

GUIDANCE CONCERNING HEALTH ASPECTS OF CHEMICAL ACCIDENTS

**For Use in the Establishment of Programmes and Policies Related to Prevention of, Preparedness for,
and Response to Accidents Involving Hazardous Substances**

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1996

42818

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Related to Prevention of, Preparedness for, and Response to
Accidents Involving Hazardous Substances

*To Be Read in Conjunction with the OECD Guiding Principles
for Chemical Accident Prevention, Preparedness and Response*

Environment Directorate

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1996

The Inter-Organization Programme for the Sound Management of Chemicals (IOMC) was established in 1995 by UNEP, ILO, FAO, WHO, UNIDO and the OECD (the Participating Organizations), following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

About the OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organization in which representatives of 28 industrialized countries in North America, Europe and the Pacific, as well as the European Commission, meet to co-ordinate and harmonize policies, discuss issues of mutual concern, and work together to respond to international problems. Most of the OECD's work is carried out by more than 200 specialized Committees and subsidiary groups composed of Member country delegates. Observers from several countries with special status at the OECD, and from interested international organizations, attend many of the OECD's Workshops and other meetings. Committees and subsidiary groups are served by the OECD Secretariat, located in Paris, France, which is organized into Directorates and Divisions.

The work of the OECD related to chemical accident prevention, preparedness and response is carried out by the Expert Group on Chemical Accidents, with Secretariat support from the Environmental Health and Safety Division of the Environment Directorate. As part of its work on chemical accidents, the OECD has issued several Council Decisions and Recommendations (the former legally binding on Member countries), as well as numerous Guidance Documents and technical reports including the OECD *Guiding Principles for Chemical Accident Prevention, Preparedness and Response*; the joint IPCS/OECD/UNEP/WHO publication, *Health Aspects of Chemical Accidents* (on which this Guidance Document is based); users' guides to hazardous substance data banks and to information systems useful to emergency planners and responders; and the joint OECD/UNEP *International Directory of Emergency Response Centres*.

This Guidance Document was produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals (IOMC). Derestriction was recommended by the OECD's Joint Meeting of the Chemicals Group and Management Committee of the Special Programme on the Control of Chemicals. A French translation is being prepared. This document is published on the responsibility of the Secretary-General of the OECD.

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There is a list of OECD Environmental Health and Safety publications beginning on page 51.

To Assist the Reader

The **Glossary** in **Section J** provides definitions for purposes of this text. These definitions have been taken, for the most part, from the OECD *Guiding Principles for Chemical Accident Prevention, Preparedness and Response* as well as from relevant World Health Organization documents.

Some of the terms defined in the Glossary may not be well known. In addition, the meaning of some of these terms may not always be clear in the particular context in which they are used without reference to the Glossary. Furthermore, while an attempt has been made throughout the text to use words in a manner consistent with their common meanings, some words are understood differently in different countries and contexts.

It should be noted that the term "accident" has been defined in a manner consistent with the OECD *Guiding Principles* (i.e. "an unplanned, sudden event which causes or is liable to cause injury to people or damage to buildings, plant, material or the environment"). However, the WHO and other organizations focusing on health issues use the term "chemical accident" to refer to "an event or dangerous occurrence resulting in the release of a substance or substances hazardous to human health and/or the environment in the short or long term." (See pages 36-37 of the *Health Aspects of Chemicals Aspects*, a 1994 publication prepared as a joint effort of IPCS, OECD, UNEP IE, and WHO-ECEH). These two terms refer to the same types of events (for example, fires, explosions, leakages, or other releases of hazardous substances). In any case, this text has been prepared to be flexible in its application in different countries and cultures.

The **Key Word Index** in **Section L** will help the reader locate the paragraphs that concern a particular subject or party. The cross-references in Section L refer to related, although not necessarily identical, concepts.

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I. Introduction

1. This text has been prepared with the recognition that hazardous substances are present in communities around the world, mainly in industrial facilities and in transit via highways, rail and waterways. Accidents, including fires, explosions and leakages resulting in the release of these substances, can have adverse effects on human health, property and the environment. Human exposure to hazardous substances can cause injury or even death to a large number of people. Human exposure may occur directly through eye exposure, skin contact, inhalation or ingestion, or as a result of contamination of water or soil, which can affect the food chain.

2. The population at risk in the event of an accident (or the "potentially affected public") is, for the most part, either inside or immediately outside an industrial site or near transportation routes, although dispersed populations may be affected through the contamination of water or the food chain. Less frequently, the exposed population may be at some distance from the accident site, possibly in areas across national borders.

