in 1981. One of the main conclusions of this Symposium was that the ILO should take a leading role in producing a code of practice on occupational safety and health and working conditions in the transfer of technology to developing countries. A tripartite meeting of experts[1] convened in October 1986, following a

[1] The following experts took part in the meeting:

Experts appointed after consultation with governments:

Mr. J. I. Nkurlu, Acting Labour Commissioner, Ministry of Labour and Manpower Development, Dar es Salaam (United Republic of Tanzania).

Mr. J. Santos Reis, Assistant to the superintendent of FUNDACENTRO, Engineer in Occupational Health and Safety, FUNDACENTRO, São Paulo (Brazil).

Mr. A. Schulte, Head, Federal Ministry for Labour and Social Affairs, Bonn (Federal Republic of Germany).

Dr. S. Shahab, Head, Sub-Directorate of Occupational Health, Department of Manpower, Jakarta (Indonesia).

Mr. J. Sircz, Director, National Occupational Safety Training Centre, Budapest (Hungary).

Experts appointed after consultation with Employers:

Dr. A. O. Alakija, Occupational Physician, Shell Petroleum Development Company of Nigeria Ltd., Lagos (Nigeria).

Dr. Kyu Sang Cho, Catholic Medical College, Seoul (Republic of Korea).

Mr. J. Tainguy, Chief Engineer, Chief of General Equipment Department, Chantiers du Nord et de la Méditerranée, Etablissement la Ciotat (France).

Mr. A. Thomas, Health and Safety Officer, Air Mauritius Ltd., Phoenix (Mauritius).

Experts appointed after consultation with Workers:

Mr. C. Campos, Chief of Department of Work Safety, Social Security and Labour Affairs, Workers' Centre, Havana (Cuba).

Mr. S. Hisamura, General Secretary, Japanese Affiliates of the International Federation of Chemical, Energy and General Workers' Unions (ICEF-JAF), Tokyo (Japan).

Dr. A. Khalef, Health and Safety Expert, General Union of Algerian Workers, Algiers (Algeria).

Mr. J. Mathews, General Secretary, Chemical Workers' Union of Malaya, Petaling Jaya (Malaysia).

Mr. M. Wright, United Steelworkers of America, Pittsburgh (United States).

The following international governmental and non-governmental organisations were represented:

World Health Organization.
International Electrotechnical Commission.
International Organization for Standardization.
International Social Security Association.
Arab Labour Organisation.
International Organisation of Employers.

decision by the Governing Body of the ILO at its 231st Session (November 1985), finalised and adopted this code based upon a draft prepared by the Office.

The practical recommendations of this code of practice are intended for the use of all those, in both the public and the private sectors, who have responsibility for safety and health hazards arising from the transfer of technology. The code is not intended to replace national laws or regulations, or accepted standards. It has been drawn up with the object of providing guidance to those who may be engaged in the framing of provisions relating to safety and health in the transfer of technology: public authorities; enterprise committees or management; government ministries directly and indirectly concerned with the transfer of technology (notably ministries of labour, industry, health, energy, public works, construction, agriculture and economics); and research and standard-setting institutes. The code should also offer guide-lines to manufacturers, exporters and importers of all forms of technology, and to employers' and workers' organisations.

The text of the code was approved for publication by the Governing Body of the ILO at its 235th Session (February-March 1987).

European Council of Chemical Manufacturers' Federations.
International Confederation of Free Trade Unions.
World Federation of Trade Unions.
International Federation of Chemical, Energy and General Workers' Unions.

Contents

1. General provisions

1.1. Objectives

1.1.1. The objectives of this code are –

(a) to ensure the appropriate design, proper installation and safe operation and use of new equipment, processes, projects and related products being transferred to developing countries;

(b) to provide the means of analysing, from the standpoint of safety and health and conditions of work, existing technologies imported by developing countries and of modifying them to remove the hazards discovered by the analyses;

(c) to provide guidance in the setting up of administrative, legal and educational frameworks within which preventive and remedial measures can be implemented.

1.1.2. This code covers the following matters:

(a) the explanation of ways of dealing with safety and health problems associated with the transfer of technology;

(b) the promotion of the principles of safety and health in the transfer of technology through the creation of awareness among all concerned, by training, among other things.

1.2. Application and uses

1.2.1. This code addresses the safety and health aspects of the transfer of technology and calls for attention to be paid to them by –

(a) technology designers;

(b) technology exporters;

(c) technology importers;

(d) technology licensors;

(e) the competent authorities with responsibility for safety and health and working conditions with regard to imported technology;

(f) the contractors and subcontractors involved in installing and operating the technology;

(g) technology users.

1.2.2. The methods of transferring technology covered by this code include the following:

(a) the use of the services of experts;

(b) the supply of machinery and equipment directly or under a contract which provides for the transfer of the technology, as well as the machinery and equipment;

(c) the acquisition of a technology through a licence agreement so that patented technology is made available to the developing country;

(d) the use of turnkey contractors to set up the plant and put it into operation;

(e) the direct import of technologies by foreign companies.

1.3. Definitions

1.3.1. In this code, the following terms have the meanings hereby assigned to them:

(a) *code of practice:* a document offering practical guidance on the policy and standard setting in occupational safety and health for use by governments, employers and workers in order to promote safety and health at the national level and at the level of the enterprise. A code of practice is not necessarily a substitute for existing national legislation, regulations and safety standards;

(b) *licence*: the consent given by the owner of an exclusive right (licensor) to another person (licensee) to perform certain acts which are covered by an exclusive right, or consent to the use of know-how;

(c) *licence agreement:* the contract under which a licensor grants a licence to a licensee;

(d) *major hazard installation:* any industrial activity which stores, processes or produces dangerous substances in such a form and such a quantity that they possess the potential to cause extensive damage and to kill or injure persons within or outside the industrial site;

(e) *patent:* an exclusive right, granted under the law, relating to the exploitation of a technical invention;

(f) *process package transfer:* the transfer of systems, with one or more major innovations, requiring the services of a firm to put the process together;

(g) *project package transfer:* the contractual transfer of technology in which the technology is obtained from a firm which uses it in its own production;

(h) *safety and health infrastructure:* a country's resources in manpower, technical and institutional facilities, and administrative machinery that can be used to implement and promote sound occupational safety and health practices;

(i) *safety audit:* a methodical, in-depth examination of an organisation, performed by one or more trained persons, using a predetermined check-list of items that reflect good safety practice to provide the basis for management decisions affecting the organisation's safety programme;

(j) *standard:* a technical specification or other document available to the public, based on the consolidated results of science, technology and experience, aimed at the promotion of optimum community benefits and approved by a standardising body recognised at the national, regional or international level;

(k) *technology:* the sum of knowledge, experience and skills necessary for manufacturing a product or performing a task and for establishing an enterprise for this purpose;

(l) *trade mark:* a conspicuous sign, protected by an exclusive right granted under the law, which serves to distinguish goods of one enterprise from those of others;

(m) *transfer of technology:* the export of technologies from one country to another in various forms, including the building of complete factories and plants, the import

of equipment and software, the financing of major industrialisation or infrastructural projects, the provision of foreign experts as consultants and the training of local personnel.

1.4. Basic principles

1.4.1. Along with the technology, the technology-exporting country should furnish all standards, national regulations and legal requirements, and other relevant information pertaining to the operation and development of the technology in question and the purpose for which it is used.

1.4.2. In addition to this information, the technology-receiving country should compile from other sources all available information on safety and health with respect to the proposed technology.

1.4.3. The information and data thus collected should be used by the technology-receiving country to enable the competent authorities to judge the safety and suitability of such technology.

1.4.4. The information and data related to safety and health compiled by the technology-receiving country should be made public so as to enable all concerned, such as industry, commerce and the national authorities as well as workers' organisations, to deal expeditiously with initial proposals to set up certain processes or make other forms of technology transfer.

1.4.5. The technology-exporting country should not export technology involving processes, equipment or substances which are prohibited in its own territory because of their potential to cause serious risk to safety and health.

1.4.6. Imported technology should be subject to safety and health standards, regulations, practices or guide-lines that are no less stringent than those applied to the same technology in the exporting country.

1.4.7. Technology-receiving countries should recognise the need to accept technologies adapted with due regard for the workers' safety, health and well-being. Although such technologies are sometimes more expensive initially, they can be beneficial or profitable in the long run.

2. Factors to consider in the transfer of technology

2.1. General

2.1.1. For the technology to be transferred safely, any appropriate or necessary adaptations should be made to the original technology to ensure that the processes, plants and equipment take adequate account of the differences between the receiving country and the supplying country.

2.1.2. Technology should not be selected for transfer on purely economic or technical criteria.

2.1.3. Technology should be transferred only after careful consideration of all factors affecting occupational safety and health and working conditions.

2.1.4. The proper use and safe operation of the processes, plants and equipment by the technology-receiving country should be ensured through appropriate training and instruction.

2.1.5. Facilities for the proper repair and maintenance of processes, plants and equipment should be available to or within the developing country.

2.2. Safety and health in the tropics and subtropics

2.2.1. When factories are built in tropical and subtropical countries, their interior design should be adapted to conditions in those countries.

2.2.2. Within the tropical and subtropical regions, importance should be given to the following:

(a) the effect of tropical heat on the skin;

(b) the acceptability of personal protective equipment and the effect of climate on the protection provided by the personal protective equipment;

(c) the effect of higher temperatures on the rate of absorption of toxic substances through the intact skin;

(d) the effect of high levels of sunlight;

(e) heat stress problems in non-acclimatised personnel, particularly when the use of personal protective equipment is necessary;

(f) the effect of climate on the stability of chemical substances;

(g) the effect of climate on equipment operation and maintenance;

(h) the effect of climate on sampling and monitoring equipment and results.

2.2.3. The combined effect of the increased respiratory rate produced by a hot climate, the absorption of chemicals owing to excessive sweating and the altered level of normal bodily functions resulting from work at high temperatures should be taken into consideration when establishing the requirements of safety and health and working conditions.

