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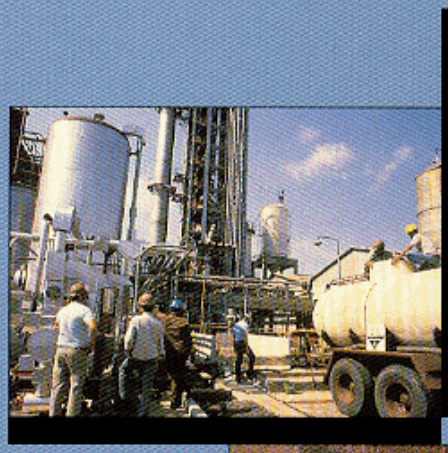
Safety in the use of Chemicals at Work

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Safety in the use of chemicals at work







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.

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Safety in the use
of chemicals at work

An ILO code of practice

Safety in the use of chemicals at work

An ILO contribution to the
International Programme on Chemical Safety
of UNEP, the ILO and the WHO (IPCS)

International Labour Office Geneva

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Preface

Chemicals are used in virtually all work activities, thus presenting certain chemical risks in a large number of workplaces all over the world. Many thousands of chemicals are used in substantial quantities, and many new chemicals are also introduced into the market each year. It is therefore an urgent task to establish a systematic approach to safety in the use of chemicals at work.

An effective control of chemical risks at the workplace requires an efficient flow of information from the manufacturers or importers to the users of chemicals on potential hazards and on the safety precautions to be taken. This flow of information should be followed by daily action by employers to ensure that the necessary measures are taken to protect workers, and consequently the public and the environment.

In accordance with the decision taken by the Governing Body of the ILO at its 250th Session (May-June 1991), a meeting of experts was convened in Geneva from 24 March to 1 April 1992 to draw up a code of practice on safety in the use of chemicals at work. The meeting was composed of seven experts appointed following consultations with governments, seven following consultations with the Employers' group and seven following consultations with the Workers' group of the Governing Body.[1]

---

[1] *Experts appointed following consultations with governments:*

Mr. W. Allescher, Engineer, Ministry of Labour and Social Affairs (Germany).
Dr. E. C. Enabulele, Deputy Director of Factories, Federal Ministry of Employment (Nigeria).
Mr. P. A. Novoa Fuenzalida, Doctor of Labour Law, Ministry of Labour and Social Welfare (Chile).
Mr. Krishnan C. Gupta, Director-General, Directorate General of Factory Advisory Services (India).
Mr. Evgeny A. Malov, Vice-President, State Committee of the Russian Federation for the Control of Occupational Safety (Russian Federation).
Ms. Helene J. Orr, Manager, Standards Branch, National Occupational Health and Safety Commission (Australia).
Ms. J. Silk, Senior Health Scientist, US Department of Labor (United States).

Experts appointed following consultation with the Employers' group:

Mr. Aristide-Albert Batonon, Pharmacist-biologist (Benin).
Mr. Murray A. Cappers, c/o United States Council for International Business (United States).
Ms. Nuala Flavin, Health and Safety Executive, Federation of Irish Employers (Ireland).
Dr. Tio Lam Hauw, Head of Technological Laboratory, Shell Eastern Petroleum (Singapore).
Mr. Yoshitaka Hoshikawa, Director, Environment and Safety Department, Mitsubishi Petrochemical Co. Ltd (Japan).
Dr. Horst Knies, Director for Occupational Safety and Health, BASF Aktiengesellschaft (Germany).
Mr. Pedro Chico Llaver, Vice-President, Health and Safety Committee, Argentine Industrial Union (Argentina).

Experts appointed following consultation with the Workers' group:

Mr. Jim Centner, Occupational Safety and Health Adviser, United Steelworkers' Union of America (United States).
Mr. Lajos Fócze, President, Chemical Workers' Union (VDSZ) (Hungary).
Mr. Øle Heegaard, Occupational Safety and Health Department, LO-Denmark (Denmark).
Mr. Erhard Lechelt, Occupational Safety and Health Department, IG Chemie, Papier, Keramik (Germany).
Dr. Héctor San Román, Director, Occupational Safety and Health, Confederation of Mexican Workers (Mexico).

After examining and finalising the text, based on a draft prepared by the Office, the experts adopted this code of practice. The code provides practical guidance on the implementation of the provisions of the Chemicals Convention, 1990 (No. 170), and Recommendation, 1990 (No. 177), and is not intended to discourage competent authorities from adopting higher standards.

The practical recommendations of this code of practice are intended for the use of all those who have a responsibility for safety in the use of chemicals. The code is not intended to replace national laws, regulations or accepted standards. Its object is to provide guidance to those who may be engaged in the framing of provisions relating to the use of chemicals at work such as competent authorities, the management of companies where chemicals are supplied or used, and emergency services. The code should also offer guidelines to suppliers', employers' and workers' organisations.

Local circumstances and the availability of financial and technical resources will determine the speed and extent of implementation. The provisions of this code should also be read in the context of the conditions in the country proposing to use the information. With this in mind, the needs of developing countries have been taken into consideration.

Mr. Gibson Sibanda, President, Zimbabwe Congress of Trade Unions (Zimbabwe).
Dr. Malinee Wongphanich, Occupational Health and Safety Adviser, Petroleum and Chemical Workers' Federation of Thailand (PCWT) (Thailand).

International governmental and non-governmental organisations represented:

World Health Organization (WHO).
International Agency for Research on Cancer (IARC).
International Programme on Chemical Safety (IPCS).
United Nations Environment Programme/International Register of Potentially Toxic Chemicals (UNEP/IRPTC).
Food and Agriculture Organization of the United Nations (FAO).
Organisation for Economic Co-operation and Development (OECD).
International Social Security Association (ISSA).
Commission of the European Communities (EC).
International Organization for Standardization (ISO).
International Organisation of Employers (IOE).
European Chemical Industry Council (CEFIC).
World Federation of Trade Unions (WFTU).
World Confederation of Labour (WCL).
International Federation of Chemical, Energy and General Workers' Unions.
World Federation of Industry Workers (WFIW).

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The text of the code was approved for publication by the Governing Body of the ILO at its 253rd Session (May-June 1992).

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1. General provisions

1.1. Objective

1.1.1. The objective of this code is to protect workers from the hazards of chemicals, to prevent or reduce the incidence of chemically induced illnesses and injuries resulting from the use of chemicals at work, and consequently to enhance the protection of the general public and the environment by providing guidelines for:

a) ensuring that all chemicals for use at work, including impurities, by-products and intermediates, and wastes that may be formed, are evaluated to determine their hazards;

b) ensuring that employers are provided with a mechanism for obtaining from their suppliers information about the chemicals used at work to enable them to implement effective programmes to protect workers from chemical hazards;

c) providing workers with information about the chemicals at their workplaces and about appropriate preventive measures to enable them to participate effectively in safety programmes;

d) establishing principles for such programmes to ensure that chemicals are used safely;

e) making special provision to protect confidential information whose disclosure to a competitor would be liable to cause harm to an employer's business so long as the safety and health of workers are not compromised thereby.

1.1.2. This code provides practical guidance on the implementation of the provisions of the Chemicals Convention, 1990 (No. 170), and Recommendation, 1990 (No. 177), and is not intended to discourage competent authorities from adopting higher standards.

1.2. Application

1.2.1. This code applies to any work activity in which chemicals are used, except those branches of economic activity, enterprises or products specifically excluded from the application of this code by the competent authority.

1.2.2. The code should also be applied to such self-employed persons and homeworkers as are specified in national laws or regulations, who may be affected by the use of chemicals during a work activity and whose use of chemicals may affect the health and safety of other workers.

1.2.3. The provisions of this code should be considered as basic requirements for preventing or reducing the risks to workers' health and safety when using hazardous chemicals. The most representative organisations of employers and workers concerned should be consulted by the competent authority on the measures to be taken to give full effect to the provisions of Convention No. 170 and Recommendation No. 177.

1.2.4. Excluded from this code is the use of articles which will not expose workers to a hazardous chemical under normal or reasonably foreseeable conditions of use.

1.2.5. Also excluded is the use of organisms, but the code does apply to chemicals derived from such organisms.

1.2.6. This code provides for assessment, controls, checks and records on safety in the use of chemicals, as well as emergency and reporting measures. Where hazardous chemicals are used, an employer should set up or have access to an occupational health service, consistent with the principles and objectives of the Occupational Health Services Convention, 1985 (No. 161), and Recommendation, 1985 (No. 171). Where available, the occupational health service should provide guidance to employers on the practical application of the provisions of this code, in the light of national law and practice, to help them comply with their general responsibilities under section 2.2 (General responsibilities of employers) and advise where surveillance of workers' health is required.

1.2.7. Where workers are exposed to ionising radiations as a result of the use of radioactive chemicals, the provisions of the ILO code of practice, *Radiation protection of workers (ionising radiations)* (Geneva, 1987), should apply.

1.3. Definitions

Article: An object which is formed to a specific shape or design during its manufacture or which is in its natural shape, and whose use in that form is dependent in whole or in part on its shape or design.

Chemicals: Chemical elements and compounds, and mixtures thereof, whether natural or synthetic.

Competent authority: A minister, government department or other public authority with the power to issue regulations, orders or other instructions having the force of law.

Hazardous chemicals. These include any chemical which has been classified as hazardous in accordance with Article 6 of Convention No. 170, or for which relevant information exists to indicate that the chemical is hazardous.

Use of chemicals at work: Any work activity which may expose a worker to a chemical, including: (a) the production of chemicals; (b) the handling of chemicals; (c) the storage of chemicals; (d) the transport of chemicals; (e) the disposal and treatment of waste chemicals; (f) the release of chemicals resulting from work activities; (g) the maintenance, repair and cleaning of equipment and containers for chemicals.

Work activity: Includes all branches of economic activity in which workers are employed, including the public service.

Workers' representatives: Persons who are recognised as such by national law or practice, in accordance with the Workers' Representatives Convention, 1971 (No. 135).

2. General obligations, responsibilities and duties

2.1. Role and obligations of the competent authority

2.1.1. The competent authority should formulate and state a coherent policy on safety in the use of chemicals at work, taking into account national conditions and practice and in consultation with the most representative organisations of employers and workers concerned. This should form part of the national policy on occupational safety and health and the working environment required by the Occupational Safety and Health Convention, 1981 (No. 155). As part of this policy, the criteria for the use of chemicals at work should be as consistent as possible with the protection of the general public and the environment, and with any other criteria established for that purpose.

2.1.2. The competent authority should review existing national measures and practice, in consultation with the most representative organisations of employers and workers concerned, for ensuring safety in the use of chemicals at work. Such measures and practice should be compared with international regulations, standards and systems, and with the measures and practice recommended by this code.

2.1.3. In the light of the stated policy and the review, the competent authority should formulate and implement the necessary measures including laws, standards and criteria for safety in the use of chemicals at work, in consultation with the most representative organisations of employers and workers concerned, to give effect to Convention No. 170 and Recommendation No. 177, including the principles of good practice in this code, in accordance with international regulations, standards and systems.

2.1.4. The competent authority should periodically review the stated policy and the existing measures to implement that policy, in consultation with the most representative organisations of employers and workers concerned, and implement any necessary changes in law, standards and criteria, taking into account current national conditions and in accordance with international regulations, standards and systems.

2.1.5. The competent authority should ensure that compliance with laws and regulations concerning safety in the use of chemicals at work is secured by an adequate and appropriate system of inspection. Adequate penalties should be provided for violations of these laws and regulations.

2.1.6. The competent authority should have the power, if justified on safety and health grounds, to either:

a) prohibit or restrict the use of certain hazardous chemicals; or

b) require advance notification and authorisation before such chemicals are used.

When all or some uses of hazardous chemicals are prohibited for reasons of safety and health at work, this prohibition and the reasons for it should be communicated by the exporting State to any importing country. States should designate a competent authority

to perform the exchange of information about decisions regarding the import or export of chemicals. Guidance can be found in the London Guidelines for the Exchange of Information on Chemicals in International Trade drawn up by the United Nations Environment Programme (UNEP).

2.1.7. The competent authority should have powers to specify categories of workers who, for reasons of safety and health, are not allowed to use specified chemicals or are allowed to use them but only under conditions prescribed in accordance with national laws or regulations.