3. For purposes of this and other OECD documents related to chemical accident prevention, preparedness and response, the focus is on accidents at fixed installations involving hazardous substances that could affect people, property or the environment, although many provisions also apply to transport accidents. "Fixed installations" are defined broadly as including plants or sites that produce, process, use, handle, store, or dispose of hazardous substances. Thus, fixed installations include facilities of chemical manufacturers, as well as other industrial sites where chemicals are used or handled; warehouses containing hazardous substances; disposal facilities; and ports and other designated transport interfaces.¹

4. It should be noted that many elements of the community, industry and government are involved in efforts to prevent, prepare for, and respond to chemical accidents. The OECD *Guiding Principles for Chemical Accident Prevention, Preparedness and Response*² provide a blueprint for such efforts. The *Guiding Principles* give an overview of the actions which should be taken by public authorities, industry, labour and other interested parties. They have been the starting point for the development of this text concerning the health-

¹ See the joint International Maritime Organization (IMO)/OECD *Guidance Concerning Chemical Safety in Port Areas: Guidance for the Establishment of Programmes and Policies Related to Prevention of, Preparedness for, and Response to Accidents Involving Hazardous Substances* (OECD, Paris, 1996).

² *Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry, Labour and Others for the Establishment of Programmes and Policies related to Prevention of, Preparedness for, and Response to Accidents Involving Hazardous Substances* (OECD, Paris, 1992).

related aspects of chemical accidents. In that regard, it should be noted that the general premises and definitions set out in the *Guiding Principles* also apply to this text.

5. This guidance focuses on aspects of chemical accident prevention, preparedness and response specific to the protection of human health including, for example, the need for special expertise and resources when there is a likelihood of human exposure to hazardous substances. Not all of the relevant provisions of the *Guiding Principles* have been repeated. However, it should be understood that this guidance should be used in the context of the *Guiding Principles*, and that actions by health/medical professionals and others interested in the protection of human health should not be undertaken in isolation from related activities of the other stakeholders.

6. The aim of this text is to provide guidance to managers and other decision-makers in order to improve prevention of accidents involving hazardous substances which might affect human health and, should an accident occur, to minimize adverse effects on human health. As the focus is on the health aspects of accidents, this text is particularly directed to officials in the health/medical field including those working in, for example:

- ministries of health, labour, industry and transport;
- regional and local health authorities and inspectorates;
- hospitals and other treatment facilities;
- providers of toxicological/health information, such as poison information centres (PICs) and chemical emergency centres;
- hazardous installations (in a health/medical capacity);
- occupational health centres; and
- suppliers of pharmaceuticals and medical equipment.

7. This document is also directed to other organizations and officials who need to consider health aspects of accidents involving hazardous substances, and to work closely with health/medical personnel on accident prevention, preparedness and response.

II. Background

8. To develop the basis for this guidance, the OECD joined with three United Nations bodies which have particular expertise in this subject:

- the International Programme on Chemical Safety (IPCS);
- the United Nations Environment Programme Industry and Environment centre (UNEP IE); and
- the World Health Organization European Centre for Environment and Health (WHO-ECEH).

9. The four collaborating organizations hosted an international Workshop on Health Aspects of Chemical Accidents at Utrecht, in the Netherlands, in April 1993. This Workshop brought together approximately 100 medical and other professionals, who had an opportunity to comment on several documents prepared by the host organizations and discuss related issues, with the objective of developing sound, up-to-date and practical guidance applicable worldwide. The documents were revised following the Workshop, taking into account the collective experience of the participants. The revised Workshop documents have been published in *Health Aspects of Chemical Accidents: Guidance on Chemical Accident Awareness, Preparedness and Response for Health Professionals and Emergency Responders*.³

10. *Health Aspects of Chemical Accidents* was used as the basis for this Guidance Document. Earlier drafts of this document were circulated for review and comment by the OECD's Expert Group on Chemical Accidents, the three collaborating organizations, health care professionals, and industry and trade union representatives.

³ Available in English and French from any of the collaborating organizations. Published as IPCS Joint Series 22, OECD Environment Monograph No. 81, and UNEP IE Technical Report No. 19 (Paris, 1994).

III. Provisions

A. Executive Summary

A.1 Prevention

A.1.1. Public authority and corporate policies related to hazardous installations should have, as primary objectives, preventing accidents involving hazardous substances and limiting any adverse health consequences should an accident occur.

A.1.2. Public authorities should set general safety objectives and establish a clear and coherent control framework with respect to accidents involving hazardous substances. In this regard, they should seek to protect the health of workers and the public through the development and implementation of appropriate laws, regulations, standards, codes and guidance.