2.2.4. Parasitic, bacterial, viral, fungal and other biological hazards should be taken into consideration.

2.2.5. The occupational health implications of the physiological characteristics of workers in tropical regions should be borne in mind.

2.2.6. Occupational exposure limits that were originally developed and established in temperate climates should be applied with extreme caution in tropical countries because of the different ambient climatic conditions.

2.2.7. In tropical climates, special precautions should be taken to protect occupational safety and health monitoring and analytical instruments from damage and to ensure their proper operation and correct reading.

2.3. Ergonomic and anthropometric considerations

The design of machinery for technology transfer should incorporate ergonomic and anthropometric features appropriate to the technology-receiving countries. For details, see "Ergonomic and anthropometric considerations" (Appendix A, section A.11).

3. Decisions to be made before any transfer of technology

3.1. Suitability of a technology

3.1.1. Technology-receiving countries should decide upon and enumerate at national level those transfers of technology that are unsuitable or unacceptable (see section 1.4).

3.1.2. Technology-receiving countries should draw up lists of technologies that may be transferred subject to restrictions, such as technologies for the manufacture of certain highly toxic substances and those whose use should be restricted in the present state of the art.

3.1.3. In preparing such lists, developing countries should take note of those substances which are –

(a) prohibited or restricted in industrialised countries;

(b) the subject of elaborate and stringent safety and health precautions.

3.1.4. There should be an evaluation, case by case, of all proposed transfers of technology.

3.2. Recognition of injuries and diseases associated with a technology

Health, preventive and social insurance services in the technology-receiving country should be sufficiently developed to provide the necessary medical surveillance, treatment and compensation of occupational injuries and diseases which the use of a given technology may cause.

3.3. Choice of projects

3.3.1. Safety and health aspects should be taken into consideration in each of the following stages preceding the choice of a technology transfer project:

(a) pre-investment studies, including the preparation of a feasibility study, an environmental impact assessment and a detailed project report;

(b) a study of the process or manufacturing technology to be acquired;

(c) basic and detailed engineering studies, including the preparation of machinery specifications and studies of plant design and factory layout;

(d) the selection of equipment, plant construction, the erection and installation of machinery and plant start-up;

(e) a study of the availability and selection of personnel required by the imported technology;

(f) possible requirements for technical assistance during the post-installation period, including training programmes and various forms of management assistance.

3.3.2. The study of a technology proposed for transfer should include a consideration of alternative technologies available for the same purpose in order to select the safest.

4. Design of plant, equipment and machinery

4.1. General

4.1.1. The purchaser of a new technology should be told clearly by the supplier which safety- and health-related technical standards have been used in the design of such technology.

4.1.2. Likewise, the relevant workers' organisation should be told which safety- and health-related technical standards have been used in the design of the technology.

4.1.3. Qualified safety and health specialists from the technology-exporting or the technology-receiving country, as appropriate, should be associated with the design work of the technology.

4.2. Location of plant

4.2.1. Before a new plant or factory is built, all possible risks of the proposed location should be appraised.

4.2.1.1. The risk appraisal should examine the plans and specifications, as well as details of the hazard analysis carried out at the design stage.

4.2.1.2. The risk appraisal should be carried out by a group of specialist consultants, independent of the technology exporter, who may if necessary be brought into the technology-receiving country from outside.

4.2.2. The standards to be applied in fixing the location of the site should cover the following aspects:

(a) meteorological conditions: rain, sunshine, temperature, humidity, wind speed and direction, and smog;

(b) the size of the site;

(c) the nature of the terrain on which it is located;

(d) accessibility and mode of transport;

(e) measures for dealing with emergencies and ease of rescue operations;

(f) other related environmental factors such as proximity to residential, industrial and agricultural areas.

4.2.3. Where the site is located far from adequate housing, transportation, eating establishments or other necessary facilities, measures should be taken to ensure that workers have sufficient access to such facilities at the enterprise or in the surrounding community.

4.3. Site layout

The layout of the site should take the following aspects into consideration: size; the location of buildings and vehicle parking areas; internal roads, railways and footpaths; production units; access to work areas; storage, loading and unloading; the

location of the main hazardous work processes; noise; fire-fighting; fire escape routes; fire spread; emergency and rescue operations; passageways and gangways within buildings; maintenance space; workshop layout; storage of gas cylinders; and climatic hazards.

4.4. Hazard analyses

The design, construction and commissioning stages of a new technology should be accompanied by hazard analyses, which consist of the following phases:

(a) a preliminary study of the potential hazards inherent in the raw materials and in materials used in the process;

(b) a detailed analysis of the potential hazards of the various major components, the equipment and the piping and instrument diagram which make up the plant, using appropriate methods such as fault tree analysis or detailed failure mode and effect analysis;

(c) a check by the senior manager, in consultation with appropriate workers' representatives, prior to commissioning, that the measures arising from the previous phases have been implemented;

(d) a pre-commissioning safety inspection of the plant by design and operating staff, in consultation with appropriate workers' representatives, to check that all statutory requirements and relevant safety codes have been complied with;

(e) a final safety audit soon after the plant has been commissioned to check that its performance meets the criteria for preventing major hazards and that new hazards have not been introduced during the modifications made when the plant was commissioned. This should be followed by similar periodic safety audits.

4.5. Use of occupational safety and health check-list: Control of hazards

4.5.1. Where the transfer of technology involves principally the design and construction of a machine, process, plant or complete factory, the technology-receiving country should use a safety and health check-list as a means of ensuring that the machine, process, plant or factory it receives or designs is reasonably safe and free from hazards. A check-list should also be used when the technology involves a new chemical to be employed in an existing process.

4.5.2. In addition to the safety and health aspects of the transfer of technology appearing in ILO codes of practice and guides, this check-list should concentrate on the following aspects:

(a) the properties of substances used in the process, plant or factory;

(b) a hazard analysis of the process, plant or factory;

(c) the selection of a suitable site for the process, plant or factory;

(d) equipment;

(e) the storage and handling of dangerous substances;

(f) the handling and removal of hazardous waste products;

(g) civil engineering considerations;

(h) hazardous atmospheres;

(i) protection against fire;

(j) general emergency plan;

(k) ergonomic considerations.

4.5.3. For further details, reference should be made to the safety and health check-list given in Appendix A.

4.6. Use of technical standards

4.6.1. For protection against safety and health hazards, technology-receiving countries should use internationally recognised standards such as those of the International Organization for Standardization (ISO), especially those designed for developing countries, and the International Electrotechnical Commission (IEC).

4.6.2. Technology-receiving countries may also make use of national and industrial standards such as those formulated by the organisations listed in Appendix C.

4.6.3. Where possible, technology-receiving countries should set up their own national standards institutes. These could –

(a) modify existing standards to suit national needs;

(b) create new standards based on local experience and conditions.

4.7. Regulations

4.7.1. Any regulations adopted by the technology-receiving country should refer to one or a combination of the following:

(a) international labour Conventions and Recommendations and ILO codes of practice;

(b) national statutes, which may include legislative instruments and regulations, orders, decrees and codes;

(c) regional standards in the form of directives issued by intergovernmental agencies and organisations.

4.7.2. The adoption and use of regulatory provisions prescribing principles for the safe transfer of technology should be encouraged and advocated by employers' and workers' organisations alike.

5. Technologies requiring additional safety provisions

5.1. General

5.1.1. Apart from routine safety and health provisions, special attention needs to be paid to major hazard installations.

5.1.2. Major hazard installations possess the potential, by virtue of the nature and quantity of dangerous substances present, to cause a major accident in one of the following general categories:

(a) the release of toxic gases in tonnage quantities which are lethal or harmful at considerable distances from the point of release;

(b) the release of extremely toxic substances in kilogram quantities which are lethal or harmful at considerable distances from the point of release;

(c) the release of flammable liquids or gases in tonnage quantities which form a large cloud that in turn burns or explodes;

(d) the presence of unstable or highly reactive materials which may explode.

5.1.3. Major hazard installations should be designed and built in accordance with the following principles, which should be applied by both the technology-exporting and the technology-importing country:

(a) critical systems and equipment should be based on a fail-safe design;

(b) the plant should include back-up safety devices and systems, and should embody the concept of defence in depth;

(c) safety devices should be adequate to handle the most serious emergency that could occur;

(d) critical systems should be isolated from each other in such a way as to prevent the spread of an accident;

(e) where possible, dangerous chemical intermediates should be produced only in small quantities for immediate use, in order to avoid long-term bulk storage.

5.2. Action by the technology supplier

5.2.1. The supplier of a technology which may store, process or produce dangerous substances should indicate to the technology-receiving country whether the technology involves activities which are classified as a major hazard in the supplier's or any other country.

5.2.2. Where a technology is likely to create a major hazard, the technology supplier should provide the technology-receiving country with information on the following aspects:

(a) an identification of the dangerous substances, their hazardous properties, the quantities involved and the manner in which they are stored, processed or produced;

(b) a thorough assessment of the process in order to show –

(i) how control and containment of the dangerous substances could fail;
(ii) how accidents could occur;
(iii) the consequences of accidents;
(iv) the vulnerability of the process to abnormal external events such as floods, earthquakes, unusual climatic conditions and their effects;
(v) the measures that can be taken to counteract these potential problems;

(c) the management of the systems to prevent accidents from occurring, including –

(i) the use of design standards;
(ii) the provision of protective devices;
(iii) maintenance requirements;
(iv) inspection and testing schedules;
(v) plant modification controls;
(vi) operating procedures;
(vii) training requirements;
(viii) safeguards against deviations from the process covering chemical reactions, pressure, temperature, liquid levels, flow rates, and start-up and shut-down procedures;
(ix) joint labour-management safety and health committees;

(d) emergency planning both on and off the site, based on the consequences of possible accidents assessed under *(b)*, above, and including –

(i) procedures for raising the alarm;
(ii) personnel requirements and responsibilities for dealing with emergencies;
(iii) fire-fighting requirements and procedures;
(iv) procedures for limiting an accident and mitigating its consequences;
(v) emergency medical services and supplies;
(vi) plant shut-down procedures;
(vii) procedures for re-entering a plant where a major accident has occurred;
(viii) information for the buyer to pass on to the local authorities enabling them to devise an appropriate off-site emergency plan, with appropriate information for the surrounding population.