2.1.8. The competent authority, or a body approved or recognised by the competent authority, should establish:

a) systems and specific criteria appropriate for classifying chemicals according to their intrinsic physical and health risks by type and degree;

b) systems and specific criteria for assessing the relevance of the information required to determine whether a chemical is hazardous;

c) requirements for marking and labelling chemicals taking into account the need to harmonise such systems internationally. In the case of transport, account should be taken of the United Nations *Recommendations on the transport of dangerous goods;*

d) criteria for the information contained in the chemical safety data sheets received by employers.

The competent authority should set out the necessary rules to determine these criteria and requirements but is not necessarily expected to undertake technical tasks or laboratory tests itself.

2.1.9. Classification systems and their application should be progressively extended, while taking into account harmonisation with internationally recognised systems. The competent authority should make arrangements for compiling and periodically updating a consolidated list of the chemical elements and compounds used at work, together with relevant hazard information. To the extent available, lists compiled by other national authorities under pre-manufacture or pre-market notification requirements may be used to compile and update this list.

2.1.10. The competent authority should require manufacturers and importers to provide it with information on specified criteria for assessing the hazards of chemical elements and compounds which are not yet included in the consolidated list compiled by the competent authority. Prior to use of the chemicals at work, the required information should be provided by the manufacturer and importer intending to place new chemicals on the market, whether the chemicals are individual substances or components of a mixture. The competent authority may specify a minimum threshold quantity for new chemicals for which such information should be provided. The powers of exemption may be used to exempt requirements for information on all components of a mixture where their quantities are insignificant in relation to the specific criteria set and do not affect the classification of the chemical, or where the same information has already been provided. Confidential information should be kept and disclosed in a manner consistent with the requirements of section 2.6.

2.1.11. The competent authority should ensure that criteria are established on measures which provide for safety of workers, in particular:

a) in the production and handling of hazardous chemicals;

b) in the storage of hazardous chemicals;

c) in the transport of hazardous chemicals, consistent with national or international transport regulations;

d) in the disposal and treatment of hazardous chemicals and hazardous waste products, consistent with national or international regulations.

The competent authority may achieve this by:

i) national laws and regulations;
ii) adopting, approving or recognising standards, codes or guidelines;
iii) where such standards, codes or guidelines do not exist, encouraging their adoption by a competent body;
iv) requiring employers to justify the criteria to which they are working.

2.1.12. The competent authority may prescribe:

a) the hazardous chemicals in respect of which the exposure of workers should be monitored and recorded;

b) periods for keeping records undertaken by employers of monitoring the working environment and of exposure of workers;

c) periods for keeping records of the results of medical surveillance of workers.

2.2. General responsibilities of employers

2.2.1. Employers should set out in writing their policy and arrangements on safety in the use of chemicals, as part of their general policy and arrangements in the field of occupational safety and health, and the various responsibilities exercised under these arrangements, in accordance with the objectives and principles of the Occupational Safety and Health Convention, 1981 (No. 155), and Recommendation, 1981 (No. 164). This information should be brought to the attention of their workers in a language the latter readily understand.

2.2.2. Employers should ensure that all chemicals used at work are labelled or marked in accordance with the provisions of this code, and that chemical safety data sheets have been provided in respect of all hazardous chemicals used at work. They should also ensure that the chemical safety data sheets provided by the supplier, or similar relevant information where such data sheets have not been provided, are made available to workers and their representatives.

2.2.3. Employers receiving chemicals which have not been:

a) labelled or marked; or

b) provided with chemical safety data sheets;

in accordance with the provisions of this code should not use the chemicals until the relevant information has been obtained from the supplier or from other reasonably available sources, and has been made available to workers and their representatives. Wherever practical, non-hazardous or low-hazard chemicals should be used.

2.2.4. Employers should maintain a record of hazardous chemicals used at the workplace, cross-referenced to the appropriate chemical safety data sheets. The record should be accessible to all workers in the workplace who might be affected by the use of the chemicals, and to their representatives.

2.2.5. Employers should make an assessment of the risks arising from the use of chemicals at work, taking into account the information provided by the supplier or, where this is not available, obtained from reasonably available sources, and should protect the workers by appropriate preventive measures.

2.2.6. Employers should take appropriate measures to protect workers against the risks identified by the assessment of risks. Where the risks cannot be eliminated or adequately controlled, employers should provide and maintain personal protective equipment, including clothing, as appropriate, at no cost to the worker, and should implement measures to ensure its use.

2.2.7. Employers should comply with appropriate standards, codes and guidelines formulated, approved or recognised by the competent authority concerning safety in the use of chemicals.

2.2.8. Employers should ensure adequate and competent supervision of work and work practices, and the application and use of the control measures provided.

2.2.9. Employers should make adequate arrangements to deal with incidents and accidents involving chemicals, e.g. accidental exposure, inadvertent release, or fire or explosion. The arrangements should deal with the identified risks and include, where appropriate, the provision of fire-fighting equipment, fire alarms and release-containment measures. Where the identified risk warrants it, the emergency arrangements should include evacuation of the workplace and the locality.

2.2.10. Employers should provide their workers with necessary, appropriate and periodic instructions and training, taking account of the functions and capacities of different categories of workers and, where appropriate, workers' representatives.

2.2.11. Where an employer is also a national or multinational enterprise with more than one establishment, the employer should provide safety and health measures relating to the prevention and control of, and protection against, risks from hazardous chemicals, without discrimination, to all workers who may be affected regardless of the place or country in which they are situated.

2.2.12. In all countries in which they operate, multinational and multi-site enterprises should make available to:

a) the workers concerned;

b) workers' representatives;

c) the competent authority;

d) employers' and workers' organisations;

information on the standards and procedures related to the use of hazardous chemicals relevant to their local operations, which they observe in other countries.

2.3. General duties of workers

2.3.1. Workers should take all reasonable steps to eliminate or minimise risk to themselves and to others from the use of chemicals at work.

2.3.2. Workers should take care of their own health and safety and that of other persons who may be affected by their acts or omissions at work, as far as possible and in accordance with their training and with instructions given by their employer.

2.3.3. Workers should make proper use of all devices provided for their protection or the protection of others.

2.3.4. Workers should report forthwith to their supervisor any situation which they believe could present a risk, and which they cannot properly deal with themselves.

2.4. General responsibilities of suppliers

2.4.1. Suppliers of chemicals, whether manufacturers, importers or distributors, should ensure that:

a) such chemicals have been classified or their properties assessed;

b) such chemicals are marked;

c) hazardous chemicals are labelled;

d) chemical safety data sheets for hazardous chemicals are prepared and provided to employers;

in accordance with the guidelines in the relevant paragraphs of this code and in pursuance of the requirements of Convention No. 170 and Recommendation No. 177.

2.4.2. Suppliers should ensure that all chemicals are marked to indicate their identity. The marking should be easily understood at both the place of origin and the destination.

2.4.3. Suppliers should identify and assess the properties of all chemicals, including the components of mixtures, which are not classified by the relevant competent authority or by a body approved or recognised by the relevant competent

authority to determine whether the chemicals are hazardous. The assessment should be based on a search of available information.

2.4.4. Suppliers should ensure that all chemicals they supply are classified in accordance with systems and criteria approved or recognised by the relevant competent authority, or by a body approved or recognised by the relevant competent authority, or that their properties are assessed in accordance with paragraph 2.4.3 (assessment of chemical hazards). The relevant competent authorities include those authorities responsible for classification and labelling at the places of origin and destination of the hazardous chemicals.

2.4.5. Suppliers should ensure that all hazardous chemicals are labelled in the manner required by the relevant competent authorities, or a body approved or recognised by the relevant competent authorities.

2.4.6. Suppliers of hazardous chemicals should ensure that revised labels and chemical safety data sheets are prepared and provided to employers, by a method which accords with national law and practice, whenever new relevant safety and health information becomes available.

2.4.7. Where information on the names and concentrations of components is not included in the chemical safety data sheet because it is confidential, the supplier should disclose this information in accordance with section 2.6 (Confidential information).

2.5. Rights of workers

2.5.1. The workers concerned and their representatives should have the right to:

a) information on the identity of chemicals used at work, the hazardous properties of such chemicals and precautionary measures;

b) the information contained in labels and markings;

c) chemical safety data sheets;

d) any other information required to be kept as specified by this code;

in forms and languages which they easily understand.

2.5.2. Workers should receive:

a) information on the classification and labelling of chemicals, and on chemical safety data sheets, in forms and languages which they easily understand;

b) information on the risks which may arise from the use of hazardous chemicals in the course of their work;

c) instruction, written or oral, based on the chemical safety data sheet and specific to the workplace if appropriate;

d) training and, where necessary, retraining in the methods which are available for the prevention and control of, and for protection against, such risks, including correct

methods of storage, transport and waste disposal as well as emergency and first-aid measures.

2.5.3. Workers and their representatives should have the right to take adequate precautions, in cooperation with their employer, to protect workers against risks from the use of hazardous chemicals at work.

2.5.4. Workers and their representatives should have the right to request and participate in an investigation by the employer or the competent authority of possible risks resulting from the use of chemicals at work. In particular, this should include the assessment of risks arising from the use of chemicals at work (paragraph 2.2.5 (risk assessment)) and investigations into accidents and hazardous occurrences.

2.5.5. Where disclosure of the specific identity of an ingredient of a chemical mixture to a competitor would be liable to cause harm to the employer's business, the employer may, in providing the information required under paragraphs 2.5.2 (right to information) and 2.5.4 (right to participate in investigations), protect that identity in a manner approved by the competent authority as detailed in section 2.6 (Confidential information).

2.5.6. Workers should have the right:

(a) to bring to the attention of their representatives, the employer or the competent authority, potential hazards arising from the use of chemicals at work;

(b) to remove themselves from danger resulting from the use of chemicals when they have reasonable justification to believe that there is an imminent and serious risk to their safety or health; such workers should inform their supervisor immediately;

(c) in the case of a health condition, such as chemical sensitisation, placing them at increased risk of harm from a hazardous chemical, to alternative work not involving that chemical, if such work is available and if the workers concerned have the qualifications or can reasonably be trained for such alternative work;

(d) to compensation if the case referred to in (c) above results in loss of employment;

(e) to adequate medical treatment and compensation for injuries and diseases resulting from the use of chemicals at work;

(f) to refrain from using a chemical which is labelled as being hazardous, if the relevant information is not available in the form of a chemical safety data sheet or as information obtained by the employer.

2.5.7. Workers who remove themselves from danger in accordance with the provisions of paragraph 2.5.6 (b) (removal from danger) or who exercise any of their rights under this code should be protected against undue consequences.

2.5.8. Women workers should have the right, in the case of pregnancy or breastfeeding, to alternative work not involving the use of, or exposure to, chemicals hazardous to the health of the unborn or nursing child, where such work is available, and the right to return to their previous jobs at the appropriate time.

2.6. Confidential information

2.6.1. The competent authority should make special provisions to protect confidential information whose disclosure to a competitor would be liable to cause harm to an employer's business, so long as the safety and health of workers are not compromised. The special provisions should:

a) limit the disclosure of confidential information to those who have a need related to workers' safety and health;

b) ensure that those who obtain confidential information agree to use it only to address safety and health needs, and otherwise to protect its confidentiality;

c) provide that relevant confidential information be disclosed immediately in an emergency;

d) provide for procedures to consider promptly the validity of the confidentiality claim and of the need for the information withheld where there is a disagreement regarding disclosure.

2.6.2. Where disclosure of the specific identity of an ingredient of a chemical mixture to a competitor would be liable to cause harm to the employer's business, the employer may, in providing the information required under paragraph 2.5.1 to workers and their representatives, protect that identity in a manner approved by the competent authority in accordance with paragraph 2.6.1.

2.6.3. Where the names or concentrations of the ingredients of chemical mixtures constitute confidential information, they may be omitted from the chemical safety data sheet in accordance with paragraph 2.6.1. Also in accordance with paragraph 2.6.1, the information should be disclosed on request and in writing to the competent authority and to concerned employers, workers and their representatives who agree to use the information only for the protection of workers' safety and health and not otherwise to disclose it.

2.6.4. Where the information requested is confidential in accordance with paragraphs 2.6.1 and 2.6.2, employers may require the workers or workers' representatives to limit its use to the evaluation and control of possible risks arising from the use of chemicals at work, and to take reasonable steps to ensure that this information is not disclosed to potential competitors.

2.6.5. Employers and occupational health services should ensure that access to personal records which contain confidential information on health surveillance, including the information on work-related diseases, is restricted to medical personnel. Personal data relating to health assessments may be communicated to others only with the informed consent of the worker concerned.