A.1.3. Management of a hazardous installation has the primary responsibility for designing, constructing and operating the hazardous installation in a safe manner and for developing the means to do so. It should therefore put into place the systems, procedures and structures needed to help ensure the prevention of accidents and, should an accident occur, to ensure timely and adequate response to limit adverse health consequences or other damage. Employees and their representatives should be involved in the development and implementation of such systems, procedures and structures.

A.1.4. Public authorities, including health authorities, in different countries should co-operate and should exchange information which could help prevent accidents or human exposure to chemicals.

A.1.5. Health/medical professionals should be involved in decision-making relating to the prevention of chemical accidents.

A.1.6. Systems should also be established to promote the sharing of information among health/medical professionals, including research scientists and academics, both within a country and internationally.

A.2 Emergency Preparedness

A.2.1. Public authorities at all levels, and management of hazardous installations, should establish emergency preparedness programmes concerning accidents involving hazardous installations. Public health authorities at national, regional and local levels and other health/medical personnel should be intimately involved in relevant emergency planning activities.

A.2.2. The roles and responsibilities of individuals and organizations expected to be involved in emergency response activities should be clearly defined in emergency plans (including, for example, representatives from public authorities, management, and employees and their representatives). From the health field these parties should include, but are not limited to, representatives from: health ministries; local and regional health authorities; the health/medical professions; hospitals and other treatment facilities; occupational safety and health inspectorates and factory inspectorates; health/medical staff of hazardous installations; information providers; emergency rescue services; and suppliers of pharmaceuticals and medical equipment.

A.2.3. As part of the emergency planning process, there should be an identification of potential risks and the geographical zones where effects are likely to occur in the event of an accident.

A.2.4. Preparedness (and response) decisions should take into consideration the nature of possible clinical, as well as psychological, effects on those potentially affected, including response personnel, workers, and the local population.

A.2.5. On- and off-site emergency plans should be reviewed regularly and kept up-to-date. The medical aspects of on-site and off-site emergency plans at all levels should be tested under simulated conditions, in conjunction with regular exercises of the plans.

A.2.6. As part of the emergency planning process, there should be an assessment of the types of emergency medical resources, including personnel, equipment, facilities, supplies and funds, needed to respond to different types of emergencies and the range of possible casualties.

A.2.7. The availability of up-to-date antidotes, as well as other emergency pharmaceutical supplies necessary for the treatment of the number of persons who may potentially be injured by hazardous substances, should be ensured.

A.2.8. Hospitals and other treatment facilities, which may be called on during response to an accident involving hazardous substances, should develop systems for receiving and handling large numbers of patients at one time.

A.2.9. Since personnel, equipment, and other resources available for medical response to an accident will often be limited, consideration should be given to pooling of resources among neighbouring communities and neighbouring countries.

A.2.10. As part of the planning process, information and communications needs should be examined. The parties who need information, and the types of information they require,

should be identified. The emergency plan should provide for appropriate communication and co-ordination among all members of the response team.

A.2.11. Health-related information provided for emergency preparedness and response activities should be clear, concise, and geared to the audience to which it is addressed.

A.2.12. Public authorities in each country should ensure that designated information sources are available for use in regard to health/medical aspects of emergency planning and response. Networking among information centres/sources should be promoted.

A.2.13. Health/medical personnel who may be involved in emergency response should acquaint themselves with the substances produced, used, transported or otherwise handled in significant quantities in their community. They should also make it their responsibility to be aware of relevant aspects of local emergency plans, and of their own roles within these plans.

A.2.14. Industry should make available, for emergency preparedness and response purposes, health-related information concerning the hazardous substance(s) it stores, handles, processes, manufactures and/or distributes, or which are otherwise used in the workplace.

A.3 Emergency Response

A.3.1. In an emergency response, health/medical personnel and facilities should be part of the overall response team and part of the information chain, in order to provide and receive information as appropriate.

A.3.2. Systems should be in place for the collection, dissemination and updating of information available to health/medical personnel and other parties as the emergency response progresses, including medical information or advisories provided to the public via the media.

A.3.3. The on-site co-ordinator should decide on the immediate actions to take, including actions intended to avoid or limit the exposure to hazardous substances, based on preliminary information concerning the site, nature of the release, hazardous substance(s) involved, and any related analyses. Health/medical personnel should provide assistance, upon request, in arriving at such decisions.

A.3.4. The on-site co-ordinator should take measures to avoid the contamination of rescue workers.