5.3. Action by the technology-receiving country

5.3.1. The technology-receiving country should ensure –

(a) the safe siting of a major hazard installation;

(b) the provision of appropriate safety and health regulations to ensure the safety of major hazard installations;

(c) at all times, inter-institutional (governmental and non-governmental) co-ordination for dealing with emergencies;

(d) the monitoring of compliance with the additional safety and health requirements by qualified government agencies;

(e) the establishment of joint labour-management safety and health committees.

5.3.2. In order to discharge the responsibilities mentioned in paragraph 5.3.1, the necessary safety and health infrastructure should incorporate the principles and procedures outlined in section 10.1.

6. Administrative and institutional arrangements

6.1. Legal aspects

6.1.1. The legal standards governing safety and health and working conditions to be respected in the transfer of technology should, as appropriate –

(a) be linked with existing legislation dealing with occupational safety and health; or

(b) take the form of separate regulations; and

(c) be enforced by a competent authority.

6.1.2. A licence agreement should specify whether the legal standards and regulations of the licensee's or the licensor's country are applicable to the agreement with regard to safety and health. In general, the more stringent of the two should apply.

6.1.2.1. The validity of a technology licence agreement should also be subject to approval by the competent authorities responsible for occupational safety and health in the technology-receiving country.

6.1.2.2. Licensing agreements should cover the appropriate safety and health aspects, including the training of national personnel.

6.1.2.3. Where the renewal of agreements incorporates the introduction of new techniques, such techniques should comply with all occupational safety and health rules and regulations governing the original transfer of technology, and any new measures, rules or regulations which may be necessary.

6.1.3. The granting of patents should stipulate that the technology-receiving country must be fully informed of the provisions to be observed with regard to safety and health and working conditions, and must be given any other information relevant to hazard assessment and control in the production of the patented item.

6.1.3.1. Similarly, the law relating to the granting and use of a trade mark should be such as to enable the technology-receiving country to receive all information on the safety and health and working conditions aspects of the product or process in question.

6.2. Institutional arrangements

6.2.1. Each country should establish the necessary institutional arrangements for ensuring that safety and health and working conditions are considered in the transfer of technology.

6.2.2. Such institutional arrangements should develop capabilities in the fields of safety and health and working conditions for –

(a) the intensification of the search for an appropriate technology;

(b) the development of special methods for research in safety and health;

(c) the exchange of information with other institutions;

(d) assistance in the preparation and harmonisation of national standards and regulations;

(e) the promotion of technical co-operation between industrial sectors;

(f) co-operation in developing consultancy services.

7. Training requirements

7.1. General

7.1.1. The transfer of technology should be accompanied by adequate training programmes. These should include programmes for the personnel of the competent authority with responsibility for safety and health, and for employers and workers.

7.1.2. Training programmes should be specifically adapted to the needs of the technology-receiving country, including all factors mentioned in Chapter 2.

7.2. Attitudes to risk

7.2.1. Prior to any training, efforts should be directed towards the creation of safety consciousness among management and workers in both developed and developing countries.

7.2.2. Because of their influence on attitudes to risk, cultural aspects should be recognised in their entirety and taken into account prior to training.

7.3. Training of technology users

7.3.1. Operators and other personnel involved in the new technology should be given adequate training on the safe use and handling of the technology. All other workers should be made aware of the hazards and should be trained to avoid them. Training in how to deal with emergencies should be included.

7.3.2. Training should be carried out either in the developing country or in the country of origin of the technology. In both cases such training should be done by competent trainers who are familiar not only with the technology but also with the associated factors in the receiving country.

7.3.3. Technology training should be linked to the capabilities of local industry, universities and research and standard-setting institutes.

7.3.4. Suitable training and education should be aimed at increasing the ability of local technicians to develop appropriate technologies and to adapt imported ones for further use in the developing country.

7.3.5. Training should be provided for trainers in order to achieve the required level of expertise and maintain the continuity of training.

7.3.6. Additional specialised training should be provided for members of joint safety and health committees.

7.3.7. All training of workers within enterprises should be at no cost to the workers.

7.4. Training of technology designers

7.4.1. Training programmes for the professional and technical designers of factories, machinery and equipment should be developed and implemented so as to incorporate appropriate occupational safety and health features.

7.4.2. Training programmes for industrial designers should bear in mind all the characteristics of technology-receiving countries that may influence design, in particular climatic conditions.

7.4.3. The training of engineering students from developing countries who study at universities and colleges in industrialised countries should emphasise the adaptation of technology to local conditions. To promote this training, developing countries should be given the chance to contribute to the curricula of universities and colleges in industrialised countries.

7.4.4. An understanding of the problems related to the transfer of technology should be promoted by means of training material and special publications, and other measures such as courses, discussions and seminars. These promotional efforts should be directed at policy-makers, industrial planners, management in private and public enterprises, supervisors and foremen, workers and trade union officials, the staff of labour, medical and factory inspectorates, occupational hygienists, economists, engineers, chemists, safety officers, vocational and safety trainers, and agricultural and other rural workers.

8. Collection and use of information

8.1. Provision of safety and health information by technology suppliers

8.1.1. Technology suppliers should provide, along with their technology, all available information relevant to safety and health and working conditions.

8.1.2. Information on safety and health and working conditions should undergo revision and updating, and should be immediately communicated to the authorities in the technology-receiving countries and to the users. This should be done on a periodic basis, as well as when changes are made to the technology.

8.1.3. Information on safety and health and working conditions should –

(a) be drafted in the language agreed upon by the two parties, and in a language understandable by the users of the technology;

(b) contain specific details pertaining to the safe use, handling and maintenance of the technology;

(c) take into consideration all the factors that influence the safe use, handling and maintenance of the technology in the receiving country;

(d) be supported by case studies and experience gained from the application of the technology.

8.2. Use of safety and health information by technology receivers

8.2.1. Those in receiving countries who make decisions on the selection of technology should ensure that all appropriate information is compiled with the aid of the technology supplier and is effectively used.

8.2.2. Technology receivers should be aware of, and make use of, national, regional and international standards, codes of practice and technical information pertinent to their technology.

8.2.3. Technology suppliers should be consulted prior to any modification or adaptation of the technology by the technology receiver. This should be specified in the contract between the technology supplier and the technology receiver.

8.3. Exchange of relevant safety and health information

8.3.1. A channel of communication should be established to ensure the flow of timely and complete information to those who are likely to be in need of it.

8.3.2. All available knowledge and expertise should be fully shared with non-governmental organisations such as national tripartite safety councils.

8.3.3. Multinational enterprises should make available information on –

(a) the safety and health standards which they observe in other countries and which are relevant to their local operations. In particular, they should make known to

those concerned any special hazards and related protective measures associated with new products and processes. They should co-operate in the work of international organisations concerned with the preparation and adoption of international safety and health standards;

(b) effective methods of training workers to observe proper safety and health practices and of obtaining workers' participation in the safety and health programme of the enterprise.

8.4. Exchange of safety and health information within and among developing countries

8.4.1. The exchange of safety and health information between technology-receiving countries should be encouraged to include –

(a) the experience in the field of safety and health and working conditions gained by developing countries with similar conditions;

(b) the successful adaptation, modification and handling of technology that may be useful to other countries using the same technology;

(c) the exchange of technical personnel.

8.4.2. The experience in the field of safety and health and working conditions gained from multinational and other large enterprises in a developing country should be widely disseminated and shared among smaller domestic enterprises.

8.4.3. The exchange of information on safety and health and working conditions should take place between professional associations, employers' organisations, workers' organisations and other safety and health interest groups within the country.

9. Action at the enterprise level

9.1. General

9.1.1. The establishment of a full-scale manufacturing enterprise in a developing country should pass through the phases listed under section 3.3.

9.1.2. After approval by the national authorities, action at the enterprise level should take into consideration all the safety and health and working conditions practices listed in Chapter 4, and should regard them as complementary to such action.

9.2. Pre-planning phase

The technology selected should take fully into account safety and health and working conditions aspects, with particular attention to those influenced by climatic, cultural and related factors which vary from one country to another.

9.3. Planning and design phase

9.3.1. The planning and design of new technologies should allow for future improvements and modifications that are likely to take place.

9.3.2. At the time of initial planning studies, the technology-supplying enterprise should consult the technology-receiving country in order to obtain all the necessary information needed for design, and should supply to that country information necessary for proper planning. The information obtained should be used to ensure the application of all the relevant guide-lines for the design and transfer of plant, equipment and machinery listed in Chapters 2, 3 and 4 and Appendix A of this code.

9.3.3. The planning and design phase should include the investigation of a similar existing technology for the purpose of noting –

(a) the alterations, if any, made over the course of time;

(b) the effect of the technology on the environment and the social system of the country of origin;

(c) the design, operation and status of facilities such as housing, transportation and medical services;

(d) the operation and maintenance of its technical system;

(e) any additional safety and health measures found to be required.

9.3.4. A representative from the technology-receiving country who will ultimately be involved in the operation of the plant or equipment should be present at the design stage of the technology transfer project.

9.3.5. The technology-supplying enterprise should develop, as one of the design books containing all information on the technology transferred, a safety specifications book which contains the specific information relating to the safe operation of the process and the plant.

9.3.5.1. The safety specifications book should include the details of all the hazard analyses provided by the licensor.

9.3.5.2. The technical codes and standards used during the design stage of the process and construction of the plant should be included for reference in the safety specifications book.

9.3.5.3. The occupational safety and health check-list described in Appendix A should be used and carefully examined in preparing the safety specifications book.

9.3.5.4. During the design stage of the process or plant, full hazard analyses should be carried out as a normal activity, and records of the calculations should be shown in the safety specifications book.

9.3.6. The use of company standards drawn up by multinational and large enterprises should be encouraged so as to ensure the safety and health of the worker and the community.