2.7. Cooperation

2.7.1. Employers, in discharging their responsibilities, should cooperate as closely as possible with workers or their representatives with respect to safety in the use of chemicals at work.

2.7.2. Employers, workers and their representatives should cooperate as closely as possible in the application both of the measures provided by this code and of the provisions of Convention No. 170 and Recommendation No. 177 to ensure safety in the use of chemicals at work.

2.7.3. Workers should cooperate as closely as possible with their employers in the discharge by the latter of their responsibilities and should comply with all procedures and practices relating to safety in the use of chemicals at work.

2.7.4. Where workers have removed themselves from danger in accordance with paragraph 2.5.6 (b) (removal from danger), the employer, in cooperation with the workers and their representatives, should immediately investigate the risk and take any corrective action necessary.

2.7.5. Suppliers should, on request, provide employers with such information as is available and required for the evaluation of any unusual hazards which might result from a particular use of a chemical at work.

2.7.6. Publicity material concerning hazardous chemicals intended for use at work should call attention to their hazards and the necessity to take precautions.

3. Classification systems

3.1. General

3.1.1. The competent authority, or a body approved or recognised by the competent authority, should establish systems and specific criteria for classifying a chemical as hazardous and should progressively extend these systems and their application. Existing criteria for classification established by other competent authorities or by international agreement may be followed, if they are consistent with the criteria and methods outlined in this code, and this is encouraged where it may assist uniformity of approach. The results of the work of the UNEP/ILO/WHO International Programme on Chemical Safety (IPCS) coordinating group for the harmonisation of classification of chemicals should be considered when appropriate. The responsibilities and role of competent authorities concerning classification systems are set out in paragraphs 2.1.8 (criteria and requirements), 2.1.9 (consolidated list) and 2.1.10 (assessment of new chemicals).

3.1.2. Suppliers should ensure that chemicals they supply have been classified or that they have been identified and their properties assessed (see paragraphs 2.4.3 (assessment) and 2.4.4 (classification)).

3.1.3. Manufacturers or importers, unless exempted, should give to the competent authority information about chemical elements and compounds not yet included in the consolidated classification list compiled by the competent authority, prior to their use at work (see paragraph 2.1.10 (assessment of new chemicals)).

3.1.4. The limited quantities of a new chemical required for research and development purposes may be produced by, handled in, and transported between laboratories and pilot plant before all hazards of this chemical are known in accordance with national laws and regulations. All available information found in literature or known to the employer from his or her experience with similar chemicals and applications should be fully taken into account, and adequate protection measures should be applied, as if the chemical were hazardous. The workers involved must be informed about the actual hazard information as it becomes known.

3.2. Criteria for classification

3.2.1. The criteria for the classification of chemicals should be based upon their intrinsic health and physical hazards, including:

a) toxic properties, including both acute and chronic health effects in all parts of the body;

b) chemical or physical characteristics, including flammable, explosive, oxidising and dangerously reactive properties;

c) corrosive and irritant properties;

d) allergenic and sensitising effects;

e) carcinogenic effects;

f) teratogenic and mutagenic effects;

g) effects on the reproductive system.

3.3. Method of classification

3.3.1. The classification of chemicals should be based on available sources of information, e.g.:

a) test data;

b) information provided by the manufacturer or importer, including information on research work done;

c) information available as a result of international transport rules, e.g. the United Nations *Recommendations on the transport of dangerous goods*, which should be taken into account for the classification of chemicals in the case of transport, and the UNEP Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), which should be taken into account in respect of hazardous wastes;

d) reference books or literature;

e) practical experience;

f) in the case of mixtures, either on the test of the mixture or on the known hazards of their components;

g) information provided as a result of the risk evaluation work performed by the International Agency for Research on Cancer (IARC), the UNEP/ILO/WHO International Programme on Chemical Safety (IPCS), the European Communities and various national and international institutions, as well as information available through systems such as the UNEP International Register of Potentially Toxic Chemicals (IRPTC).

3.3.2. Certain classification systems in use may be limited to particular classes of chemicals only. An example is the WHO *Recommended classification of pesticides by hazard and guidelines to classification,*[1] which classifies pesticides by degree of toxicity only and principally by acute risks to health. Employers and workers should understand the limitations of any such system. Such systems can be useful to complement a more generally applicable system.

3.3.3. Mixtures of chemicals should be classified based on the hazards exhibited by the mixtures themselves. Only if mixtures have not been tested as a whole should they be classified on the basis of intrinsic hazards of their component chemicals.

[1] UNEP/ILO/WHO, latest ed.

4. Labelling and marking

4.1. General

4.1.1. The competent authority, or a body approved or recognised by the competent authority, should establish requirements for the marking and labelling of chemicals to enable persons handling or using chemicals to recognise and distinguish between them, both when receiving and when using them, so that they may be used safely (see paragraph 2.1.8 (criteria and requirements)). Existing criteria for marking and labelling established by other competent authorities may be followed where they are consistent with the provisions of this paragraph and are encouraged where this may assist uniformity of approach.

4.1.2. Suppliers of chemicals should ensure that chemicals are marked and hazardous chemicals are labelled, and that revised labels are prepared and provided to employers whenever new relevant safety and health information becomes available (see paragraphs 2.4.1 (suppliers' responsibilities) and 2.4.4 (classification)).

4.1.3. Employers receiving chemicals that have not been labelled or marked should not use them until the relevant information is obtained from the supplier or from other reasonably available sources. Information should be obtained primarily from the supplier but may be obtained from other sources listed in paragraph 3.3.1 (sources of information), with a view to marking and labelling in accordance with the requirements of the national competent authority, prior to use.

4.2. Nature and type of marking

4.2.1. All chemicals should be marked so as to indicate their identity.

4.2.2. The mark chosen should be such as to enable users to distinguish between chemicals during receipt, handling and use. Marking may be by chemical identity, common name, trade name, code name or number or other name, so long as the identity so established is unique and, in the case of a hazardous chemical, is identical to that used on the label and the chemical safety data sheet. Inclusion of the name of the supplier on the shipped container or packaging is recommended.

4.2.3. Waste chemicals should be marked as such.

4.2.4. The marking of chemicals may be impracticable because of the size of the container or nature of the package. They should, however, be readily identifiable by such means as tagging or accompanying documents.

4.2.5. Each container or layer of packaging should be marked. The particulars should always be visible on the container or package during each stage of the supply and use of the chemicals.

4.3. Nature and type of labelling

4.3.1. Hazardous chemicals should be labelled in accordance with national law and practice to give essential information, as well as the identity of the chemicals, in a way that is easily understood by the workers who are to use them (but see paragraph 4.3.6 regarding transport of chemicals where the information on the container or package may be different).

4.3.2. The purpose of the label is to give essential information on:

a) the classification of the chemical;

b) its hazards;

c) the precautions to be observed.

The information should refer to both acute and chronic exposure hazards.

4.3.3. Labelling requirements, which should be in conformity with national requirements, should cover:

a) the information to be given on the label, including as appropriate:
   i) trade names;
   ii) identity of the chemical;
   iii) name, address and telephone number of the supplier;
   iv) hazard symbols;
   v) nature of the special risks associated with the use of the chemical;
   vi) safety precautions;
   vii) identification of the batch;
   viii) the statement that a chemical safety data sheet giving additional information is available from the employer;
   ix) the classification assigned under the system established by the competent authority;

b) the legibility, durability and size of the label;

c) the uniformity of labels and symbols, including colours.

4.3.4. Concentrations of solutions, individual isomers and components of petroleum distillates and reactive chemicals should be indicated where this is relevant to the characteristic properties of the chemical.

4.3.5. In the case of mixtures, any component present which is thought to contribute significantly to the characteristic properties of a mixture, or which is above a concentration limit approved or recognised by the competent authority, should be indicated.

4.3.6. In the case of transport, similar information should be given in conformity with national requirements, taking account of the United Nations *Recommendations on*

the transport of dangerous goods. The information given should not only inform the transporter of the chemicals but should also give readily understandable information to the emergency services in the event of an emergency, which would also be of use to the public in such an event.

4.3.7. In the case of waste, where full labelling is not practicable, the labelling should include the telephone number of any person able to give further advice on the likely composition of the waste and its potential risks.

4.3.8. The hazardous components of the waste should also be indicated where they are known, so far as this is practicable, and where they contribute to the characteristic properties of the waste or are above a concentration limit approved or recognised by the competent authority. Examples of cases where indicating the hazardous components may be practicable include those where:

a) the material has been previously labelled and has not substantially altered before it was deemed to be waste;

b) information has been obtained from any testing done;

c) information has been derived from past experience.

The container or packaging should be appropriately labelled.

4.3.9. Labelling of hazardous chemicals may be impracticable because of the size of the container or nature of the package. It should, however, include the information required by paragraph 4.3.2 (purpose of label) by such means as tagging or accompanying documents. In these circumstances, all containers of hazardous chemicals should at least indicate the hazards of the contents by appropriate wording or symbols.

4.3.10. Each container or layer of packaging should be labelled. The particulars should always be visible on the container or package during each stage of the supply and use of chemicals.

4.3.11. Pesticide containers may also be labelled with additional information in accordance with applicable international guidelines, such as those of the United Nations Food and Agriculture Organization (FAO) on good labelling practice.

4.4. Transfer of chemicals

4.4.1. Employers should ensure that when chemicals are transferred into other containers or equipment, the contents are indicated in a manner which will make known to workers their identity, any hazards associated with their use and any safety precautions to be observed.

4.4.2. Where any chemicals are transferred into other containers or equipment for use on an employer’s premises, the new containers or equipment should be marked for identification as indicated in (a) below. If such chemicals are hazardous, they should be labelled or some other indication given to enable workers to identify:

a) the chemicals, e.g. by reference number, code or commonly used name known to all workers at the workplace;

b) any associated hazards, e.g. by appropriate words or symbols;

c) the safety precautions to be observed.

4.4.3. For some work activities, plant and equipment (e.g. reaction vessels or distillation columns) may process or handle a number of different chemicals. Where marking or labelling of individual plant and equipment is not practicable, because of changing circumstances, workers should be given information and instruction on the identity of the chemicals, the hazards associated with their use and the safety precautions to be observed. In addition, they should receive training in respect of these matters.

5. Chemical safety data sheets

5.1. General

5.1.1. The competent authority, or a body approved or recognised by the competent authority, should establish criteria for the preparation of chemical safety data sheets for hazardous chemicals (see paragraph 2.1.8 (d) (criteria for data sheets)). Essential information should be included (see section 5.3 (Content)). Existing criteria for preparing chemical safety data sheets (also called "material safety data sheets" or "safety data sheets" in some countries) established by other competent authorities or internationally recognised institutions may be followed, where they are consistent with the provisions of this paragraph. This practice is encouraged where it may promote uniformity of approach.

5.1.2. Suppliers should ensure that chemical safety data sheets for hazardous chemicals are prepared, and are provided to employers as well as any revisions thereof (see 2.4.6 (provision of data sheets)).

5.1.3. Workers and their representatives should have a right to chemical safety data sheets and to receive information on them in forms or languages they easily understand. Some of the information required in chemical safety data sheets might be intended for specialists, and further clarification may be needed from the employer.

5.2. Provision of information

5.2.1. The supplier should provide an employer with essential information about hazardous chemicals in the form of a chemical safety data sheet. The information should be given in the official language of the country in which the employer is located or in another language, agreed to in writing by the employer.

5.2.2. On the basis of the information in the chemical safety data sheet, employers should check whether any national laws, standards or practices apply to the chemical supplied, and should ensure compliance. Employers should add to the information provided by the supplier, information of importance to their enterprise.

5.2.3. Employers should not use any hazardous chemicals until they have obtained the appropriate information referred to in paragraph 5.3.2 (information in the data sheets) and have given this information to the workers in a form and language that they can easily understand. Verbal information may be appropriate in straightforward cases, but further training will often be required, supported by written instructions on methods of work, precautionary measures and action to be taken in the event of an emergency.

5.2.4. Employers should make chemical safety data sheets for hazardous chemicals available to workers and their representatives.

5.3. Content

5.3.1. Chemical safety data sheets for hazardous chemicals should give information about the identity of the chemical, its supplier, classification, hazards, safety precautions and the relevant emergency procedures.

5.3.2. The information to be included should be that established by the competent authority for the area in which the employer's premises are located, or by a body approved or recognised by that competent authority. Details of the type of information that should be required are given below.