A.3.5. Arrangements should be made for the provision of first aid and other medical treatment outside the contaminated area. Initial care should be administered at the accident site, in order to give the injured the treatment necessary to ensure that they are in stable condition before being taken (if necessary) to a main treatment facility.

A.3.6. Triage for victims of accidents involving hazardous substances should follow the rules that apply generally in emergency situations.

A.3.7. Hospitals and other treatment facilities should put their emergency plans into effect as soon as they are alerted that there is a possibility of patients arriving as a consequence of an accident involving hazardous substances. These facilities should be provided, as soon as possible, with information on the hazardous substance(s) involved, the type of accident (spill, fire, etc.), the likely number of victims, and the nature of their injuries.

A.3.8. For the appropriate treatment of exposed victims, emergency medical professionals should have access to specialized information and should be able to consult with specialists.

A.3.9. Following an accident, psychological support should be made available at an early stage.

A.3.10. Appropriate follow-up procedures should be put into place for monitoring and observation of persons seemingly unaffected by exposure to hazardous substances.

A.4 Training and Education

A.4.1. Public health and education authorities should ensure that health/medical personnel involved in emergency response activities are well trained and educated.

A.4.2. Health/medical personnel should also contribute, where appropriate, to the training of those outside the health sector who are likely to be involved in emergency response activities.

A.4.3. First responders (police, fire and ambulance personnel) should be trained and educated to be able to take appropriate actions to minimize the human health effects of accidents involving hazardous substances.

A.4.4. Management should ensure that everyone employed at a hazardous installation receives appropriate training and education on how to handle hazardous substances, on procedures to follow in order to avoid accidents occurring, and on actions to take, should an accident occur, in order to minimize adverse health consequences for those at the installation as well as the public.

A.4.5. The effectiveness of training and education programmes should be regularly assessed. As part of this process, simulation exercises should be carried out to test the competency of those likely to be involved in accident response.

A.5 Communication with the Public

A.5.1. Efforts should be made by public authorities and industry to improve public awareness of chemical hazards in the community, and of how to respond in the event of an accident, for example through an understanding of the procedures related to possible evacuations and to sheltering in place.

A.5.2. All members of the response community, including members of the health/medical professions, should co-ordinate with the media in order to ensure that any health-related information disseminated in regard to accidents involving hazardous substances is accurate and consistent.

A.5.3. If an accident occurs, the public should be given, on a continuing basis, specific information on the appropriate behaviour and safety measures to adopt.

A.6. Accident Investigation and Follow-up

A.6.1. Appropriate epidemiological and medical follow-up to chemical accidents should be initiated following the release of toxic chemicals.

A.6.2. Persons who may have had significant exposure to toxic chemicals during an accident, whether they appear to be affected or not, should be examined and properly registered to allow for short- and long-term follow-up. It may be advisable to take biological samples for immediate and later analysis.

A.6.3. Management should support the active participation by employees and others in accident investigations.

A.7. Research and Development

A.7.1. Research should be undertaken to reduce the likelihood of adverse health effects in connection with accidents involving hazardous substances, and to improve treatment should such adverse effects occur.

B. Prevention

B.1. Prevention of accidents involving hazardous substances is the concern of all interested parties, including public authorities at all levels (for example, national, regional and local health authorities), industry, employees and their representatives, and the community. This would also include representatives of the health care sector. (See Section B.1 of the *Guiding Principles*.)

B.2. Public authority and corporate policies related to hazardous installations should have as primary objectives preventing accidents involving hazardous substances, and limiting any adverse health consequences should an accident occur. For example, with respect to the design and operation of hazardous installations, the following actions should be considered to the extent that they could enhance safety and thereby reduce the potential for adverse health effects:

- substitution, for hazardous substances, of substances that are less hazardous;
- minimization, to the extent reasonably practicable, of the use or storage of hazardous substances;
- adaptation of process design to reduce complexity, temperature and pressures; and
- reduction of the likelihood of human exposure in the event of an accident, by physically separating people from hazardous substances.

(See Sections B.4 and B.5 of the *Guiding Principles*.)

B.3. Public authorities should set general safety objectives and establish a clear and coherent control framework with respect to accidents involving hazardous substances.

- (i) In this regard, public authorities should seek to protect the health of employees and the public through the development and implementation of appropriate laws, regulations, standards, codes and guidance.
- (ii) In developing safety objectives and the control framework, public authorities should consult with representatives of other stakeholders, including health/medical professionals. (See Section B.2 of the *Guiding Principles*.)