9.3.7. The safety specifications book should not be confused with the safety manual that may be required for the safe operation of the plant.

9.4. Acceptance and clearance of project design

Before the design is cleared, the national authorities should make their decisions in accordance with the practices mentioned in Chapter 3 of this code.

9.5. Purchase phase

The purchase phase should give full consideration to safety and health aspects.

9.6. Construction phase

9.6.1. The construction phase should comply with all the relevant construction requirements stipulated in Appendix A of this code.

9.6.2. During the construction phase, the purchaser of the technology should scrutinise the various items bought for the project to make sure that they comply with the equipment specifications.

9.6.3. Second-hand equipment, plant and machines should be accepted only if they meet standards of safety and health similar to those of new equipment, plant and machines.

9.7. Start-up personnel and technical advisers

9.7.1. The personnel selected to operate the new technology should be professionally qualified and highly motivated to work in the developing country, and should possess a sufficiently high level of understanding of the technology involved.

9.7.2. Technical advisers should be employed for periods long enough to allow for the full transfer of technology, including responsibility for its management and for safety and health and working conditions, to the local personnel.

9.7.3. The job descriptions of the technical advisers should give full details of the aspects of the work related to safety and health and working conditions, and should specify the responsibilities and powers of the advisers in these matters.

9.8. Operational safety and health policy

9.8.1. A written safety and health policy and a safety manual which highlights operation and maintenance should be formulated by top management and made available to all those within the enterprise.

9.8.2. Safety and health performance should be considered as being of the same importance and should be evaluated in the same manner as any other management responsibility.

9.8.3. It is important that this attitude should be fully appreciated and applied to new projects in developing countries from the start of their operation.

9.8.4. Safety and health matters should constitute an important concern to all, and should be reflected in –

(a) the level at which safety and health matters are reported, which should be that of the management board or its equivalent;

(b) the degree to which safety and health records are taken into account in assessing good management performance;

(c) the number and organisation of staff primarily concerned with safety and health matters;

(d) the widespread dissemination of safety and health information.

9.8.5. All operations should maintain records of workers' injuries and illnesses, as well as the exposure of workers to any chemicals and substances found in the working environment.

9.8.6. A statement on the enterprise's safety and health performance should be a part of the annual report of the enterprise.

9.8.7. The workers should be fully conversant with the emergency procedures for dealing with unexpected events or for closing down a plant or parts of it.

9.8.8. The workers should be trained and should be competent to deal adequately with emergency situations, using the established procedures.

9.8.9. A safety and health adviser should be employed by large enterprises on a full-time basis and by small enterprises, depending on their size, on a part-time basis.

9.8.9.1. As part of his or her normal duties, a safety and health adviser should facilitate rapid communication between workers, management and safety and health specialists.

9.8.9.2. Workers should be completely free to bring their safety and health concerns to the safety and health adviser without being penalised.

9.8.10. The enterprise should establish a joint safety and health committee in accordance with the provisions of paragraph 14.1.5.

9.8.10.1. The safety and health adviser should be a member of, or meet regularly with, the joint safety and health committee.

9.8.10.2. Workers should be completely free to bring their safety and health concerns to the committee without being penalised.

9.8.11. The enterprise should make every endeavour to minimise workers' exposure to all substances and contaminants whose hazards have not been evaluated and in respect of which standards for occupational exposure limits have not been established. It should maintain records of all occupational exposures, accidental or otherwise. These records should be made available to the workers personally concerned and to workers' representatives.

9.8.12. Where technology is, or has been, received in "package" form, the personnel of the technology-receiving country should be provided with all the means and information necessary to enable them to understand all safety and health and working conditions aspects of the technology being used, rather than to use it mechanically.

9.8.13. There should be proper labelling of substances used in technology transfer, in a language and a form readily understood by the workers of the technology-receiving country.

9.8.14. The labelling should show the name of the substance, the name of the manufacturer or supplier, the nature of the hazards, the precautions necessary for safe use, and information on first aid.

9.8.15. Manufacturers and suppliers of chemicals should prepare and distribute free of charge to purchasers of their products, material safety data sheets for all the products used and manufactured. These data sheets should include the following: the trade or commonly used name of the substance; the chemical names of its ingredients; the name, address and telephone number of the manufacturer or supplier; a detailed description of all hazards of the substance and the precautions necessary for its safe use; details of the necessary workplace controls and personal protective equipment; the symptoms of overexposure; and details of medical surveillance, first aid and required medical treatment. When justified, procedures may be established to prevent commercially sensitive information (limited to the chemical identity and the full composition of the substance) from being used for purposes other than safety and health.

9.8.16. Such data sheets and cards should be readily available to workers in the work areas where the substances are used and should be provided to workers' representatives on request.

9.8.17. Contractors hired to execute transfer of technology projects should adapt occupational hygiene standards to local climatic conditions in order to ensure a high level of safety and health.

9.8.18. Packaging should take into consideration the special conditions of transit to the technology-receiving country and the handling and storage conditions within that country.

9.9. Establishing the safety and health policy and programme

9.9.1. Employers should establish for their workplaces a safety and health policy, which should be made known to all levels of management and to the workers.

9.9.1.1. Employers should establish a workplace safety and health programme to carry out the policy.

9.9.1.2. The employers' safety and health programme should include the following:

(a) an occupational health service with appropriate personnel (see the Occupational Health Services Convention, 1985 (No. 161), and Recommendation, 1985 (No. 171));

(b) appropriate safety services with professional safety personnel;

(c) a plan and the personnel necessary to investigate accidents, major incidents and disasters with a view to prevention;

(d) a safety and health component in the programmes whereby workers and managers are trained in their duties and instructed in the technology they are expected to use;

(e) a plan for investigating and responding to workers' complaints;

(f) a plan to instruct all contractors working in the workplace to follow the safety and health policy and to observe the rules for the workplace laid down in the programme.

9.9.2. Employers should draft appropriate safety instructions, make such instructions available to all workers and ensure that workers are familiar with their contents through appropriate training.

9.9.2.1. These safety instructions and other notices should, as far as practicable, be in the languages of the workers employed. Wherever possible or necessary, easily comprehensible symbols should be used.

9.9.2.2. These texts should be displayed in a durable form and protected against damage from adverse environmental and workplace conditions.

9.9.3. When it is not reasonably practicable to avoid the exposure of workers to safety and health hazards by engineering or organisational measures, the employer should provide suitable personal protective equipment and maintain it in good condition. The fact that safety equipment has been introduced should not remove the need to seek measures which render its use unnecessary. Where an engineering or organisational failure might create an immediate risk, the workers should be provided with personal protective equipment.

9.9.3.1. Employers should equip employees with protective clothing to fit their physique and to suit the prevailing climatic conditions, in accordance with safety regulations and the requirements of the work.

9.9.3.2. Where working clothes become soiled during work, the employer should provide the workers with facilities for washing and for changing or washing their clothes.

9.9.3.3. Where working clothes could become contaminated with toxic materials, such clothes should be provided and laundered at the expense of the

employer, and workers should be provided with showers and separate lockers for work and street clothes in order to prevent cross-contamination.

9.9.4. In collaboration with the safety service and the health authorities, employers should identify jobs which may be assigned to disabled workers, older workers, pregnant women or young workers, in which they can work without danger.

9.9.5. The employer should consult the workers and their representatives in an appropriate manner on matters relating to the workers' safety and health and should take appropriate action on the decisions reached in such consultations.

9.9.6. Employers should co-operate in establishing joint safety and health committees, as outlined in paragraph 14.1.5.

9.9.7. The employer should provide the workers' representatives with the opportunity of accompanying government or other occupational safety and health inspectors in their inspections of occupational safety and health conditions, and of taking part in investigations into the causes of occupational accidents and diseases in accordance with national conditions and legislation, and with the provisions of Article 19 *(e)* of the Occupational Safety and Health Convention, 1981 (No. 155).

9.10. Workers' rights and responsibilities

9.10.1. Within the limits of their responsibilities, workers should do everything in their power to maintain their own safety and health and that of other workers, and in particular to observe safety and health regulations and instructions.

9.10.2. Workers should report defects without delay to a competent supervisor.

9.10.3. When a worker has reason to believe that there would be undue risk to life or health if a task assigned to him or to his fellow workers were carried out, he should report his fears immediately to his supervisor, the workers' safety representative and the competent safety and health adviser in the plant.

9.10.4. A worker who has removed himself from a work situation which he has reasonable justification to believe presents an imminent and serious danger to his life or health should be protected from undue consequences in accordance with national conditions and practice.[1]

9.10.5. No measures prejudicial to a worker should be taken by reference to the fact that, in good faith, he complained of what he considered to be a breach of statutory requirements or a serious inadequacy in the measures taken by the employer in respect of occupational safety and health and the working environment.[2]

9.10.6. Workers, including supervisors, should always make proper use of all safeguards and safety devices and other appliances made available for their protection or the protection of others, and should not interfere with, remove, alter or displace them unless authorised by the person having responsibility for safety and health.

[1] Article 13 of the Occupational Safety and Health Convention, 1981 (No. 155).

[2] Paragraph 17 of the Occupational Safety and Health Recommendation, 1981 (No. 164).

9.10.7. Workers should not interfere with equipment such as controls, machines, valves, piping, and electrical conductors and appliances which they have not been authorised to operate, maintain or use.

9.10.8. Workers should wear the protective clothing and personal protective equipment supplied to them and suited to their duties, and adapted to climatic conditions.

9.10.9. Workers should provide the management with information about their job experience so that this knowledge can be used for the improvement of safety and health conditions.

9.10.10. Workers should be encouraged to undergo medical examinations necessary for the protection of their health (see the Occupational Health Services Recommendation, 1985 (No. 171)).

9.10.11. Workers and their representatives should have access to information on materials used in the plant as outlined in paragraph 9.8.12, and the results of workplace environmental monitoring (see the Occupational Health Services Recommendation, 1985 (No. 171)).