(a) Chemical product and company identification

The name should be the same as that used on the label of the hazardous chemical, which may be the conventional chemical name or a commonly used trade name. Additional names may be used if these help identification. The full name, address and telephone number of the supplier should be included. An emergency telephone number should also be given, for contact in the event of an emergency. This number may be that of the company itself or of a recognised advisory body, so long as either can be contacted at all times.

(b) Information on ingredients (composition)

The information should allow employers to identify clearly the risks associated with a particular chemical so that they may conduct a risk assessment, as outlined in section 6.2 (Procedures for assessment) of this code. Full details of the composition should normally be given but may not be necessary if the risks can be properly assessed. The following should be provided except where the name or concentration of an ingredient in a mixture is confidential information which can be omitted in accordance with section 2.6:

(i) a description of the main components, including their chemical nature;

(ii) the identity and concentrations of components which are hazardous to safety and health;

(iii) the identity and maximum concentration to be found of components which are at the concentration or exceed the concentration at which they are classified as hazardous to safety and health in lists approved or recognised by the competent authority, or which are prohibited at higher concentrations by the competent authority.

(c) Hazard identification

The most important hazards, including the most significant health, physical and environmental hazards, should be stated, clearly and briefly, as an emergency overview. The information should be compatible with that shown on the label.

(d) First-aid measures

First-aid and self-help measures should be carefully explained. Situations where immediate medical attention is required should be described and the necessary measures indicated. Where appropriate, the need for special arrangements for specific and immediate treatment should be emphasised.

(e) Fire-fighting measures

The requirements for fighting a fire involving a chemical should be included, e.g.:

(i) suitable extinguishing agents;

(ii) extinguishing agents which must not be used for safety reasons;

(iii) special protective equipment for fire-fighters.

Information should also be given on the properties of the chemical in the event of fire and on special exposure hazards as a result of combustion products, as well as the precautions to be taken.

(f) Accidental release measures

Information should be provided on the action to be taken in the event of an accidental release of the chemical. The information should include:

(i) health and safety precautions: removal of sources of ignition, provision of sufficent ventilation, provision of suitable personal protective equipment;

(ii) environmental precautions: keeping away from drains, need to alert the emergency services, and possible need to alert the immediate neighbourhood in the event of an imminent risk;

(iii) methods for making safe and cleaning up: use of suitable absorbent materials, avoiding production of gases/fumes by water or other diluent, use of suitable neutralising agents;

(iv) warnings: advise against reasonably foreseeable hazardous actions.

(g) Handling and storage

Information should be given about conditions recommended by the supplier for safe storage and handling, including:

(i) design and location of storage rooms or vessels;

(ii) separation from workplaces and occupied buildings;

(iii) incompatible materials;

(iv) conditions of storage, e.g. temperature and humidity, avoidance of sunlight;

(v) avoidance of sources of ignition, including particular arrangements to avoid static build-up;

(vi) provision of local and general ventilation;

(vii) recommended methods of work and those to be avoided.

(h) Exposure controls and personal protection

Information should be given on the need for personal protective equipment during use of a chemical, and on the type of equipment that provides adequate and suitable protection. Where appropriate, a reminder should be given that the primary controls should be provided by the design and installation of any equipment used and by other engineering measures, and information provided on useful practices to minimise exposure of workers. Specific control parameters such as exposure limits or biological standards should be given, along with recommended monitoring procedures.

(i) Physical and chemical properties

A brief description should be given of the appearance of the chemical, whether it is a solid, liquid or gas and its colour and odour. Certain characteristics and properties, if known, should be given, specifying the nature of the test to determine these in each case. The tests used should be in accordance with the national laws and criteria applying at the employer's workplace and, in the absence of national laws or criteria, the test criteria of the exporting country should be used as guidance. The extent of the information provided should be appropriate to the use of the chemical. Examples of other useful data include:

– viscosity;
– freezing point/freezing range;
– boiling point/boiling range;
– melting point/melting range;
– flashpoint;
– auto-ignition temperature;
– explosive properties;
– oxidising properties;
– vapour pressure;
– molecular weight;
– specific gravity or density;
– pH;
– solubility;
– partition coefficient (water/*n*-octane);
– parameters such as vapour density, miscibility, evaporation rate and conductivity.

(j) Stability and reactivity

The possibility of hazardous reactions under certain conditions should be stated. Conditions to avoid should be indicated, such as:

(i) physical conditions, e.g. temperature, pressure, light, shock, contact with moisture or air;

(ii) proximity to other chemicals, e.g. acids, bases, oxidising agents or any other specific substance which may cause a dangerous reaction.

Where hazardous decomposition products are given off, these should be specified along with the necessary precautions.

(k) Toxicological information

This section should give information on the effects on the body and on potential routes of entry into the body. Reference should be made to acute effects, both immediate and delayed, and to chronic effects from both short- and long-term exposure. Reference should also be made to health hazards as a result of possible reaction with other chemicals including any known interactions, for example, resulting from the use of medication, tobacco and alcohol.

(l) Ecological information

The most important characteristics likely to have an effect on the environment should be described. The detailed information required will depend on the national laws and practice applying at the employer's workplace. Typical information that should be given, where appropriate, includes the potential routes for release of the chemical which are of concern, its persistence and degradability, bioaccumulative potential and aquatic toxicity, and other data relating to ecotoxicity, e.g. effects on water treatment works.

(m) Disposal considerations

Safe methods of disposal of the chemical and of contaminated packaging, which may contain residues of hazardous chemicals, should be given. Employers should be reminded that there may be national laws and practices on the subject.

(n) Transport information

Information should be given on special precautions that employers should be aware of or take while transporting the chemical on or off their premises. Relevant information given in the United Nations *Recommendations on the transport of dangerous goods* and in other international agreements may also be included.

(o) Regulatory information

Information required for the marking and labelling of the chemical should be given here. Specific national regulations or practices applying to the user should be referred to. Employers should be reminded to refer to the requirements of national laws and practices.

(p) Other information

Other information which may be important to workers' health and safety should be included. Examples are training advice, recommended uses and restrictions, references, and sources of key data for compiling the chemical safety data sheet, the technical contact point and date of issue of the sheet.

6. Operational control measures

6.1. General principles

6.1.1. The competent authority should ensure that criteria are established for safety in the use of hazardous chemicals, including criteria for the measures outlined in sections 6.4 (Elimination) to 6.9 (measures for disposal and treatment).

6.1.2. After reviewing the chemicals being used at work, obtaining information about their hazards and making an assessment of the potential risks involved, employers should take steps to limit exposure of workers to hazardous chemicals, on the basis of the measures outlined in sections 6.4 to 6.9, in order to protect workers against hazards from the use of chemicals at work. The measures taken should eliminate or minimise the risks, preferably by substitution using non-hazardous or less hazardous chemicals, or by the choice of technology; but where this cannot be achieved the risks should be eliminated or minimised using good engineering controls. Other measures such as safe working systems and practices, personal protective equipment and the provision of information and training will further minimise risks and may have to be relied upon for some activities entailing the use of chemicals.

6.1.3. For new work activities involving the use of chemicals, the hazards should be identified and the risks assessed at the earliest stage when the new work activity is being considered. The hazards and risks should be reviewed at each subsequent stage in the development of a new process.

6.1.4. The purpose of the assessment is to enable an informed decision to be made by employers about the validity of measures to eliminate or minimise risks from chemicals. Employers should show that all aspects of the use of chemicals have been considered in the assessment. Where an employer identifies risks which can or should be eliminated or minimised, he or she should eliminate or minimise these risks as soon as possible and by the best possible means following the order of preference in the measures outlined in paragraph 6.1.2. A programme should be prepared to specify the action necessary to eliminate or minimise the risks and the time for completion.

6.1.5. For complex work activities, such as the manufacture of chemicals, the hazards of the process may be identified by breaking down the process into its component operations; the stages for reviewing risks may include a desk study (a paper review of the process and known risks), laboratory development work, pilot plant operations, commissioning and full operation of plant.

6.1.6. Hazardous chemicals might be used in quantities which have the potential to be a major risk not only to workers, but also to the population in the vicinity of the use of the chemicals and to the general environment. The use of such chemicals should additionally be controlled by following the objectives and procedures of the ILO code of practice, *Prevention of major industrial accidents* (Geneva, 1991), and in accordance with national law and practice.

6.2. Procedures for assessment

6.2.1. The assessment should be carried out by employers or by persons acting on their behalf who have the necessary information, instruction and training and are competent to do so. It should include:

(a) Assessment of risks

This should include consideration of which chemicals are used and the nature of their hazards, i.e. whether they may present a risk of one or more of the following:

(i) acute or chronic ill health by entry into the body through inhalation, skin absorption or ingestion;

(ii) injury or ill health from skin or eye contact;

(iii) injury from fire, explosion or other events resulting from physical properties or chemical reactivity;

(b) Appraisal of control measures

An estimate of risk, and whether it can be eliminated, should be made, taking into account the engineering control measures and systems of work. The estimate should cover the hazards and control measures outlined in sections *6.5* (control measures) to 6.9 (measures for disposal and treatment). In estimating health risks, account should be taken of exposure limits or other exposure criteria specified, approved or recognised by the competent authority. Personal protective equipment should only be taken into account as a method of control where other measures have been taken but are not sufficient;

(c) Action programme

The estimated risk should be compared with criteria that have been formulated, agreed or recognised by the competent authority for safety in the use of chemicals and a programme of work drawn up based on these established criteria or, where such criteria do not exist, other valid criteria.

6.2.2. The assessment of risks should take into account:

(a) the quantity of the chemical present at the workplace;

(b) the operating conditions and processes applied at the workplace;

(c) the range of uses of chemicals for which the employer is responsible, which might include production, handling, storage, transport and disposal;

(d) the variety of tasks that contribute to a work activity, particularly those where the engineering controls provided are not available, e.g. during certain maintenance, breakdown or cleaning tasks;

(e) the nature of the chemical and whether the hazards and associated risks are increased by the way it is used, e.g. at high temperatures and pressures;

(f) the consequences and likelihood of a possible failure or sequence of failures of the control measures provided.

6.2.3. Atmospheric sampling should be used where appropriate. It may be used as a control parameter for the effectiveness of measures provided, and in particular for assessing exposure where operations or tasks are complex and the chemicals involved have established exposure limits.

6.3. Review of assessment

6.3.1. The assessment should be reviewed whenever there is reason to suspect that it is no longer valid or where there has been a significant change in the work to which the assessment relates.

6.3.2. The assessment may be shown to be no longer valid because of, for example:

(a) the results of periodic thorough examinations and tests of engineering controls;

(b) an incident which led or was liable to lead to a fire or explosion;

(c) the results of monitoring exposure at the workplace, the results of health or medical surveillance, or a confirmed case of occupationally induced disease;

(d) new information on health hazards, or on fire and explosion risks.

6.3.3. A significant change in the work may consist of:

(a) a change in the substances used or their source;

(b) plant modification, including engineering controls;

(c) a change in the process or methods of work;

(d) a change in the volume or rate of production.

6.4. Elimination

6.4.1. Employers should include in their assessment consideration as to whether the risks from the hazardous chemicals used can be eliminated by:

(a) ceasing to use the chemicals;

(b) replacing them by less hazardous chemicals or by the same substances in a less hazardous form. Care should be taken to consider all the known risks of the proposed substitutes, and action should be taken on precautionary measures before substitution;

(c) using an alternative process.

6.4.2. Where the use of hazardous chemicals cannot be prevented, the control measures outlined in sections 6.5 (health-related measures), 6.6 (measures related to properties), 6.7 (measures for storage), 6.8 (measures for transport) and 6.9 (measures for disposal and treatment) should be followed.

6.5. Control measures for chemicals hazardous to health

6.5.1. Workers should be protected against the risk of injury or disease from chemicals hazardous to health. Workers should not be exposed to chemicals hazardous to health, in particular to an extent which exceeds exposure limits or other exposure criteria for the evaluation and control of the working environment established by the competent authority, or by a body approved or recognised by the competent authority in accordance with national or international standards.