B.4. Public authorities should establish land use planning arrangements which would lead to appropriate siting of hazardous installations, in order to minimize the adverse health effects of any accidents involving hazardous substances. These arrangements should prevent the location of inappropriate developments near hazardous installations (for example, housing, schools, recreation facilities, hospitals) and inappropriate changes to existing installations. (See Section C of the *Guiding Principles*.)

B.5. Public authorities, for example health authorities, in different countries should co-operate including through exchanges of information which could help prevent accidents or human exposure to chemicals as a consequence of an accident. This co-operation could be undertaken directly and/or through international organizations.

B.6. Management has the prime responsibility for designing, constructing and operating a hazardous installation in a safe manner and for developing the means to do so. It should therefore put into place the systems, procedures and structures needed to help ensure prevention of accidents and, should an accident occur, those which will be needed for timely and adequate response in order to limit adverse health consequences or other damage. Employees and their representatives should take part in the development and implementation of such systems, procedures and structures. (See Section B.3 of the *Guiding Principles*.)

B.7. Health/medical professionals should be involved in decision-making relating to the prevention of chemical accidents.

- (i) For example, they should be consulted when decisions are being made concerning the siting, construction, licensing and maintenance of hazardous installations.
- (ii) They should also be involved in the development and implementation of industry training and education programmes related to the prevention of, and response to, accidents involving hazardous substances.

B.8. Systems should be established to promote the sharing of information among health/medical personnel, including research scientists and academics, both within countries and internationally. The types of information which could be shared include practical approaches to management and communication networks; emergency planning procedures; toxicological studies; human epidemiological studies; and case histories concerning acute exposures to chemicals.

B.9. Particular attention should be given to the role of human factors in preventing accidents at hazardous installations, recognizing that humans will on occasion fail and that the majority of accidents are in some part attributable to human error, meaning human actions which unintentionally exploit weaknesses in equipment, procedures, systems and/or organizations. (See Section B.5 of the *Guiding Principles*.)

- There should be pre-employment and periodical medical screening of employees, as appropriate, to minimize the likelihood that the state of their physical or mental health will increase the risk of an accident involving hazardous substances.

C. Emergency Preparedness

C.1 Emergency Preparedness: General

C.1.1. Public authorities at all levels, and management, should establish emergency preparedness programmes concerning accidents involving hazardous installations.

- (i) Public authorities should develop guidelines and standards for off-site and on-site emergency preparedness plans. They should also ensure the development, implementation, testing and updating of these plans in co-ordination with the management of hazardous installations and, as appropriate, with the participation of other stakeholders. It is recognized that the responsibility for the actual development and implementation of the plans will differ among countries.
- (ii) There must be close co-operation among those responsible for off-site and on-site emergency planning.

(See Section E.1 of the *Guiding Principles*.)

C.1.2. Public health authorities at national, regional and local levels and other health/medical personnel should be intimately involved in relevant emergency planning.

- (i) As emergency planning is a multi-disciplinary task, there should be close co-operation among the various parties involved in planning and response, including both health/medical and non-medical organizations. Thus, health/medical personnel should work closely with public authorities and others in the community who have been designated to take part in the development of such plans. This applies to the development of on-site and local off-site emergency plans, as well as any regional and national emergency plans.
- (ii) In this regard, public health authorities, along with other health/medical personnel, should be responsible for developing the health-related components of preparedness plans, as part of the overall emergency planning process. Public health authorities and other health/medical personnel should be involved in, among other areas, toxicological interpretation, exposure and risk assessment, medical management, training of key personnel, follow-up systems, epidemiological investigations, and research.

C.1.3. Management of hazardous installations should provide, without reservation, information it has which is necessary in order to assess hazards and develop off-site plans. (See Section E.1 of the *Guiding Principles*.)

C.1.4. The roles and responsibilities of the individuals and organizations expected to be involved in emergency response activities should be clearly defined in emergency plans. From the health field, these parties should include representatives from health ministries; local and regional health authorities; the health/medical professions; hospitals and other treatment facilities; occupational safety and health inspectorates and factory inspectorates;

health/medical staff of hazardous installations; information providers; emergency rescue services; and suppliers of pharmaceuticals and medical equipment.

C.1.5. As part of the emergency planning process, potential risks and the geographical zones where effects are likely to occur in the event of an accident involving hazardous substances should be identified. These zones should indicate, *inter alia*, the public potentially affected and those areas for which decisions concerning evacuation, sheltering in place, or other actions to limit exposure may be taken. The identification of such zones should also provide an indication of the nature and extent of resources which may be needed in the event of an accident.