9.10.12. Workers should have access to their own medical records.

9.11. Summary of hazard analyses

Enterprises should take appropriate measures based on the summary of hazard analyses of the process, plant or factory outlined in Appendix A, section A.2.

9.12. Requirements for subsidiaries

9.12.1. Subsidiary enterprises should have full access to all information concerning the safety and health and working conditions aspects of the main enterprise, including its decisions and practice.

9.12.2. Subsidiaries should compile information on safety and health and working conditions.

9.12.3. Subsidiaries should also possess the competence to evaluate information on safety and health and working conditions.

10. Action at the national level

10.1. Government action

10.1.1. A technology-receiving country should develop the necessary occupational safety and health infrastructure to deal adequately with all the problems related to safety and health and working conditions involved in technology transfers.

10.1.1.1. Developing countries should use existing national standards institutions to assist in aspects of the transfer of technology related to safety and health and working conditions, or should set up a national standards body for the purpose.

10.1.1.2. There should be effective means of enforcing legislation, including sufficient manpower and expertise.

10.1.1.3. The laws and regulations in the developing countries should make provisions for the use of safety and health monitoring equipment and strategies that are simple, practicable and not necessarily expensive.

10.1.2. Governments should develop the necessary capability to choose technology in such a manner as to ensure proper safety and health provisions and working conditions for the workers.

10.1.3. Inducements offered by governments to attract investment in technologies should not compromise, directly or indirectly, the safety and health and working conditions of the workers and the general public.

10.1.4. National negotiators for the transfer of technology should have received the necessary training in the requirements of safety and health and working conditions in order to ensure the inclusion of these matters in the technology transfer process.

10.1.5. Where policies for the progressive take-over of foreign enterprises by national interests are adopted by the national authorities, care should be taken to ensure that the resulting mixed or national enterprises have the full background knowledge, information, experience and competence, including staff skills, to deal with safety and health and working conditions aspects, as well as the ability to handle all emergencies.

10.1.6. ILO member States should be guided by international labour Conventions and Recommendations, in particular the Occupational Safety and Health Convention, 1981 (No. 155), in the implementation of measures to deal with the adverse safety and health effects of the transfer of technology.

10.2. Other measures

10.2.1. Consultancy services should be promoted to provide assistance within developing countries in order to –

(a) facilitate the adaptation of the borrowed technology to local conditions and its implementation, with due regard for the skilled personnel, raw materials and industrial infrastructure available;

(b) help in the establishment of competent research facilities, which should be suitably linked with research-based and specialised institutions in industrialised

countries, for the development of innovations and new techniques and the adaptation of techniques that have proved successful in the country of origin.

10.2.2. Developing countries should sponsor and encourage the publication of technical manuals and other information on the safety and health aspects of the development of technology for technology users at different levels of application.

10.2.3. The formation and development of professional organisations among the engineering and scientific community should be encouraged, and their discussions should include the safety and health aspects of the transfer of technology.

11. Action at the regional level

11.1. Technical co-operation between developing countries

11.1.1. National institutions in different countries should co-operate with each other so as to facilitate training, research and the collection and dissemination of information on safety and health and working conditions aspects of the transfer of technology.

11.1.2. Established regional technology centres should include safety, health and working conditions aspects of the transfer of technology in their programmes and activities.

11.1.3. The pooling and interchange of technical expertise at the regional level should be encouraged in order to assist in the diagnosis or identification of working conditions and environment problems associated with technology transfer and to recommend remedial or preventive measures.

12. Role of international organisations

12.1. Role of the ILO

The ILO should continue its efforts with a view to –

(a) assisting in the formulation of measures to make more readily and easily available technical information on safety, health and working conditions, as required by the actual users of technology in developing countries;

(b) participating in identifying and strengthening existing institutions dealing with safety, health and working conditions to help them to develop their capacity to cope with technology transfer;

(c) promoting the exchange of information and the development of curricula, manuals, audio-visual aids and other training materials;

(d) assisting developing countries through its technical co-operation programmes.

12.2. Role of international organisations in general

12.2.1. The work of the international organisations with regard to safety and health and working conditions should include –

(a) the provision of technical information;

(b) the maintenance of a list of suitable consultants who could be available for assistance to developing countries;

(c) advice and assistance to developing countries on problems of safety and health and working conditions;

(d) the provision of technical assistance in the development of hazard control systems.

12.2.2. International standard-setting activities such as the preparation of conventions and codes of practice should be continued, taking into consideration the implications of the transfer of technology for safety and health and working conditions.

12.2.3. Projects financed by international agencies should include safety and health and working conditions requirements in their guide-lines.

12.2.4. Co-operation should be strengthened between the various international organisations in the field of occupational safety and health in the transfer of technology.

13. Role of employers' organisations

13.1. Promotion of safety and health

13.1.1. Employers' organisations should continue to develop and promote awareness and expertise among their members in matters relating to the safety and health and working conditions of workers using transferred technology.

13.1.2. This awareness should be developed through seminars, symposia, safety campaigns and the establishment of training centres.

13.1.3. In this connection, congresses, conferences and symposia held by employers' organisations should place greater emphasis on matters of safety and health and working conditions.

14. Role of workers' organisations

14.1. Promotion of safety and health

14.1.1. Workers' organisations should continue to develop and promote awareness and expertise among their members in matters relating to the safety, health and working conditions of workers using transferred technology.

14.1.2. This awareness should be developed through seminars, symposia, safety campaigns and the establishment of training centres.

14.1.3. In this connection, congresses, conferences and symposia held by workers' organisations should place greater emphasis on matters of safety, health and working conditions.

14.1.4. Workers and their organisations should have the right –

(a) to contact the labour inspector where necessary (see the Occupational Safety and Health Recommendation, 1981 (No. 164));

(b) to exchange views with and consult workers of similar enterprises;

(c) to contact directly the supplier of the technology, if necessary.

14.1.5. Workers' organisations should co-operate in the establishment of joint safety and health committees in the enterprise in accordance with the provisions of the Occupational Safety and Health Recommendation, 1981 (No. 164).

Appendices

A. Occupational safety and health check-list for hazard control in the design and operation of a plant or process

The check-list given below is intended for the use of ILO 4member States, both as technology-exporting and technology-receiving countries. It provides detailed information on many of the practical measures having a bearing on occupational safety and health that should be taken in designing, constructing and operating a technology transfer, especially measures not covered in other ILO codes of practice (see Appendix B). This check-list covers not only large plants and processes, but will also be found applicable to many smaller installations. However, it is not exhaustive. It should therefore not be regarded as covering, in their entirety, all of the occupational safety and health matters that should be taken into account.

A.1. Properties of substances used in the process, plant or factory

A.1.1. Attention should be paid to the substances used or liable to be produced during processes.

A.1.2. Work processes should as far as possible be designed so that dangerous gases, vapours or suspended particles are not released and so that workers do not come into skin contact with hazardous solid or liquid substances or their preparations. If this is not technically possible, the substances should be collected and removed in a safe manner, or technically feasible ventilation measures should be taken.

A.1.3. Before a plant involving a chemical process is designed, consideration should be given, among other things, to the properties of –

(a) the substances to be processed or produced, as well as intermediate products and by-products;

(b) any catalysts used;

(c) substances that may be produced under abnormal process conditions.

A.1.3.1. Consideration of the chemical properties should cover –

(a) chemical reactivity such as oxidation and reduction by contact with water, air, oxygen, steam or the materials of which the plant is constructed;

(b) fire and explosion risks with reference to particle size, flashpoint, ignition temperature, explosion limits and auto-ignition of flammable materials.

A.1.3.2. Consideration of the physical properties should cover –

(a) liquids: solubility, viscosity, density, surface tension and critical temperatures;

(b) solids: particle size, minimum explosive concentration, generation of electrostatic charges, expansion coefficient and solubility in liquids;

(c) gases: density, critical temperature, generation of electrostatic charges, expansion coefficient and solubility in water and other liquids.

A.1.4. The toxicity of substances should be considered and the relevant health standards consulted.

A.1.5. Particular attention should be paid to very fine dust and to radioactivity as both are invisible to the naked eye and can cause serious damage to the body, and also to odourless and colourless gases.

A.2. Hazard analysis of the process, plant or factory

A.2.1. A full hazard analysis should be carried out as part of normal activities as the design of the plant proceeds.

A.2.2. The hazard analysis should review the major plant items and the piping and instrument diagram, and should be carried out using appropriate methods such as fault tree analysis and failure mode and effect analysis.

A.2.3. The hazard analysis should also take account of other factors, such as –

(a) climatic conditions at the place where the factory is to be erected, as these have a bearing on the release of heat and water vapour from the process;

(b) chemical reactions;

(c) normal operating conditions;

(d) abnormal and emergency operating conditions;

(e) physical, chemical, biological, physiological and psychological hazards.

A.2.4. The results of the analysis should be used to make modifications to the initial design so that the final design should work at a high level of safety.

A.2.5. The hazard investigation should ascertain whether abnormal conditions could lead to a critical situation such as a fire, an explosion, the release of toxic or other hazardous substances or of very hot or very cold substances, or the production of smoke and mist.

A.3. Selection of a suitable site for the process, plant or factory

A.3.1. Climatic factors such as rainfall, prevailing wind direction and average speed, angle of solar radiation, maximum and minimum temperatures and humidity, and seasonal variations should be taken into consideration in view of their effects on the dispersion and concentrations of volatile, flammable and toxic substances, fog formation and temperature inversion. The layout of noisy, malodorous and dirty areas should also be considered.

A.3.2. The size of the site should be large enough for a factory or plant including service buildings, stores, storage tanks, loading and unloading facilities, and car or lorry parking.

A.3.3. The site should not be subject to flooding or situated above a high or a strongly varying water table.

A.3.3.1. The soil should be firm and not subject to subsidence; it should not be acid to such an extent as to attack pipes, cables and foundations.

A.3.3.2. The site should not be located in the vicinity of geological faults or worked-out mines.

A.3.4. If internal rail transport is required, a safe link-up with the existing railway system (if any) is necessary.