6.5.2. Control measures to provide protection for workers could be any combination of the following:

(a) good design and installation practice:
   (i) totally enclosed process and handling systems;
   (ii) segregation of the hazardous process from the operators or from other processes;
   (iii) plants processes or work systems which minimise generation of, or suppress or contain, hazardous dust, fumes, etc., and which limit the area of contamination in the event of spills and leaks;
   (iv) partial enclosure, with local exhaust ventilation;
   (v) local exhaust ventilation;
   (vi) sufficient general ventilation;

(b) work systems and practices:
   (i) reduction of the numbers of workers exposed and exclusion of non-essential access;
   (ii) reduction in the period of exposure of workers;
   (iii) regular cleaning of contaminated walls, surfaces, etc.;
   (iv) use and proper maintenance of engineering control measures;
   (v) provision of means for safe storage and disposal of chemicals hazardous to health;

(c) personal protection:
   (i) where the above measures do not suffice, suitable personal protective equipment should be provided until such time as the risk is eliminated or minimised to a level that would not pose a threat to health;
   (ii) prohibition of eating, chewing, drinking and smoking in contaminated areas;
   (iii) provision of adequate facilities for washing, changing and storage of clothing, including arrangements for laundering contaminated clothing;
   (iv) use of signs and notices;
   (v) adequate arrangements in the event of an emergency.

6.6. Control measures for flammable, dangerously reactive or explosive chemicals

6.6.1. Workers should be protected against risks of injury resulting from the use of flammable, unstable or explosive chemicals. A combination of the following measures should be used to reduce the risk of a fire or explosion.

(a) Good design and installation practice:

In addition to the fundamental principles in paragraph 6.5.2 (a) (good design) which should be applied to eliminating flammable vapours, fumes or dusts liable to be given off, the following practices should also be observed where appropriate:

(i) elimination or control of sources of ignition;

(ii) separation of processes that use flammable chemicals from:
- other processes;
- bulk storage of the flammable chemicals or bulk storage which may cause a hazard in the event of fire;
- the boundary and premises off site, which are not under the control of the employer; and
- fixed sources of ignition;

(iii) provision of an inert atmosphere for totally enclosed processes and handling systems;

(iv) provision of means of fire detection and alarm which, as far as is practicable, should include automatic means of extinguishing incipient fires;

(v) installation of means for detecting increases in pressure and the automatic operation of a gas suppressor to prevent an explosion, e.g. for dust explosions;

(b) Safe work systems and practices:

(i) use and proper maintenance of the engineering control measures provided;

(ii) minimisation of the quantities of chemicals kept in the workplace;

(iii) minimisation of the quantities of chemicals handled and used in buildings;

(iv) separation of arrangements for storing chemicals from normal process activities;

(v) separation of incompatible chemicals;

(vi) reduction of the numbers of workers exposed and exclusion of non-essential access;

(vii) arrangements for spillages to be cleared up immediately;

(viii) arrangements for the safe disposal of chemicals;

(ix) ensuring that appropriate equipment is provided, e.g. non-sparking tools for low-incendive materials in specified situations;

(x) use of appropriate signs and notices;

(c) Personal protection:

(i) ensuring that where personal protective equipment and general work clothing are provided, they are not liable to increase the possibility of serious bums. Certain synthetic materials may melt in a fire and thereby cause more serious bums;

(ii) making adequate preparations for an emergency.

6.6.2. The adequacy of the means of escape, fire-fighting arrangements, the fire alarm system and provisions for the evacuation of the premises should be considered, following the assessment of chemicals that may be flammable, unstable or explosive.

6.7. Control measures for the storage of hazardous chemicals

6.7.1. Hazardous chemicals should be stored under conditions specific to their inherent properties and characteristics to ensure safety and in accordance with established criteria. Chemicals with typical properties and characteristics that are relevant include:

(a) flammable liquids;

(b) flammable gases;

(c) toxic chemicals;

(d) corrosive chemicals;

(e) chemicals that emit highly toxic fumes in the event of a fire;

(f) chemicals which, in contact with water, give off flammable gas;

(g) oxidising chemicals;

(h) explosives;

(i) unstable chemicals;

(j) flammable solids;

(k) compressed gases.

6.7.2. Chemicals known to have carcinogenic, mutagenic or teratogenic health effects should be kept under strict control.

6.7.3. Many standards, codes or guidelines exist concerning the storage of specific chemicals in bulk or in small containers. Where smaller containers (e.g. drums, cylinders, sacks or bags) are used, intermixing of chemicals is liable to occur. The major risk is that of fire and the resultant release of chemicals or combustion products. Many incidents of loss or injury resulting from warehouse activities have been caused by fire. With these fundamental points in mind, the control measures to provide protection should cover any combination of the following:

(a) the compatibility and segregation of stored chemicals. Chemicals that can react together to form unstable or noxious products, or produce heat, should be kept separate. Because of their reactivity and their liability to produce heat, oxidising chemicals should be kept separate from flammable liquids or other flammable chemicals;

(b) limitations on quantities of chemicals to be stored. This applies to chemicals with certain characteristic properties, so as to limit the effects of an accident or incident involving (or liable to involve) the chemicals in an emergency;

(c) adequate security of and access to storage areas. Potential ignition sources should be prohibited or controlled;

(d) safe siting of storage areas. In order to minimise the effects of an incident, storage areas for chemicals should be kept separate from process areas, occupied buildings and other storage areas, as well as from boundaries and off-site premises over which the employer has no control, and fixed sources of ignition, except for a small quantity of a hazardous chemical stored in a workplace in a safe manner (e.g. a small amount of a flammable liquid in a fire-resistant cabinet);

(e) the appropriate construction, nature and integrity of storage containers;

(f) safe loading and unloading of storage containers. Criteria relating to suitable equipment and safe systems of work, including training, are of primary importance for (f), (g) and (h);

(g) adequate precautions against accidental release, fire, explosion and chemical reactivity;

(h) adequate precautions and procedures in case of spillage;

(i) temperature, humidity and ventilation requirements. These are particularly important where the ambient temperature and humidity are high. Ventilation requirements should ensure that there is no accumulation of gases, vapours or fumes in enclosed areas;

(j) labelling and relabelling requirements;

(k) emergency procedures;

(l) requirements relating to possible physical and chemical changes in stored chemicals (e.g. not to store beyond the expiration period recommended on the label and the chemical safety data sheet);

(m) deployment of surveillance systems.

6.8. Control measures for the transport of chemicals

6.8.1. Hazardous chemicals should be transported in accordance with criteria established by the competent authority for the safety of the workers involved.

6.8.2. The criteria established by the competent authority should be consistent with national or international transport regulations and cover, as applicable:

(a) the properties and quantity of chemicals to be transported;

(b) the nature, integrity and protection of the packaging and containers used in transport, including pipelines;

(c) the specifications of the vehicle used in transport;

(d) the routes to be taken;

(e) the training and qualifications of transport workers;

(f) labelling requirements;

(g) loading and unloading;

(h) procedures in case of emergency, e.g. fire or spillage.

6.8.3. The criteria that are established should be consistent with the criteria of existing international transport requirements (e.g. the International Maritime Dangerous Goods Code, the Convention on International Civil Aviation and, in Europe, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)), which cover goods moving between countries and which are primarily aimed at protecting the environment and persons (other than the transport workers concerned) who may be involved in transport accidents.

6.8.4. The criteria should complement the above by:

(a) providing protection for workers; and

(b) providing protection for other persons who may be involved in a transport accident involving hazardous chemicals being transported internally within a country or within a workplace.

6.9. Control measures for the disposal and treatment of chemicals

6.9.1. The disposal of chemicals no longer required and the risks to workers should be included in the employers' assessment of risks. The chemicals should also be handled, treated or disposed of in a manner which eliminates or minimises the risk to safety and health and to the environment, in accordance with national law and practice. Containers which have been emptied but which may contain residues of hazardous chemicals should be treated as hazardous.

6.9.2. Hazardous chemicals deemed to be waste should be disposed of according to procedures based on criteria established by the competent authority or laid down in standards, codes or guidelines which have been approved or recognised by the competent authority for the treatment and disposal of hazardous chemicals and hazardous waste products, with a view to ensuring the safety of workers; these criteria should be consistent with the protection of the general public and the environment.

6.9.3. The criteria established by the competent authority should be consistent with national or international regulations regarding disposal and treatment of hazardous waste and should cover, where applicable:

(a) the method of identification of waste products. Waste products should be identified as waste, by their origins and also by their main components, where known. The main components should be determined from the history of the products. In cases of doubt about the degree of hazard, the waste should be classified as the highest hazard;

(b) the handling of contaminated containers. Empty containers which have not been cleansed of hazardous chemicals should be closed and stored to await disposal or reuse, and treated as if they contained those hazardous chemicals. Empty containers should retain the identification, marking and labelling of their previous contents;

(c) the identification, construction, nature, integrity and protection of waste containers. The waste containers should be designed or chosen to provide protection to workers against the hazards identified in (a) and (b) above, taking into account the methods of work and disposal to be followed;

(d) the effects on the working environment. The discharge of effluent, the disposal and transport of waste, and the emission of smoke and chemicals into the atmosphere should be undertaken in such a way as to prevent or minimise risks to workers, or should be in accordance with national laws and practice for the protection of the general public and the environment;

(e) the demarcation of disposal areas. Disposal areas and storage areas for waste products should be set aside. Sufficient space should be provided on site to prevent the presence of waste containers in the normal process and storage areas;

(f) the provision, maintenance and use of personal protective equipment and clothing. Personal protection should be provided against the hazards referred to in (a) and (b) above and in accordance with the method of work to be followed;

(g) the method of disposal or treatment. Where there are no on-site facilities to dispose of waste safely, hazardous waste products should be disposed of through a specialist contractor in accordance with national laws and practice. Where an employer disposes of waste (e.g. waste flammable solvents and residues) by burning, this should be in a plant or process designed to do this safely and following a clearly defined system of work.

6.9.4. Guidelines concerning controls in respect of the transboundary movement of hazardous wastes can be found in the UNEP Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

6.10. Programme for action

6.10.1. Where the assessment of risks shows that the controls are inadequate or likely to become inadequate, risks should be eliminated or a programme should be prepared to minimise the risks and in any case to meet established criteria. Where these

do not currently exist, valid criteria for the control of risks during the use of chemicals outlined in sections 6.5 (health-related measures), 6.6 (measures related to properties), 6.7 (measures for storage), 6.8 (measures for transport) and 6.9 (measures for disposal and treatment) should be drawn up by the employer. In preparing the programme, the general principles to be followed for the control measures in chapters 7 (Design and installation), 8 (Work systems and practices) and 9 (Personal protection) should be borne in mind, and attention paid to ensuring the adequacy of the information, instruction and training provided by employers, of the checking and monitoring systems and of the arrangements in the event of emergencies.

6.10.2. Each employer, after consultation with workers and workers' representatives, should establish and implement a programme to eliminate or minimise the identified risks in the use of hazardous chemicals. The programme should ensure that the risks are eliminated or minimised as soon as possible and by the best possible means. Preferred measures are by elimination or substitution of the hazardous chemicals involved, or where this cannot be achieved, by engineering controls. These measures may be difficult to complete immediately. Measures such as the provision of personal protective equipment may allow an earlier, though temporary, reduction in risks. The programme should specify the action necessary to eliminate or minimise the risks and the time for it to be completed.

7. Design and installation

7.1. General principles

7.1.1. Plant and equipment should be designed and installed to contain or minimise the risks from chemicals used at work, e.g.:

(a) by reducing the release of harmful or flammable chemicals, including the vapour and dust from such chemicals;

(b) by preventing the spread of fire and explosion in the workplace.

7.1.2. Containment of a hazard is best achieved by fully enclosing processes involving the use of chemicals. Full enclosure of processes can be more easily achieved where plant and equipment are automated or operated remotely. This should be a primary consideration during the design of plant and equipment and the process to be used. Bulk storage, with fixed pipework transfer suitably designed and fit for the purpose, should be used in preference to small container storage, where appropriate.

7.1.3. To reduce leaks, where particularly hazardous chemicals are used, enclosed plant and equipment should be fitted with extraction systems, which should be designed to ensure a slight negative pressure within the plant and equipment, where the process allows. Extraction systems should vent to a safe place, or contaminated air should be filtered or treated to ensure that exposure limits or other established criteria for the control of the working environment are not exceeded.

7.1.4. Working areas, plant and equipment should be so designed and installed as to avoid unnecessary exposure of workers to hazardous chemicals; this should include the provision of local exhaust ventilation, ensuring that cleaning can be kept to a minimum, and facilitating maintenance and cleaning procedures.

7.1.5. To further reduce risks from hazardous chemicals, plant, equipment and storage should be separated from other processes, from incompatible chemicals or other chemicals which may cause a hazard in the event of fire, from premises off site and other areas outside the control of the employer and, in the case of flammables, from fixed sources of ignition.