- (i) The identification of zones where effects are likely to occur should take into account the possibility that adverse health effects can result from **direct contact** with toxic or irritating substances (for example, through eye exposure, skin contact or inhalation); from thermal radiation or overpressure; from **indirect exposure** (for example, through ingestion of contaminated food or water); or from **indirect injuries** (for example, from collapsing structures, projectiles, or fire).
- (ii) The identification of zones where effects are likely to occur should indicate the existence of areas or developments with sensitive populations such as hospitals, schools, or other locations where children congregate, and nursing/retirement homes.
- (iii) The identification of such zones and possible impacts should be made on the assumption of a worst-case accident scenario.
- (iv) It should be recognized that, at the time of an accident, the areas at actual risk will need to be determined based on the nature of the hazardous substance(s) released, the weather conditions/prevailing winds, and likely dispersion of the substance(s) in the environment.

C.1.6. Preparedness (and response) decisions should take into consideration possible types of clinical, as well as possible psychological, effects on those potentially affected (for example, response personnel, employees and the local population).

- (i) In this regard, it should be taken into account that health effects on exposed populations can be short-term and/or long-term. Adverse effects may appear immediately or some time after the accident. As indicated above, such effects might be direct or indirect.
- (ii) Psychological effects, not necessarily directly related to exposure to the hazardous substances involved in the accident, could appear during or after the accident. Emergency planning should therefore, as appropriate, include mechanisms for diagnosing stress reactions (in, for example, emergency response personnel, employees and the public) and actions which should be taken to deal with possible psychological effects (including, for example, the formation of crisis counselling teams). In high-risk areas, epidemiological data and internationally accepted instruments for the assessment of mental health

impacts should be available so that monitoring can take place in the event of an accident.

- (iii) Preparedness decisions should also take into account mechanisms for reducing stress on those with responsibilities for crisis management and communication.
- (iv) It should be recognized that addressing psychological effects of accidents may result in significant consumption of emergency/health response resources, not only in the short term but also with respect to the need for long-term support.

C.1.7. Health care providers normally should not enter contaminated areas. Nevertheless, the planning process should take account of the need to protect them from exposure to hazardous substances as a consequence of handling victims who have not been properly decontaminated, and from exposure at the accident site due to, for example, unexpected changes in wind direction or participation in decontamination procedures.

- (i) Only exceptionally (for example, for triage and life-saving procedures) should health care providers be permitted to enter a contaminated area. In such cases, they should be fully protected and accompanied by rescue personnel.
- (ii) Health care workers who might need to handle contaminated victims, or who otherwise might be exposed to hazardous substances, should receive appropriate education and training, including in the use of personal protective equipment.

C.1.8. On- and off-site emergency plans should be reviewed regularly and should be kept up-to-date.

C.1.9. The medical aspects of on-site and off-site emergency plans at all levels should be tested under simulated conditions. Public health authorities should take part in regular exercises along with other relevant authorities, in order to test emergency plans and train medical emergency response personnel. (See paragraph E.1.13 of the *Guiding Principles*.)

- During such exercises attention should be paid to health-related elements of the plans, such as the availability of medical personnel, equipment and information and communications among, and co-ordination of, the various agencies/organizations involved.

C.1.10. The organization and planning of health-related response to accidents should involve veterinarians and others familiar with the care of livestock and pets.

C.1.11. The "Polluter-Pays Principle", with respect to medical aspects of emergency preparedness and response related to accidents involving hazardous substances, should be applied, as appropriate, in accordance with OECD Council Recommendation C(89)88(Final). (See Annex III of the *Guiding Principles*.)

C.1.12. Public authorities, including health authorities, in different countries should exchange information which could help reduce adverse health effects of accidents involving hazardous substances. This could be done directly and/or through international organizations.

C.2 Emergency Preparedness: Availability of Personnel, Equipment, Supplies, Facilities and Procedures

C.2.1. As part of the emergency planning process, there should be an assessment of the types of emergency medical resources needed to respond to different types of emergencies and to the range of possible casualties (including personnel, equipment, facilities, supplies and funds). In this regard, consideration should be given to the need for, for example, transportation facilities, decontamination equipment for on-site and hospital use, personal protective equipment for response and decontamination personnel, pharmaceutical supplies, extra bedding, sampling equipment, and communication equipment.

- (i) Access to essential emergency medical resources should be ensured.
- (ii) The primary consideration in determining the need for personnel, equipment, facilities, supplies and funds should be the type of medical problems which might be encountered, based on possible releases of hazardous substances which may occur in the community. However, the type and number of health/medical response personnel may vary from country to country and among communities according to applicable laws, regulations and policies, as well as available resources.
- (iii) All emergency equipment should be in working order, reliable, effective, available, and accessible at short notice.
- (iv) Decisions concerning those with authority to release and use emergency resources should be made prior to an accident, and should be clearly indicated in the preparedness plan.