A.3.4.1. If access to the site is by water, there should be safe mooring, loading and unloading facilities and enough room for the safe movement of vessels.

A.3.4.2. There should be safe supply and delivery roads for raw materials and finished products.

A.3.4.3. Safe means of access and egress for motor vehicles, bicycles and pedestrians should be provided.

A.3.4.4. The route to be followed by fire and ambulance services should be free of obstacles such as railway level crossings and swing-bridges.

A.3.5. Adequate electrical, gas, communications, water and drainage services should be made available.

A.3.6. Where an undue hazard might arise, the area adjacent to the plant should be free of –

(a) ignition sources such as open fires;

(b) overhead high-voltage electric cables;

(c) sources of vibration and loud noise;

(d) airfields.

A.3.7. Office buildings, canteens, laboratories and similar facilities should be segregated from the hazardous areas of the plant.

A.3.7.1. Buildings used for purposes not directly connected with the production process should be situated well away from the production plant.

A.3.7.2. Parking areas for bicycles, private cars, buses, lorries and road tankers should be outside the main site area and should have safe entrances and exits.

A.3.8. Large installations should be constructed with numerous points of access.

A.3.9. When the production process involves quantities of highly flammable substances, the fire-fighting arrangements will be more efficient if water or foam can be applied from several directions; this could be made possible by the construction recommended in paragraph A.3.8, above.

A.3.10. Equipment and connecting pipelines should be so located as to ensure ease of maintenance operations, including routine inspections and the replacement of relief valves.

A.3.11. Main pipelines should be in trenches or channels, with pipe bridges at the major crossings. Overhead crossings of pipes should be kept to a minimum; they should be protected and should carry cautionary signs as high vehicles and cranes could damage the pipes.

A.3.12. Equipment and parts of processes where extremely reactive substances are mixed should, as far as is reasonably practicable, be segregated from other process equipment. Account should be taken of prevailing winds in the siting of potential ignition sources such as boiler houses, switching stations and flares, in relation to plant containing flammable substances. Lightning protection should also be provided.

A.3.13. Plants handling large quantities of flammable liquids or pressurised gases which are liable to escape into the atmosphere should be located at a safe distance from sources of ignition such as open fires. Here also prevailing wind direction should be taken into account.

A.3.14. Cooling towers, which can cause mist and make the ground slippery over the surrounding area, should be so located as to cause the least possible hazard.

A.3.15. On extensive sites where large tanks are used to contain flammable, toxic or corrosive substances, these should be placed in not more than two rows to make them more accessible during maintenance, fire-fighting and rescue operations. Adequate bund-walls should also be provided.

A.3.16. Raw materials and intermediate and final products should be stored with plenty of space between them. Spacing should be planned with due regard for the flammability, toxicity and stability of the materials and the vulnerability of their packaging.

A.3.17. The position and layout of warehouses for product storage, loading facilities and weighbridges should be such as to keep to a minimum the amount of traffic moving in the area at any given time.

A.3.18. For rescue purposes, access to the site from various locations should be available in cases of emergency.

A.3.19. Mobile rescue and fire-fighting equipment should be stationed at a safe location from which it can readily be moved to any place on the site.

A.3.20. Rescue teams for dealing with serious escapes of gas should be available where required.

A.4. Equipment

A.4.1. Equipment should be designed, specified and commissioned to ensure that it complies with standards for design, choice of material, construction and installation, as well as with any other special provisions which may apply.

A.4.2. To avoid equipment failure, additional safety devices, such as relief safety valves, should be introduced.

A.4.3. Where the probability of explosion exists within a plant, the equipment should be constructed to withstand explosion pressures, or supplied with the necessary pressure relief devices such as bursting discs.

A.4.3.1. If pressure relief devices are fitted, the hazards which may arise from the operation of such devices should be taken into consideration in the location of the plant and the surrounding structures, and in the provision of ancillary equipment such as scrubbers and blow-down tanks.

A.4.3.2. When an explosive or flammable atmosphere is liable to exist, great attention should be paid to eliminating sources of ignition.

A.4.4. Where a high-pressure system is connected to a low-pressure system through a control valve or a reducing valve, or by some other means, the low-pressure system should –

(a) be able to withstand the full pressure of the high-pressure system; or

(b) be fitted with a safety device.

A.4.4.1. The hazards of a combined blow-off system where, for example, safety valves blow off into a system of lower pressure should be allowed for.

A.4.4.2. Plant should include allowance for thermal expansion and contraction arising from ambient temperature changes.

A.4.4.3. In cases where a vacuum may occur, equipment should be designed to withstand it.

A.4.5. In selecting the materials to be used for the equipment, the following factors should be taken into consideration:

(a) the maximum and minimum process temperatures, including those caused by abnormal working conditions and the weather;

(b) the maximum and minimum process pressures, including those caused by abnormal working conditions;

(c) the possibility of corrosion and erosion by the substances present in the plant;

(d) the catalytic and other chemical effects of the substance on its container, and vice versa;

(e) the presence of insulating material which might find its way into equipment.

A.4.6. During construction of the factory, plant and machinery, the following should be taken into consideration:

(a) weather effects such as lightning, wind load, sandstorms, rain and snow;

(b) earthing and bonding;

(c) stresses arising from expansion and contraction, and from the weight of pipes and their contents;

(d) provisions for lifting and hoisting.

A.4.7. To ensure good siting and arrangement of the plant, the following matters should receive attention:

(a) safe means of access to all parts of the plant, including vessels, where workers may at any time need to go for purposes of inspection, maintenance, repairs and fire-fighting;

(b) the provision of trays, pumps and sand, to catch leaks and spills; where flammable or other dangerous substances are regularly drained off, these should be channelled into a closed collecting system to prevent them from spreading over floors or contaminating the atmosphere;

(c) the reduction of loud, harmful or disturbing noise;

(d) the avoidance of undesirable stresses within pipework and other installations.

A.4.8. Colour coding and safety and danger symbols should be used.

A.4.8.1. Monitoring and alarm instruments should be used to detect and signal the presence of flammable or explosive atmospheres, toxic substances and other hazardous conditions. If required by the technology, sensors should be able to trigger off emergency shut-down procedures.

A.4.8.2. The local overheating of equipment should be recognisable by means of colour-changing paint or infra-red detectors.

A.4.8.3. Provision should be made for electric power failure. In addition, there should be provisions for failures in the water, steam and compressed air supplies.

A.4.8.4. Flame arresters should be used where flashbacks could occur.

A.5. Storage and handling of dangerous substances

A.5.1. The conditions stipulated for the storage of dangerous substances should take fully into account the nature of the substance and its quantity.

A.5.2. For safe storage of dangerous substances, the following aspects should be taken into account:

(a) the nature of the hazard, which may result from the degree of flammability, liability to explode, toxicity, instability, chemical reactivity, radioactivity or fire-promoting properties;

(b) the quantity stored, which is of vital importance since it also determines the potential danger;

(c) the location of the storage area and its distance from production installations, and service and office premises;

(d) labelling in accordance with the provisions given under paragraphs 9.8.13 and 9.8.14 of this code.

A.5.3. The conditions of storage should be determined bearing in mind the nature of the material to be stored.

A.5.4. Flammable liquids should be stored in ground-level tanks, underground tanks or tanks covered by earth mounds.

A.5.5. Loading installations should be located and designed, and loading procedures and safety precautions organised, with a view to minimising leakages of dangerous liquids, vapours and gases, as well as their consequences.

A.5.6. Under normal loading procedures, and in the event of a serious leakage, precautions should be taken to ensure that any escaped substances do not create an undue hazard in the surrounding area.

A.5.6.1. Nearby plant and equipment, such as furnaces, and railway and road vehicles, should not create an undue hazard to loading operations.

A.5.6.2. There should be an adequate distance between the loading site and the main storage area.

A.5.7. The access road to the loading site should be routed so as to avoid other danger zones of the factory or plant. The traffic density in the vicinity of the loading site should be kept as low as reasonably practicable.

A.5.7.1. Roads and railway lines should be perfectly level at loading and unloading points of road vehicles and rolling stock, to avoid the risk of such vehicles rolling downhill.

A.5.7.2. Loading-site buildings, weighbridges, and waiting and parking areas should be laid out so as to permit speedy and safe loading operations.

A.5.8. In selecting the product-handling system, the following should be taken into consideration: the properties of the substance to be moved; the risk of an explosive mixture being formed with air and preventive measures; the need to prevent the escape of liquids, gases and vapours; the frequency of product delivery; and emergency stops.

A.5.9. Access by road and rail tankers, ships and barges should be facilitated by means of loading bays, platforms, ramps and docks. Two places of access or egress should always be provided for ships.

A.5.9.1. There should be means of collecting any leaking liquids and of safely draining them away or making them harmless.

A.5.9.2. Installations should provide for the unloading of all or part of a tanker's cargo in the event of overfilling or the return of products failing to meet specifications.

A.5.9.3. Equipment such as pipelines and pumps should be so located as to eliminate the risk of damage from vehicles, or appropriate collision barriers should be provided.

A.5.9.4. Loading bays should be clearly marked, and wheel chocks and similar equipment should be readily available for road tankers. There should be adequate means of earthing road tankers while they are using the facilities.

A.5.9.5. Adequate lighting, including emergency lighting, should be provided.

A.5.9.6. Personal protective equipment and suitable protective clothing should be provided, as well as easily accessible emergency showers.

A.5.9.7. Sufficient fire-fighting equipment should be kept at strategic locations which should be so arranged that the equipment can be reached at all times, irrespective of the wind direction.

A.5.9.8. There should be fully adequate communication arrangements between the operating personnel.

A.5.10. While being easily accessible, pumps and ancillary equipment should be firmly mounted at a safe distance from the loading point. An emergency cut-off valve which can be operated from a distance is very desirable, as is also an emergency stop system on the pumps.

A.5.11. When hoses, rather than rigid pipelines, have to be used, they should be inspected and approved so as to be –

(a) capable of withstanding the highest possible operating pressure;

(b) suitable for the substance being transported.