7.1.6. To prevent the spread of fire and explosion the following safety engineering techniques should be considered:

(a) design and construction to contain the effects of an explosion;

(b) limiting the effects of a fire or explosion by means of suitably sized and designed pressure-relief vents, explosion-relief panels, etc., which vent to a safe place;

(c) methods that prevent or reduce the spread of fire, such as the use of non-combustible or fire-resistant materials of a specified standard;

(d) the use of chokes, baffles or similar means to contain the effects of a fire or explosion within areas of the plant;

(e) automatic means of extinguishing or suppressing a fire or explosion, such as the use of automatically operated inert gas systems to suppress an explosion, or automatically operated extinguishing systems, e.g. water sprays.

7.1.7. To prevent the spread of a hazardous chemical in the event of its release, a secondary means of containment should be provided in accordance with established criteria, such as bund walls for hazardous liquids, diversion walls and evaporation areas for heavier-than-air flammable gases at or near their boiling points at ambient temperature (e.g. butane), and containment areas for the evaporation of cryogenic liquids. A “bund wall” is a properly designed and constructed containment wall to contain the contents of a storage vessel enclosed by the wall. A “diversion wall” is a low wall adjacent to a storage vessel used to divert released flammable gas and liquid away from danger areas and to an area for safe evaporation.

7.1.8. Assessment of risks from harmful chemicals, including monitoring where appropriate, should be made as soon as plant and equipment are installed in order to determine whether the criteria established by the competent authority have been met.

7.2. Local exhaust ventilation

7.2.1. Where total enclosure of a process involving hazardous chemicals is not reasonably practicable, local exhaust ventilation equipment should be provided and maintained to ensure that criteria such as exposure limits specified by the competent authority are not exceeded and that hazards such as flammable concentrations are eliminated or kept to a minimum.

7.2.2. The local exhaust ventilation should be so designed, constructed and installed as to ensure either the safe and effective removal of contaminated air from the workplace to a safe place, or the filtering or treatment of the contaminated air to avoid further hazard, taking into account exposure limits or other criteria for the control of the working environment established, approved or recognised by the competent authority. It should also be so designed as to prevent the spread of fire and explosion, following the principles outlined in paragraph 7.1.6 (prevention of the spread of fire).

7.2.3. The performance of the local exhaust ventilation should be checked upon installation against the design specification.

7.2.4. For efficient operation to prevent exposure of the worker, the exhaust ventilation should be located as close as possible to points of emission of hazardous chemicals. The length of ducting and the number of bends should be kept to a minimum to enable efficient operation.

7.3. General ventilation

7.3.1. Work areas should be supplied with clean air to balance the volume of extracted air as it is exhausted through the various extraction systems. This ensures efficient extraction and helps to reduce concentrations of chemicals.

7.3.2. The flow rates of general ventilation should be sufficient to change the air of the work area according to safety and health requirements, taking into account its size, the working conditions and numbers of workers.

7.3.3. Recirculation of extracted air into workrooms should be avoided, except under conditions acceptable to the competent authority. Where recirculation is allowed:

(a) effective methods should be used to decontaminate the air, which should be regularly checked and maintained;

(b) some air should be vented during recirculation and replaced by fresh air to avoid an accumulation of possible contamination;

(c) the rate of replacement by fresh air should be designed to ensure that hazardous limits or criteria for the control of the working environment, established, approved or recognised by the competent authority, are not exceeded in plant and workrooms;

(d) account should be taken in the design of the need to prevent any inadvertent release of hazardous chemicals from causing a hazard and spreading it to other working areas.

7.4. Elimination or control of sources of ignition

7.4.1. Where flammable chemicals are used, the primary consideration in design and installation should be to eliminate flammable atmospheres. Nevertheless, an assessment should be made of where flammable atmospheres may occur during the use of chemicals at all stages, and sources of ignition eliminated or minimised.

7.4.2. Areas should be classified according to the degree of probability of a flammable concentration occurring in the area. Unless classified as safe, electrical apparatus should not be used in these areas, where practicable. Where this is not practicable, electrical apparatus should be designed and constructed according to the classification of the hazard. The design and construction should be in accordance with standards recognised or approved by the competent authority.

7.4.3. Examples of ways in which sources of ignition may be eliminated include:

(a) the setting up and maintenance of “no smoking” areas;

(b) the prohibition of pumps and other electrical apparatus within the bunded areas of storage tanks (the pump should be located in its own containment area in case of leakage);

(c) the prohibition of electrical motors within ducts that contain flammable chemicals, e.g. replacing them with remote-driven fans;

(d) the prohibition of battery-charging operations for fork-lift trucks within storage areas or storage buildings.

7.4.4. The potential for creating static charges, e.g. with non-polar chemicals such as hydrocarbon solvents or certain dusts and solids such as sulphur, can be reduced by:

(a) avoiding free fall of the chemicals during filling of vessels from pipelines or from one container to another;

(b) a reduction in pumping rates at discharges;

(c) using anti-static electricity additives.

7.4.5. Special attention should be given to providing engineering measures to prevent a fire or explosion due to accumulation and discharge of static electricity. These measures should be periodically reviewed.

7.4.6. The type of heating provided in a workroom or storeroom should be suited to the likely conditions in that room. The following points should be observed where flammable chemicals are used:

(a) portable heaters such as oil and gas heaters, radiant electric fires and oil-filled electric radiators should be avoided;

(b) where oil and gas fired systems are used, they should be of the indirect type, i.e. the products of combustion should be safely flued to the outside atmosphere. The intake of air into such systems should come from safe locations where no spillage of flammable chemicals is likely to occur and enter the heating system.

8. Work systems and practices

8.1. General principles

8.1.1. Work procedures should be devised and followed for all uses of hazardous chemicals at work to protect workers against the risks which have been identified as a result of the employer's assessment of risks.

8.1.2. A work procedure should be devised after other appropriate means to eliminate and minimise risks have been chosen (i.e. the appropriate chemicals, technology and engineering control measures for a particular use at work).

8.1.3. The work procedure should incorporate the most effective use of the control measures provided.

8.1.4. The work procedure should make it clear who is in charge of the work, specify the particular tasks included in that work (and which individuals have responsibilities where there is an overlap) and provide for the exchange of necessary information at shift changeover time.

8.1.5. The work procedures that are devised should be in accordance with the requirements of national law and practice.

8.1.6. Other than for straightforward tasks, work procedures should be described in writing.

8.1.7. In particular, written work procedures should be devised and followed where good work procedures and practices are of primary importance, e.g. during routine maintenance, the testing, examination and repair of plant and equipment, the transfer of chemicals (including loading and unloading) and identification of the content of containers, including the potential hazards and corresponding precautions.

8.1.8. In some cases, the possible risks presented by hazardous chemicals are very high, e.g. during the maintenance of plant and equipment where entry is necessary. In such cases a formal written procedure, referred to as a "permit-to-work" system, is required. A "permit-to-work" form states exactly what work is to be done and when, and which parts are safe. A responsible person should assess the work and check safety at each stage and on completion. The people doing the jobs should sign the permit to show that they understand the hazards and necessary precautions.

8.1.9. For persons working alone, particular attention should be given to work procedures and to the arrangements in the event of an emergency, and special provisions made where appropriate.

8.1.10. Work procedures for emergency shut-down of the chemical processes should be established.

8.2. Review of work systems and practices

8.2.1. Frequent checks on the work procedures should be included in the review of control measures for hazardous chemicals and appropriate action should be taken. These checks should be made at the same time as those on information and training referred to in section 10.2 (information and training review).

8.2.2. The review should include checks on:

(a) changes in staff, materials, equipment, location and operating procedures;

(b) procedures followed outside “normal” working hours;

(c) adequacy of supervision;

(d) whether systems and practices are followed as intended;

(e) arrangements for leaving a job that cannot be finished.

9. Personal protection

9.1. Personal protective equipment

9.1.1. The use of personal protective equipment should not be regarded as an alternative to engineering or other suitable control measures but should be provided and maintained where such control measures cannot ensure protection. Effective action should continue to be taken by the employer to ensure that control measures are developed and applied in order to eliminate or minimise the risk to a level at which personal protection may not be required. Personal protective equipment includes respiratory protective equipment, protective clothing and footwear, equipment to protect the face, eyes and hands, and equipment to prevent an accumulation of static electricity, e.g. anti-static footwear.

9.1.2. Personal protective equipment should afford adequate protection against the risk from those hazardous chemicals to which the wearer is exposed, throughout the period during which such equipment is necessary, having regard to the type of work.

9.1.3. Items of personal protective equipment provided should comply with national law or be in accordance with criteria approved or recognised by the competent authority and based on national or international standards.

9.1.4. The equipment provided should be suitable for its purpose and there should be a sufficient supply readily available in the workplace for workers who require it.

9.1.5. Workers required to wear protective equipment should be fully instructed in its use.

9.1.6. When workers have been informed accordingly, they should use the equipment provided throughout the time they are exposed to the risk that requires its use for protection.

9.1.7. Employers should provide supervision to ensure that the equipment is properly used.

9.1.8. All personal protective equipment that is necessary for safety in the use of chemicals should be provided and maintained by the employer without cost to the worker.

9.2. Respiratory protective equipment

9.2.1. Respiratory protective equipment should be selected in compliance with national laws or national or international standards, approved or recognised by the

competent authority, concerning the suitability of the design of such equipment for the type of hazardous chemical and the degree of exposure involved.

9.2.2. Respiratory protective equipment should also be selected taking into account the work involved and should be matched to the wearer.

9.2.3. Respiratory protective equipment should be used only as a supplementary, temporary, emergency or exceptional measure and not as an alternative to technical control.

9.3. Protective clothing

9.3.1. The selection of protective clothing should take into account:

(a) the ability of the material from which it is made to resist penetration by the hazardous chemicals concerned;

(b) the adequacy of the design and the fit of the clothing, and whether it is suitable for the intended use;

(c) the environment in which it will be worn;

(d) in the case of dust, the dust release characteristics of the clothing material;

(e) in the case of flammable substances, its characteristics in the event of a fire;

(f) the need to prevent fire or explosions due to static electricity.

9.3.2. Protective clothing should not be used as an alternative to technical control.

9.4. Cleaning and maintenance of personal protective equipment and clothing

9.4.1. All protective equipment necessarily provided should be maintained in good condition and replaced, at no cost to the worker, when no longer suitable for its purpose.

9.4.2. The protective equipment should not be used longer than the time indicated by the producer.

9.4.3. Workers should make proper use of the equipment provided, and maintain it in good condition, as far as this is within their control.

9.4.4. Respiratory protective equipment, other than one-shift disposable respirators, should be cleaned, disinfected and thoroughly examined either (depending on which is first) each time it is reissued or after a period specified by national laws or by national or international standards approved or recognised by the competent authority, or specified as part of the employer’s control measures.

9.4.5. A record should be kept of the cleaning, disinfection and examination of such respiratory protective equipment, and of its condition and any defects, in accordance with national law and practice.

9.4.6. The record should be authenticated by the person carrying out the test, who should be properly trained for the purpose.

9.4.7. Employers should provide for the laundering, cleaning, disinfection and examination of protective clothing or equipment which have been used and may be contaminated by chemicals hazardous to health.

9.4.8. It should be prohibited for protective equipment which may be contaminated by chemicals hazardous to health to be laundered, cleaned or kept at workers' homes.

9.4.9. When a contract laundry is employed, care should be taken to ensure that the contractor fully understands the precautions necessary for handling contaminated clothing.

9.5. Welfare facilities and personal hygiene

9.5.1. Adequate washing facilities should be provided to enable workers to meet a standard of personal hygiene consistent with the adequate control of exposure and the need to avoid the spread of chemicals hazardous to health.

9.5.2. The washing facilities should be conveniently accessible but situated so that they do not themselves become contaminated from the workplace.

9.5.3. The type of washing facilities should be related to the nature and degree of exposure.

9.5.4. Clothing accommodation should be provided when protective clothing is used or when there is a risk of the contamination of outdoor clothing by hazardous chemicals.

9.5.5. Changing facilities should be so situated and designed as to prevent the spread of contamination from protective clothing to personal clothing and from one facility to another.

9.5.6. To reduce the risk of ingesting chemicals hazardous to health, workers should not eat, chew, drink or smoke in a work area which is contaminated by such chemicals.

9.5.7. Employers should prohibit eating, chewing, drinking or smoking in work areas in which adequate control of exposure can only be achieved by employees

wearing personal protective equipment to prevent exposure to chemicals hazardous to health, and in any other area where such chemicals are likely to be present.