C.2.2. Hospitals and other treatment facilities which may be called upon during response to an accident involving hazardous substances should develop systems for receiving and handling large numbers of patients at one time addressing, for example, triage, arrangements for patient identification and documentation, and possible decontamination. In this regard, hospitals and other treatment facilities should:

- develop standard operating procedures that can be used in the event of an emergency;
- maintain an inventory of available equipment that might be needed, and have up-to-date information on how to obtain additional equipment;
- ensure that decontamination equipment facilities are available (if not on-site, then where mobile units may be obtained);

- maintain a register of health/medical personnel who could be called upon to assist the hospitals/facilities providing care during an emergency;
- have plans for sending patients to other hospitals/facilities when necessary;
- have a designated (separate) telephone line, in service 24 hours a day every day of the year, for use by emergency services in the event of an accident;
- institute sampling procedures for the collection, storage and analysis of biological (human) specimens. This should include biological sampling, as soon as possible, of those who have been exposed or might have been exposed to hazardous substances, including those who do not exhibit any immediate symptoms; and
- establish mechanisms for follow-up and monitoring.

C.2.3. Provision should be made for rapid transformation of facilities normally used for other purposes, in order to accommodate emergency needs. For example, when access to a hospital is limited, alternative premises such as schools, sports facilities and tents should be identified as places where temporary medical care could be provided to accident victims.

C.2.4. Emergency plans should indicate the protective measures which should be taken in the event a hospital or treatment facility is contaminated as a result of an accident. Plans should provide for alternative treatment facilities if there is a possibility that the primary designated facilities could become contaminated.

C.2.5. Since the personnel, equipment, and other resources available for medical response to an accident are often limited, consideration should be given to the pooling of resources among neighbouring communities and neighbouring countries.

C.2.6. The availability of up-to-date antidotes and other emergency pharmaceutical supplies, including oxygen, in quantities adequate to treat the number of persons who could potentially be injured by hazardous substances should be ensured. Since there are not specific antidotes for most chemicals, attending medical personnel should rely on supportive therapies and rapid decontamination.

- (i) Management of hazardous installations should ensure that sufficient quantities appropriate, updated emergency pharmaceutical supplies are easily accessible should an accident occur.
- (ii) Hospitals and other treatment facilities near hazardous installations should also stock appropriate emergency pharmaceutical supplies, including antidotes.
- (iii) If public health authorities are unable to ensure the availability of adequate quantities of emergency pharmaceutical supplies, the industry that uses or produces the hazardous substance(s) in question should be required to make adequate quantities of the appropriate supplies available to the health/medical services.

- (iv) Antidotes and other pharmaceuticals should be checked regularly to ensure that their shelf life has not expired.

C.3 Emergency Preparedness: Access to Information

C.3.1. As part of the planning process, information and communication needs should be examined, identifying the parties who need information and the types of information they require. The emergency plan should provide for appropriate communication and co-ordination among all members of the response team.

- (i) Emergency plans should identify sources of information and emergency response assistance, and the means of rapidly obtaining and disseminating the necessary information (including information for the public).
- (ii) Communication links should be established to ensure the availability and dissemination of the information needed for emergency response, taking into account the need of response personnel to be in a position to deal with a wide range of possible accident scenarios.
- (iii) Exchange of information is a key element in successful emergency planning and response. Information exchange should be interactive, not uni-directional, with mechanisms in place to ensure that information is kept up-to-date.
- (iv) Planning should take into account the possibility that normal means of communication (for example, telephone/fax lines) may be interrupted during emergency situations. The possible need for dedicated telephone phone lines in order to avoid overload, and for alternative communications systems (for example, via radio), should also be recognized.