A.5.11.1. Hoses should be regularly replaced. Hoses and couplings should not be dragged along the ground, in order to avoid leaks that may damage or contaminate floors and to prevent the risk of sparks.

A.5.11.2. An adequate supply of adaptors and couplings should be kept available so that safe connections can always be made.

A.5.11.3. Delivery lines and hoses should be depressurised and allowed to drain before they are uncoupled; other precautions should be taken according to the substance transported.

A.5.11.4. Wherever necessary, pipes and loading hoses should be connected by equipotential links to loading couplings in order to avoid static electricity effects.

A.5.12. Where filling of containers to a level above the maximum allowable level could be dangerous, two independent filling control systems should be provided. One of these two systems should be fitted with a calibration system for continuous measurement.

A.5.13. Consideration should also be given to the desirability of interlocking rail points, barriers and pumps. In some cases it may be desirable to interlock the earthing circuit and the pump.

A.6. Handling and removal of hazardous waste products

A.6.1. The disposal of hazardous waste materials and their movement by road, rail and water should conform to the best recognised international standards or to those of the country concerned, if these are stricter.

A.6.2. When waste products and materials are released or disposed of, attention should be given to the following:

(a) the continuity of the release or disposal and the medium in which it is effected;

(b) the means of transportation of the waste products;

(c) the composition and quantity of the waste products;

(d) the adoption of appropriate precautionary measures;

(e) the organisation of appropriate waste facilities.

A.6.3. The need to dispose of hazardous waste and products should be reduced through –

(a) the controlled burning of the substances;

(b) the modification of the substances or their transformation into less hazardous substances;

(c) recycling the hazardous waste into part of the process;

(d) process changes aimed at reducing the quantity of waste products;

(e) the use of waste material from one process as raw material for another process.

A.7. Civil engineering considerations

A.7.1. Tests should be made at a prospective site to determine the nature, mechanical properties and bearing capacity of the soil before the plant installation is designed.

A.7.1.1. Soil characteristics, including acidity, should be determined in view of their possible effects on foundations, cables, pipes and underground tanks.

A.7.1.2. Likely ground movements arising from natural settlement and irregular subsidence should be assessed, as well as those arising from subsidence caused by mining, natural gas production and salt extraction.

A.7.1.3. Variations in the water table should be taken into account.

A.7.1.4. Water necessary for the process and drinking water should be available in required quantities.

A.7.2. The possibility of increased settlement of friction piling and other foundations arising from vibration, which can cause viscosity changes in the soil, should be allowed for in the design.

A.7.3. Where tanks are to be erected, the bearing capacity of the subsoil should be consistent beneath the whole foundation in order to prevent uneven settlement; the composition of the foundation should be such as to protect the case of the tank from corrosion and weakening.

A.7.4. Drainage and sewerage systems should be designed for their specific functions (removal of rain-water, cooling water, chemically polluted water or domestic waste water).

A.7.4.1. Where there is a junction between two different sections of a drainage system, precautions should be taken to prevent any movement of waste from the section carrying the more hazardous waste to that designed for less hazardous material.

A.7.4.2. Precautions should be taken against the possible release of dangerous vapours at such junctions and the risk of undesirable reactions whenever different sorts of waste water come into contact.

A.7.4.3. The capacity of a sewer must be matched to maximum rainfall, including monsoon conditions, and the maximum flow of water likely to be used in fire-fighting.

A.7.4.4. Connections between process plant on a firm base and unsupported drainage systems must be flexible so that they do not break. Where pipes are subjected to mechanical loads (e.g. under roadways), adequate measures should be taken to protect them.

A.7.5. The material chosen for road surfaces, in particular at special areas such as loading sites, should be resistant to any substances likely to be spilt.

A.7.5.1. The design of roads should include considerations of width, traffic arrangements and the maximum permissible load, which should be great enough for all normal traffic and for emergency vehicles.

A.7.5.2. The maximum permissible load of bridges, crossings and jetties must be conspicuously displayed and weak points should be protected by guard-rails.

A.7.6. The internal arrangements of a factory building should include precautions against the hazards of fire, explosion and the release of toxic or asphyxiating substances.

A.7.6.1. The construction material of the buildings should be both chemically and physically as resistant as possible to weathering and to any substances likely to be released into the factory atmosphere.

A.7.6.2. Precautions should be taken against the release of any harmful chemical compounds from the building material itself as a result of fire.

A.7.6.3. Where there is a risk of explosion outside the process equipment but within the building, the latter should have collapsible walls and a light roof structure to reduce the violence of any explosion that may occur.

A.7.6.4. Where the ventilation system of a building draws in air from outside, there must be a cut-off arrangement to stop the flow of air, if, for example, there is a gas alarm outside the building. If gas-detection equipment is provided, it should be linked automatically to this cut-off arrangement.

A.7.6.5. Where an explosive atmosphere could develop inside the ventilation system, there should be no sources of ignition within the system, and every endeavour should be made to eliminate electrostatic charges.

A.7.7. Floors, walkways and other means of access to operating platforms and other parts of the plant and factory should be safe and should provide good footholds and, where appropriate, handholds.

A.7.7.1. Vertical ladders should be caged in and their length restricted.

A.7.7.2. Floors, platforms and stair treads should be anti-slip. Where there is considerable risk of fire, floors should be solid and fireproof.

A.8. Hazardous atmospheres

In order to reduce the likelihood of a fire or explosion occurring, ignition sources should be eliminated, as far as is practicable. To achieve this, electrical equipment should be properly designed, specified, installed, maintained, housed and protected.

A.9. Protection against fire

A.9.1. To prevent fires, attention should be given to –

(a) the non-flammability of construction materials;

(b) the use of intrinsically safe equipment in "spark-free" areas;

(c) the proper design and installation of electrical systems;

(d) the safe construction of gas storage and distribution systems;

(e) the provision of adequate ventilation;

(f) protection against lightning;

(g) the elimination of electrostatic charges;

(h) the provision of permit-to-work procedures.

A.9.2. To prevent or minimise personal accidents in case of fire –

(a) there should be enough suitably located exits, including emergency exits, of adequate dimensions;

(b) corridors should not have dead ends;

(c) the type, location and swing of doors should be correct;

(d) emergency lighting should be provided;

(e) emergency escape routes should be clearly indicated;

(f) there should be arrangements for taking a roll-call.

A.9.3. To prevent the spread of fire –

(a) the plant should be departmentalised;

(b) partition walls should be impenetrable by fire;

(c) fire doors and smoke traps should be used;

(d) ventilation shafts should be fitted with baffles that close automatically in case of fire;

(e) the ventilation system should be remotely controlled;

(f) measures should be adopted to prevent the spread of fire to other buildings or plants.

A.9.4. To minimise the damage caused by fire:

(a) load-bearing elements should be covered with fireproof, heat-insulating materials;

(b) hollow load-bearing structures should be internally water cooled;

(c) sprinkler systems and water screens should be installed;

(d) facilities should be provided for drawing water for fire-fighting;

(e) measures should be taken to minimise smoke damage.

A.9.5. The fire-fighting system should be so organised as to enable a fire to be kept under control until external help arrives.

A.9.6. The fire alarm system should be able to transmit alarm signals to a control unit located in a safe place.

A.9.7. Matters to be considered in fire-fighting should include –

(a) fire extinguishers and their suitability for the flammable materials encountered;

(b) sources of water and adequacy of water volume and pressure, including availability under abnormal conditions;

(c) design criteria for the fire-fighting system.

A.9.8. All workers exposed to the risk should be trained in the use of the fire-fighting equipment, including training on emergency escapes.

A.10. General emergency plan

A.10.1. There should be a comprehensive, general emergency plan that follows step-by-step procedures.

A.10.2. The emergency plan should be revised and rehearsed periodically to check that it is adequate and is put into practice correctly.

A.11. Ergonomic and anthropometric considerations

A.11.1. These considerations should ensure that project jobs are adapted to the workers by taking into account the anthropometric and related characteristics of the workers in the technology-receiving country.

A.11.2. The ergonomic principles and factors should be taken into account early on in the project, namely during the design stages or on the setting up of a pilot project. These factors should include –

(a) the level of energy requirements for heavier work so as to prevent undue fatigue. Machines should be used to reduce heavy physical workload;

(b) the efficiency and economy of physical effort in the way the work is carried out, with particular regard to lifting;

(c) appropriate design for both seated and standing work activities, taking into account posture and body movement;

(d) instrument dials and displays to suit the worker, taking cultural and other factors into account;

(e) facial and cranial configuration and dimensions to ensure the proper fit of personal protective equipment and devices.

A.11.3. The anthropometric data to be collected for machine operators will include aspects of body size, reach, grasp and muscular strength.

A.11.4. These data should be used to ensure that the design of machines and plant, including dials, and control levers and panels, suit the workers who will use them. If this is not done, errors, accidents and bodily and mental fatigue will result.

A.11.5. Environmental conditions, such as temperature, air movement and level of humidity, levels of noise and vibration, natural and artificial lighting, including local lighting, and levels of air contaminants (dust, fumes, gases and radiations), should not place undue stress upon workers or damage their health.

A.11.6. Where the transfer of technology results in exposure to noise, vibration or atmospheric contaminants or to other hazards with cumulative effects over time, restrictions should be placed on the length of the working day.

A.11.6.1. Where the operation of the new technology involves continuous work, sufficient numbers of relief personnel should be engaged so as to allow rest periods.

A.11.6.2. If conditions in the working environment so warrant, specially designed rest booths or rest rooms should be provided to protect the workers from noise, heat, exposure to harmful agents and substances, and other adverse conditions.

A.11.6.3. Where the transfer of technology results in conditions which may require emergency showers, special washing facilities or other special services, these facilities should be provided.

A.11.6.4. Where a payment-by-results system would provide clear incentives for the unsafe operation of a transferred technology, such a system should be prohibited.

B. Bibliography

I. ILO publications

Listed below are various Conventions, Recommendations, codes of practice, guides and other ILO publications, which may assist the reader seeking further information about safety, health and working conditions in the transfer of technology to developing countries.