9.5.8. Where it is necessary to prohibit eating or drinking, suitable facilities should be set aside for these activities to be carried out in an uncontaminated area, which should be conveniently accessible to the work area.

10. Information and training

10.1. General principles

10.1.1. Workers should be informed of the hazards associated with chemicals used at their workplace.

10.1.2. Workers should be instructed about how to obtain and use the information provided on labels and chemical safety data sheets.

10.1.3. Workers should be trained in the correct and effective use of the control measures, in particular the engineering control measures and measures for personal protection provided, and should be made aware of their significance.

10.1.4. Employers should use chemical safety data sheets, along with information specific to the workplace, as a basis for the preparation of instructions to workers, which should be in writing if appropriate.

10.1.5. Workers should be trained on a continuing basis in the working systems and practices to be followed and their significance for safety in the use of chemicals at work, and in how to deal with emergencies.

10.2. Review

10.2.1. The extent of the training and instruction received and required should be reviewed and updated simultaneously with the review of the working systems and practices referred to in section 8.2 (review of work systems).

10.2.2. The review should include the examination of:

(a) whether workers understand when protective equipment is required, and its limitations;

(b) whether workers understand the most effective use of the engineering control measures provided;

(c) whether workers are familiar with procedures in the event of an emergency involving a hazardous chemical;

(d) procedures for the exchange of information between shiftworkers.

11. Maintenance of engineering control measures

11.1. General principles

11.1.1. Engineering control measures should be thoroughly examined and tested at suitable or specified intervals to ensure that they are continuing to perform as originally intended. The intervals and content of the thorough examination should be in accordance with national laws or criteria specified in national or international standards approved or recognised by the competent authority, and should be specified as part of the control measures outlined in Chapter 6 (Operational control measures), taking into account the extent of the risk in the event of failure of the control measure.

11.1.2. The results of each thorough examination and test should be compared with the assessment of risks and control measures outlined in Chapter 6 (Operational control measures). Any defects disclosed as a result of the examination or test should be remedied as soon as possible or within such time as the examiner directs.

11.1.3. A suitable record of each thorough examination should be kept.

11.2. Local exhaust ventilation

11.2.1. As an example of the content of the thorough examination and test, the examination and test for local exhaust ventilation (LEV) should provide correctly the information listed below:

(a) name and address of the employer responsible for the plant;

(b) identification and location of the LEV plant, and the process and hazardous chemicals concerned;

(c) date of last thorough examination and test;

(d) conditions at time of test: normal production or special conditions (e.g. maximum use);

(e) information about the LEV plant which shows:
  (i) its intended operating performance for controlling the hazardous chemicals;
  (ii) whether the plant still achieves the same performance;
  (iii) if not, the repairs required to achieve that performance;

(f) methods used to make judgements in respect of (e) (ii) and (e) (iii) above (e.g. visual, pressure measurements, air flow measurements, dust lamp, air sampling, filter integrity tests);

(g) date of examination and test:

(h) name, designation and employer of the person carrying out the examination and test;

(i) signature or authentication of the person carrying out the examination and test;

(j) details of repairs to be carried out – to be completed by the employer responsible for the LEV plant.

11.2.2. The effectiveness of repairs carried out should be ascertained by a retest.

12. Monitoring in the workplace

12.1. General principles

12.1.1. Employers should monitor and record the exposure of workers to hazardous chemicals to ensure their safety and health. They should ensure that workers are not exposed to chemicals to an extent which exceeds exposure limits or other exposure criteria for the evaluation and control of the working environment. Based on the monitoring data, employers should assess the exposure of workers to hazardous chemicals.

12.1.2. Airborne concentrations of hazardous chemicals should be measured in all places of work where this is necessary to ensure the safety and health of workers against inhalation risks.

12.1.3. Measurements of airborne contaminants are necessary if other techniques do not suffice to provide a valid estimate of the risk of exposure and to assess the existing control measures.

12.1.4. Techniques for this risk assessment may include the following: information on the intrinsic health and physical hazards, obtained from the chemical safety data sheets; estimation of exposure based on the method of work and work pattern; advice from the supplier; experience of exposure in the workplace or of other users; and simple qualitative tests. Simple qualitative tests include, where appropriate, the use of smoke tubes or pellets to determine ventilation characteristics, and of the dust lamp for illuminating dust emissions.

12.1.5. The need for a programme for the measurement of airborne contaminants should be based on the factors listed in paragraph 12.1.4, the extent of the exposure of workers established as a result of the measurements taken, and the reliance on, and the consequent need to check the effectiveness of, engineering control measures. Where the need for a programme of measurements is determined for certain hazardous chemicals, the monitoring strategy should be followed.

12.2. Measuring methods

12.2.1. Sampling equipment should be compatible with the analytical methods available and should have been validated over a suitable range of concentrations above and below the exposure limits or other exposure criteria in accordance with published national or international standards, where they exist.

12.2.2. Static monitoring should be used to determine the distribution of an airborne chemical throughout the general atmosphere of the working area and to identify problems and priorities. Air samples should be taken:

(a) close to sources of emission in order to evaluate concentrations or the standard of engineering controls;

(b) at various places in the working area to assess the extent of the chemical's general distribution; and

(c) from working areas which represent typical exposure.

12.2.3. Personal monitoring should be used to evaluate the risk of exposure to the individual worker. Air samples should be collected in the worker's breathing zone by means of personal samplers. Sampling should be carried out while the work activity is in operation.

12.2.4. Where concentrations vary from one work operation or phase to another, personal sampling should be done in such a manner that the average, and in any case the maximum, level of exposure of each individual worker can be determined.

12.2.5. Personal sampling should measure exposure, or allow assessment of exposure, throughout the work shift. The exposure should be compared to occupational exposure limit values, which are usually quoted for an eight-hour period or, for short-term limits, 15 minutes. The measurement may be continuous over the whole shift or intermittent, so long as this allows a valid calculation of the average exposure and where necessary is supplemented by short-term sampling during periods of peak emission.

12.2.6. Exposure profiles of particular jobs or occupational categories should be constructed from the air-sampling data of different operations and from the workers' exposure time in these jobs.

12.3. Monitoring strategy

12.3.1. Where a systematic measurement programme has been decided, it should evaluate whether the exposure of workers to certain hazardous chemicals prescribed by the competent authority or determined by the initial assessment is being kept under control.

12.3.2. The aims of this programme should be:

(a) to ensure that the health of the workers is efficiently protected;

(b) to ensure that the preventive actions which have been taken are still effective;

(c) to ensure that the levels, as measured previously, remain unchanged or fall;

(d) to ensure that any changes made in manufacturing processes or work practices will not lead to an excessive exposure to hazardous chemicals;

(e) to promote the implementation of more efficient preventive measures.

12.3.3. The monitoring of airborne concentrations of chemicals in the working environment should be performed only by skilled personnel with adequate equipment and technical training.

12.3.4. The employer should arrange for regular inspection, maintenance and calibration of the measuring equipment.

12.3.5. The service responsible for monitoring the working environment should be kept informed about any change in plant, equipment, process, materials or work practices likely to bring about any substantial alteration in levels of exposure to hazardous chemicals.

12.4. Record keeping

12.4.1. Records should be kept by employers on measurements of airborne hazardous chemicals. Such records should be clearly marked by date, work area and plant location.

12.4.2. Personal sampling measurements, including the exposures calculated, should be recorded.

12.4.3. The workers and their representatives, and the competent authority, should have access to these records.

12.4.4. Besides the numerical results of measurements, the monitoring data should include, for example:

(a) the marking of the hazardous chemical;

(b) the location, nature, dimensions and other distinctive features of the workplace where static measurements were made; the exact location at which personal monitoring measurements were made, and the names and job titles of the workers involved;

(c) the source or sources of airborne emissions, their location and the type of work and operations being performed during sampling;

(d) relevant information on the functioning of the process, engineering controls, ventilation and weather conditions with respect to the emissions;

(e) the sampling instrument used, its accessories and the method of analysis;

(f) the date and exact time of sampling;

(g) the duration of the workers' exposure, the use or non-use of respiratory protection and other comments relating to the exposure evaluation;

(h) the names of the persons responsible for the sampling and for the analytical determinations.

12.4.5. Records should be kept for a period of time determined by the competent authority. Where this has not been prescribed, it is recommended that the employer keep the records, or a suitable summary, for:

(a) at least 30 years where the record is representative of the personal exposures of identifiable employees;

(b) at least five years in all other cases.

12.5. Interpretation and application of monitoring data

12.5.1. The risk of exposure should be assessed on the basis of the numerical results obtained, supported and interpreted in the light of other information such as length of exposure, work procedures and patterns, measurements of ventilation performance and other particular circumstances of work during measurement.

12.5.2. In the event that monitoring discloses levels which are in excess of the exposure limits, employers should inform the workers and their representatives, in a manner which is easily understood by the workers, of the risk and of the action to be taken to reduce this as part of the action programme.

13. Medical and health surveillance

13.1. General principles

13.1.1. Medical surveillance includes, where appropriate, pre-assignment and periodical medical examinations. It also includes, where appropriate, medical examinations upon resumption of work after a prolonged absence for health reasons, and upon and after termination of work involving exposure to chemicals.

13.1.2. Medical surveillance, conducted by an approved medical practitioner, should be used as part of overall health surveillance, in accordance with the objectives and principles of the Occupational Health Services Recommendation, 1985 (No. 171). Health surveillance should also include, where appropriate, simple techniques for the early detection of effects on health. These could include examination and questioning about health complaints.

13.1.3. Where necessary, the employer, or the institution competent under national law and practice, should arrange, through a method which accords with national law and practice, medical surveillance of workers:

(a) for the assessment of the health of workers in relation to risks caused by exposure to chemicals;

(b) for the early diagnosis of work-related diseases and injuries caused by exposure to hazardous chemicals;

(c) for the assessment of the workers' ability to wear or use required respiratory or other personal protective equipment.

13.1.4. In the case of exposure of workers to specific hazards, medical and health surveillance should include, where appropriate, any examination and investigations which may be necessary to detect exposure levels and early biological effects and responses.

13.1.5. When a valid and generally accepted method of biological monitoring of workers' health exists for the early detection of the effects on health of exposure to specific occupational risks, it may be used to identify workers who need a detailed medical examination, subject to the individual worker's consent.

13.1.6. Medical surveillance is necessary where:

(a) it is required by national law whenever workers are liable to be exposed to chemicals hazardous to health; or

(b) the employer is advised by an occupational health service that it is necessary as part of the protection of workers exposed to chemicals hazardous to health, given special attention to pregnant and breastfeeding women and other susceptible workers; or

(c) atmospheric or biological monitoring show that there could be effects on the health of a worker because of exposure to chemicals at work and medical surveillance will assist early detection of ill effects.

13.1.7. Exposure to the following types of chemicals may be appropriate for medical surveillance:

(a) chemicals that have a recognised systemic toxicity, i.e. an insidious poisonous effect;

(b) chemicals known to cause chronic effects, e.g. occupational asthma;

(c) chemicals known to cause severe dermatitis;

(d) chemicals that are known or suspected carcinogens;

(e) chemicals that are known or suspected teratogens or mutagens, as science develops;

(f) other chemicals where there is a likelihood that the disease or effect may occur under particular conditions of the work activity.

13.2. Use of results

13.2.1. Where the results of medical tests or investigations reveal clinical or preclinical adverse effects, appropriate medical treatment should be provided and measures should be taken to improve the working conditions and environment with a view to preventing or reducing exposure of the workers concerned. In order to prevent further deterioration of their health, these measures should include a reassessment of the risks and corresponding control measures of relevant hazardous chemicals, and appropriate clinical re-evaluation of the health status of the workers should be carried out periodically.

13.2.2. The results of medical examinations should be used to determine health status with respect to exposure to chemicals, and should not be used to discriminate against the worker.

13.2.3. The results of medical examinations and biological monitoring should be clearly explained to the workers concerned.

13.3. Keeping of medical records

13.3.1. The conditions under which, and the time during which, records resulting from medical surveillance of workers should be kept, the conditions under which they may be communicated or transferred and the measures necessary to keep them confidential, in particular when the information they contain is placed on computer, should be in accordance with national laws or practice, governed by recognised ethical guidelines. Where there are no recognised national laws or practice, a period of 30 years is recommended for keeping medical surveillance records.