Although this list is current as of the date of publication of this code of practice, the ILO is constantly publishing new material and the reader is advised to contact the ILO directly or its national correspondent of the Occupational Safety and Health Information Centre (CIS) for the most up-to-date information.

Conventions

Number	Short title	Year
81	Labour Inspection	1947
115	Radiation Protection	1960
119	Guarding of Machinery	1963
120	Hygiene (Commerce and Offices)	1964
129	Labour Inspection (Agriculture)	1969
136	Benzene	1971
139	Occupational Cancer	1974
148	Working Environment (Air Pollution, Noise and Vibration)	1977
152	Occupational Safety and Health (Dock Work)	1979
155	Occupational Safety and Health	1981
161	Occupational Health Services	1985
162	Asbestos	1986

Recommendations

Number	Short title	Year
81	Labour Inspection	1947
97	Protection of Workers' Health	1953
114	Radiation Protection	1960
118	Guarding of Machinery	1963
120	Hygiene (Commerce and Offices)	1964
133	Labour Inspection (Agriculture)	1969
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147	Occupational Cancer	1974
156	Working Environment (Air Pollution, Noise and Vibration)	1977
160	Occupational Safety and Health (Dock Work)	1979
164	Safety and Health	1981
171	Occupational Health Services	1985
172	Asbestos	1986

Codes of practice

Safety and health in building and civil engineering work (Geneva, 1972, 386 pp.).

Safe construction and operation of tractors (Geneva, 1976, 39 pp.).

Safe design and use of chain saws (Geneva, 1978, 71 pp.).

Occupational exposure to airborne substances harmful to health (Geneva, 1980, 44 pp.).

Safety and health in agricultural work (Geneva, 1965, 132 pp.).

Occupational safety and health in the iron and steel industry (Geneva, 1983, 342 pp.).

Protection of workers against noise and vibration in the working environment (Geneva, 1984, 90 pp.).

Safety in the use of asbestos (Geneva, 1984, 116 pp.).

Safety and health in coal mines (Geneva, 1986, 176 pp.).

Radiation protection of workers (ionising radiations) (Geneva, 1987, 71 pp.).

Guides and manuals

Guide to the prevention and suppression of dust in mining, tunnelling and quarrying (Geneva, 1965, 421 pp.).

Guide to safety and health in forestry work (Geneva, 1968, 223 pp.).

Guide to health and hygiene in agricultural work (Geneva, 1979, 309 pp.).

Occupational Safety and Health Series

No. 36 *Dust control in the working environment (silicosis)* (Geneva, 1977, 165 pp.).

No. 37 *Occupational exposure limits for airborne toxic substances* (Geneva, 2nd (revised) ed., 1981, 290 pp.).

No. 38 *Safe use of pesticides* (Geneva, 1977, 42 pp.).

No. 39 *Occupational cancer – Prevention and control* (Geneva, 1977, 36 pp.).

No. 42 *Building work – A compendium of occupational safety and health practice* (Geneva, 1979, 212 pp.).

No. 43 *Optimisation of the working environment – New trends* (Geneva, 1979, 429 pp.).

No. 44 *Ergonomic principles in the design of hand tools* (Geneva, 1980, 93 pp.).

No. 45 *Civil engineering work – A compendium of occupational safety practice* (Geneva, 1981, 153 pp.).

No. 46 *Prevention of occupational cancer – International Symposium* (Geneva, 1982, 680 pp.).

No. 49 *Dermatoses et professions* (Geneva, 1983, 95 pp.; in French only).

No. 50 *Human stress, work and job satisfaction: A critical approach* (Geneva, 1983, 72 pp.).

No. 51 *Stress in industry: Causes, effects and prevention* (Geneva, 1984, 70 pp.).

No. 52 *Success with occupational safety programmes* (Geneva, 1984, 148 pp.).

No. 53 *Occupational hazards from non-ionising electromagnetic radiation* (Geneva, 1985, 133 pp.).

No. 54 *The cost of occupational accidents and diseases* (Geneva, 1986, 142 pp.).

No. 55 *The provisions of the Basic Safety Standards for Radiation Protection relevant to the protection of workers against ionising radiation* (Geneva, 1985, 23 pp.).

No. 56 *Psychosocial factors at work: Recognition and control* (Geneva, 1986, 89 pp.).

No. 57 *Protection of workers against radio frequency and microwave radiation: A technical review* (Geneva, 1986, 81 pp.).

ILO Industrial Committees and analogous Meetings

Occupational safety and health on plantations, with special reference to mechanisation and the use of chemicals and to labour inspection, Report III, Committee on Work on Plantations, Eighth Session, 1982.

Other ILO publications

Encyclopaedia of Occupational Health and Safety, 2 vols. (Geneva, 3rd (revised) ed., 1983).

Accident prevention – A workers' education manual (Geneva, 2nd ed., 1983, 175 pp.).

A. D. Austen and R. H. Neale: *Managing construction projects – A guide to processes and procedures* (Geneva, 1984, 158 pp.).

Safety and health practices of multinational enterprises (Geneva, 1984, 90 pp.).

A. S. Bhalla (ed.): *Technology and employment in industry* (Geneva, 3rd ed., 1985, 436 pp.).

J.-M. Clerc (ed.): *Introduction to working conditions and environment* (Geneva, 1985, 323 pp.).

II. World Health Organization (WHO) publications

Safe use of pesticides, Technical Report Series 634 (Geneva, 1979, 44 pp.).

The International Programme on Chemical Safety (IPCS). A joint UNEP/ILO/WHO endeavour. Booklets on the programme can be obtained from: The Manager, WHO/IPCS, 1211 Geneva 27, Switzerland.

III. United Nations publications

United Nations Conference on Trade and Development (UNCTAD): Handbook on the acquisition of technology by developing countries (New York, 1978, 63 pp.).

United Nations Industrial Development Organisation (UNIDO): Guidelines for the acquisition of foreign technology in developing countries (New York, 1973, 55 pp.).

IV. International Organization for Standardization (ISO) publications

Standardization in developing countries. Problems and prospects (Geneva, 1976).

V. International Social Security Association (ISSA) publications

Various publications in different sectors of industry (e.g. agriculture, chemicals, construction, mining, iron and metal manufacturing).

Information can be obtained from the ISSA Secretariat, 4 route des Morillons, 1211 Geneva 22, Switzerland.

C. Examples of national standards organisations

Österreichisches Normungsinstitut (ÖNORM) (Austria)
Standards Council of Canada (SCC) (Canada)
Association française de normalisation (AFNOR) (France)
Deutsches Institut für Normung (DIN) (Federal Republic of Germany)
Magyar Szabványügyi Hivatal (MSZH) (Hungary)
Japanese Industrial Standards Committee (JISC) (Japan)
USSR State Committee for Standards (GOST) (USSR)
British Standards Institution (BSI) (United Kingdom)
American National Standards Institute (ANSI) (United States)

Index[1]

[1] The numerals refer to chapters, sections or paragraphs; the letters A, B and C refer to the appendices.

Other ILO publications

Encyclopaedia of occupational health and safety.
Third edition (completely revised and updated). Two volumes

The *Encyclopaedia* has long been regarded as a classic work in its field. Its world-wide success has encouraged the ILO to undertake the preparation of this new fully revised edition, for which all entries have been closely examined and updated as necessary in the light of recent developments, a large number have been completely rewritten so as to take account of progress and trends in industrial toxicology and cancerology, the wider adoption of epidemiological methods, studies of the immune response, and the widespread concern for improving the working environment, increasing workers' participation and strengthening preventive standards and legislation. The new edition comprises 1,150 articles and numerous illustrations. Of the previous edition the *WHO Chronicle* wrote: "An indispensable reference work for all those concerned with the protection of workers' health and a valuable source of practical information."

ISBN 92-2-103289-2 (the set of two volumes) 275 Swiss francs

Introduction to working conditions and environment,
edited by J.-M. Clerc

The state of working conditions and the working environment in many parts of the world can only be described as alarming: for it is no secret that the lives, health and welfare of millions of workers are at stake during each moment of the working day. For many years, the need has been felt for a wide-ranging introductory volume embracing the main aspects of occupational safety and health and general conditions of work. This book has been designed to meet that need. By attempting to disseminate knowledge and information as widely as possible, the ILO is expressing its clear conviction that this is a task in which all must participate.

ISBN 92-2-105124-2 (hard cover) 45 Swiss francs
ISBN 92-2-105125-0 (limp cover) 30 Swiss francs

Safety in the use of asbestos

In recent years there has been a growing awareness that exposure to asbestos dust can have harmful effects on the health of workers. By giving technical guidance on how the risk of exposure to asbestos dust can be prevented, controlled or minimised, this code of practice forms part of the contribution of the ILO towards improving conditions in workplaces where asbestos is present.
General guidance is given in the first part of the code. More detailed guidance on the limitation of exposure to asbestos in specific activities is given in the second part, which includes sections on mining and milling, asbestos cement, textiles, friction materials and the removal of asbestos-containing materials. Useful appendices and a glossary of terms complete the code.

ISBN 92-2-103872-6 17.50 Swiss francs

Prices subject to change without notice.

Safety, health and working conditions in the transfer of technology to developing countries

Today there is a constant flow of machinery, chemicals and processes from developed to developing countries. This transfer of knowledge is not confined only to the technology itself; there is concern to provide information on the effects of the technology on the safety and health, and the working lives, of those involved.

This code of practice provides practical recommendations for all those with responsibility for safety and health hazards arising from the transfer of technology, and in particular those who may be engaged in the framing of provisions. It aims to ensure that transferred technology is appropriately designed, properly installed and safely operated; to provide the means of analysing the safety and health aspects of existing imported technologies and modifying them to remove hazards; and to offer guidance for setting up administrative, legal and educational frameworks for these preventive and remedial measures. An occupational safety and health check-list for hazard control is given in an appendix.

ISBN 92-2-106122-1

Price: 15 Swiss francs