13.3.2. Workers should have access to their own medical records, either personally or through their own physicians.

13.3.3. Workers and their representatives should have access to the results of studies prepared from medical records, where individual workers cannot be identified.

13.3.4. The results of medical records should be made available to prepare appropriate health statistics and epidemiological studies, provided anonymity is maintained, where this may aid in the recognition and control of occupational diseases.

13.3.5. The competent authority should make arrangements in accordance with national practice to ensure that medical records are maintained for establishments that have closed down.

14. Emergency procedures and first aid

14.1. Emergency procedures

14.1.1. Arrangements should be made to deal at all times, and in accordance with any requirements laid down by the competent authority or as advised by the assessment of risks, with emergencies and accidents which might arise from the use of hazardous chemicals at work.

14.1.2. These arrangements, including the procedures to be followed, should be kept up to date in the light of new information such as that provided in chemical safety data sheets, experience with the chemicals and any changes in the work activity.

14.1.3. Workers should be trained in the relevant procedures. These should describe:

(a) arrangements for raising the alarm;

(b) arrangements for calling for appropriate emergency assistance, whether in plant or off site, e.g. fire-fighting services in the event of a fire and emergency medical services;

(c) the use of appropriate personal protection and its limitations;

(d) the evacuation of the work area, premises or establishment and the location of emergency exits and escape routes;

(e) action to minimise the incident, e.g. tackling the fire, controlling leaks and spills, emergency shut-down, removal of portable pressure vessels in case of fire, and action specifically prohibited if persons are put at risk;

(f) the evacuation of nearby premises.

14.1.4. In some cases it will be necessary to provide for emergency procedures in the event of a foreseeable incident from adjacent work activities or adjacent establishments, which may affect safety during the use of chemicals. Examples might include arrangements:

(a) to cool vessels or other containers from overpressurisation in the event of a fire nearby;

(b) to stop processes and leave plant and equipment in a safe condition in the event of a chemical release from an adjacent plant or site.

14.1.5. Where an incident may affect people or property outside the establishment in which the work activity takes place, appropriate procedures should be developed in consultation with the national authorities or services that may have relevant responsibilities, e.g. external emergency services and local authorities. Guidelines on preparing an emergency response plan in the event of such an incident can be found in

the ILO code of practice, *Prevention of major industrial accidents* (Geneva, 1991), and in the UNEP handbook, *Awareness and preparedness for emergencies at local level (APELL): A process for responding to technological accidents* (Paris, 1988).

14.2. First aid

14.2.1. Adequate first-aid arrangements should be provided. These arrangements should take account of the hazardous chemicals used at work, ease of communications, and the emergency services and facilities available. They should be in accordance with any requirements laid down by the competent authority.

14.2.2. As far as is practicable, appropriate means and trained personnel for rendering first aid should be readily available at all times during the use of hazardous chemicals at work. The term "trained personnel" includes persons trained in first aid, registered nurses or medical practitioners, for example.

14.2.3. Where hazardous chemicals are used, first-aiders should be trained as regards:

(a) the hazards associated with the chemicals and how to protect themselves from these hazards;

(b) how to take effective action immediately;

(c) any relevant procedures associated with sending a casualty to hospital.

14.2.4. An assessment of the first-aid needs should be made by the employer. The reasonable practicability of having trained personnel readily available will depend on:

(a) the number of employees;

(b) the nature of the work activity;

(c) the size of the establishment and distribution of workers at the worksite;

(d) the situation of the work activity in relation to the nearest hospital or other emergency medical services that may be required.

14.2.5. The first-aid equipment and facilities should be appropriate for dealing with the hazards to be encountered in the use of chemicals at work. Suitable facilities should be available for workers to use themselves, e.g. emergency showers or eyewash stations. These should be strategically placed to allow for their immediate use in the event of an emergency.

14.2.6. There should be ready access at all times to first-aid equipment and to the facilities provided.

14.2.7. Properly equipped first-aid rooms should be provided in accordance with national laws or standards. In general, these should be provided in all establishments:

(a) where there are significant acute hazards to health from the use of chemicals at work; and

(b) taking into account the factors outlined in paragraph 14.2.4 (assessment of first-aid needs).

14.3. Fire fighting

14.3.1. Suitable fire-fighting equipment should be provided for the quantity and characteristics of the chemicals used at work. Adequate equipment should also cover on-site transport and storage.

14.3.2. Portable fire-fighting extinguishers (hand held or trolley mounted) should be provided for first-stage fire-fighting purposes in accordance with national law and standards. The extinguishing medium should be selected as a result of the assessment of risks and control measures.

14.3.3. For other fires which might affect external storage, such as those involving rubbish or vegetation, water hoses and available water supply should normally be provided.

14.3.4. Fire-fighting equipment should be readily available and located in accordance with national law and standards.

14.3.5. Equipment used for fighting fires at storage facilities, or for ensuring adequate cooling of containers exposed to heat from a nearby fire, should be provided and maintained in accordance with national law or with criteria in national or international standards.

14.3.6. Adequate drainage from the workplace should be provided to deal with water used for fire protection and fire fighting. This water should be adequately contained before final removal so as to minimise environmental damage. Interceptors or special drainage systems, particularly at large installations, should be provided to minimise the risk of contamination of local water courses.

14.3.7. Fire-fighting and fire-protection equipment should be maintained in full working order, which should be ensured by regular inspection.

14.3.8. Suitable training, instruction and information should be given to workers about the hazards of fires involving chemicals and the appropriate precautions to be taken. The training, instruction and information provided should include:

(a) not putting themselves unnecessarily at risk;

(b) when and where to raise the alarm;

(c) the use of fire-fighting and fire protection equipment, for workers expected to use it;

(d) the toxic nature of the fumes given off and first-aid measures;

(e) the proper use of appropriate personal protective equipment;

(f) evacuation procedures;

(g) the circumstances in which workers should not attempt to deal with a fire themselves but should evacuate the area and call in specialist trained fire-fighters.

Where reliance is placed on trained fire-fighters, whether in plant or off site, then such arrangements should be emphasised and the action expected of workers clearly explained.

14.3.9. Adequate information to enable adequate precautions to be taken should be given to trained fire-fighters and other emergency responders coming from off site about the nature of the chemical fire and its hazards. Information about potentially very serious risks, which have been identified, should be given to the employers of off-site fire-fighters, irrespective of whether there has been an incident. This will enable them to take adequate precautions, e.g. to provide specialised clothing where there are highly toxic hazards.

15. Investigation and reporting of accidents, occupational diseases and other incidents

15.1. Investigation of accidents and other incidents

15.1.1. In order to assess the risks and take any corrective steps necessary, the employer, in cooperation with workers and their representatives, should investigate immediately:

(a) accidents and other incidents, whether or not they cause bodily injury;

(b) suspected and confirmed cases of occupational disease;

(c) situations where workers have removed themselves from danger;

(d) any other situation where there may be an unacceptable risk involving hazardous chemicals.

15.1.2. The investigation should include a review of the existing control measures.

15.2. Reporting of accidents, occupational diseases and other incidents

15.2.1. Accidents, occupational diseases and other incidents involving hazardous chemicals should be reported to the competent authority in accordance with national laws and practice.

15.2.2. In the case of incidents leading to injury or illness, examples of reporting requirements may include:

(a) periods of absence from work which may be prescribed by the competent authority;

(b) work-related injury or illness requiring medical treatment, or loss of consciousness, resulting in either case from the absorption of any chemicals by inhalation, ingestion or skin absorption;

(c) any other work-related injury or illness resulting in the injured or sick person being admitted immediately into hospital and kept there for more than a period which may be prescribed as reportable by the competent authority.

15.2.3. The competent authority may specify and periodically review which diseases are prescribed as being of occupational origin and which require reporting, in accordance with national laws or regulations.

15.2.4. In the case of other incidents, reportable incidents might include:

(a) an explosion or fire causing the suspension of normal work or stoppage of plant, which may be prescribed by the competent authority, where such fire or explosion was due to the ignition of a hazardous chemical, including by-products, intermediates and any waste products;

(b) the sudden, uncontrolled release of a certain quantity of hazardous chemicals, which may be prescribed by the competent authority, from plant or during transport including site and cross-country pipelines;

(c) a fire involving a hazardous chemical during transport.

Annex: A possible approach for the protection of confidential information

1. Introduction

In achieving an appropriate balance in making "special provision to protect confidential information whose disclosure to a competitor would be liable to cause harm to an employer's business so long as the safety or health of workers are not compromised thereby", as specified in Article 1, paragraph 2 (b), of the Chemicals Convention, 1990 (No. 170), and depending on national law and practice, the competent authority may take into account the guidance in this annex.

2. General requirements

All safety and health information should be provided on the label or chemical safety data sheet. However, in those circumstances where the name or concentration of an ingredient of a chemical mixture is confidential information, the competent authority should establish special provision for its protection, so long as the safety and health of the worker is not compromised and provided that the supplier or employer:

(a) can support the claim that information is confidential information in accordance with national law and practice;

(b) discloses all other required information concerning the hazardous chemical on the label and chemical safety data sheet;

(c) indicates on the chemical safety data sheet that the specific chemical identity or composition is being withheld as confidential information;

(d) makes available the specific chemical identity or composition to safety and health professionals, workers and workers' representatives in accordance with the provisions of this Annex.

3. Emergency disclosure

Where a treating physician or nurse determines that a medical emergency exists due to exposure to a hazardous chemical, the supplier or employer should immediately disclose the confidential information necessary for treatment to the treating physician or nurse, who should maintain the confidentiality of the information.

4. Non-emergency disclosure

4.1. In non-emergency situations, a supplier or employer should, upon request, disclose confidential information to a safety or health professional (e.g. physician, industrial hygienist, safety engineer, toxicologist, epidemiologist, occupational health nurse) providing medical or other occupational safety and health services to exposed workers, and to workers or workers' representatives, on condition that:

(a) the request is in writing;

(b) the request describes with reasonable detail one or more of the following occupational safety and health needs for the information:

  (i) to assess the hazards of the chemicals to which workers will be exposed;

  (ii) to conduct or assess sampling of the workplace atmosphere to determine worker exposure levels;

  (iii) to conduct pre-assignment medical examinations of workers who will be assigned to tasks involving exposure, or periodic medical examinations of exposed workers;

  (iv) to provide medical treatment to exposed workers;

  (v) to select or assess appropriate personal protective equipment for exposed workers;

  (vi) to design or assess engineering controls or other protective measures for exposed workers;

  (vii) to conduct studies to determine the health effects of exposure;

(c) the request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information;

(d) the persons to whom the confidential information is disclosed agree in a written confidentiality agreement not to use the confidential information for any purpose other than the safety and health need(s) asserted and agree not to disclose the information except as authorised by the terms of the agreement.

4.2. If the requester has complied with paragraphs 4.1 (a) to (d), the confidential information should be disclosed. However, the supplier or employer may, in lieu of disclosure, suggest that the following information will satisfy the purposes described in paragraph 4.1 (b):

(a) additional properties and effects of the chemical;

(b) additional measures for controlling workers' exposure to the chemical;

(c) methods of monitoring and analysing workers' exposure to the chemical;

(d) alternative methods for diagnosis and treatment of the harmful effects of exposure to the chemical.

5. Resolution of denials

5.1. The competent authority should establish rules and procedures addressing a denial of a written request for confidential information, which should determine whether:

(a) the supplier or employer has supported the claim that the specific chemical identity or composition is confidential information;

(b) the safety and health professional, worker or workers' representative has supported the claim that there is a medical or occupational safety and health need for the information as specified in paragraph 4.1 (b) (i) to (vii); and

(c) the safety and health professional, worker or workers' representative has demonstrated adequate means to protect the confidentiality.

5.2. The competent authority should issue an order consistent with these determinations which denies access to the information, grants access to the information or grants access to the information with additional protective provisions.

6. Review of determinations and orders

6.1. Determinations and orders so issued by the competent authority may be appealed against by either party in accordance with established procedures.

6.2. Determinations and orders so issued by the competent authority should not become final pending completion of the appeal, unless contrary to national law and practice.

6.3. Where there is failure to comply with a final order, the competent authority should initiate legal action in accordance with national law and practice.

7. Disclosure to the competent authority

A supplier or employer should, upon request, disclose to the competent authority any confidential information. The competent authority should maintain the confidentiality of such information in accordance with national law and practice.

8. Disclosure of process information

Nothing in this annex should be construed as requiring the disclosure of process information which is confidential unless the physical conditions of the process create or increase a chemical risk which compromises the safety and health of workers.

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