C.3.2. The types of Information which should be available for response actions include:

- information on the hazardous substance(s) involved in the accident including, for example, physico-chemical properties; possible transformation or degradation products of the substance(s), such as when in contact with water or through pyrolysis; toxicological properties; clinical effects, including acute, delayed and long-term effects; and risk assessments;
- information on first aid and medical treatment appropriate for the user of the information including, for example, the lay (not medically qualified) person, the general practitioner, and the specialized medical expert (such as an intensive care professional). This information should include:
 - . signs, symptoms, and time of onset expected following different types and routes of exposure, such as via the eye, inhalation, skin absorption, and ingestion;
 - . how to decontaminate victims;

- . medical treatment (including use of antidotes where applicable), depending on the circumstances, severity of victims' condition, and availability of hospital or other treatment facilities;
 - . when those initially without symptoms may be expected to develop them (after a delay of hours, or longer);
 - . triage, taking into consideration the possible need to manage a large number of victims, as well as local circumstances (for example, the availability of antidotes, supportive health care facilities or special equipment, and water supplies);
 - . collection and storage of samples for toxicity and other analyses;
 - . protective measures that should be taken by medical and emergency response personnel to avoid becoming contaminated;
 - . the location of necessary pharmaceutical supplies; and
 - . the location of laboratories and the types of analyses they are able to perform;
- information on available medical facilities (including, for example, the location of health care centres and dispensaries, rural or local hospitals, and main central hospitals), together with the types of facilities they can provide (for example, number of beds and availability of supportive care, mechanical ventilators, oxygen supply, and special equipment);
 - means of transporting victims (ambulances, helicopters, etc.);
 - how and when to contact essential services, including central authorities, local authorities, and police, fire and other rescue services;
 - who has the local co-ordinating role in an emergency, and the criteria that determine the transfer of command-and-control to a higher authority; and
 - lists of experts (from industry, public authorities, etc.) who can advise on particular hazardous substances or groups of hazardous substances.

C.3.3. The parties who generally need information include:

- those involved in organizing and planning health-related aspects of emergency response (including relevant public health personnel). For proper planning, they generally need information on the nature and amounts of the hazardous substance(s) present at installations; the types of accidents that could occur; and the number and location of those who could be affected in the event of an accident and possible sensitive populations;

- first responders at the scene of the accident who need to obtain information rapidly on, for example, the hazardous substance(s) involved; the population at risk; how to prevent or limit harm from exposure; how to care for accident victims; how to protect themselves; and the location of hospitals and other local treatment facilities;
-
- health/medical personnel at all levels who may be involved in the response effort. They generally need information on the hazardous substance(s) involved; the extent and concentration of contamination; possible acute and delayed health effects; means of preventing or limiting harm; decontamination procedures, if any are indicated; first aid measures; more detailed treatment information, including specific therapy options for providing adequate care to victims; and some form of risk assessment to determine public health needs; and
- the potentially affected public, who should receive guidance before an accident occurs on how to behave in such a way as to minimize risk or harm to themselves and others in the event of an accident. The public should also be provided with information during the emergency situation, so that they can take the most appropriate action to protect themselves and their families.

C.3.4. Health-related information provided for emergency preparedness and response activities should be clear, concise, and geared to the audience to which it is addressed. For example, the medical information provided to fire and police services will be different in nature from that provided to health/medical personnel.

C.3.5. Public authorities in each country should ensure that designated information centres/sources are available for use in regard to health/medical aspects of emergency planning and response.

- (i) Each country should determine the best approach to achieve this aim. Information sources could include specialized centres established to organize the collection, collation and dissemination of emergency planning and response information concerning human exposure to hazardous substances, such as poison information centres (PICs). They could also include academic institutions, industrial organizations, or other specified sources. In some countries, where there is significant production or transport of hazardous substances, chemical emergency centres have also been established with industry participation.
- (ii) Information should be available from designated information centres/sources on a 24-hour basis every day of the year.
- (iii) Information centres/sources should participate in or contribute to, as appropriate, the emergency planning process.

C.3.6. Networking among information centres/sources should be promoted.

- (i) Where there is more than one centre or other designated source of information in a country, they should be suitably linked.

- (ii) Information centres/sources in different countries should undertake to share information and experience.
- (iii) Lists of national and international experts, and information sources, in various fields should be established and regularly updated.
- (iv) Data related to the occurrence and outcome of accidents involving hazardous substances should be made available to relevant international data bases, and should be accessible without restriction.
- (v) Where there is the possibility of an accident with transboundary effects, or where there is international transport of hazardous substances, specific mechanisms should be established for international co-operation and sharing of any information necessary for an appropriate emergency response.
- (vi) Efforts should be made to overcome any problems associated with language differences that could hinder co-operation. The use of systems based on international nomenclature for hazardous substances may facilitate this.
- (vii) Efforts should also be made to standardise the format in which information is made available for emergency planning and for response to accidents involving hazardous substances, in order to facilitate the sharing of information.

C.3.7. Health/medical personnel who could be involved in emergency response should acquaint themselves with the substances produced, used, transported or otherwise handled in significant quantities in their community. They should also determine how to obtain timely information concerning appropriate response actions. Since time is often a critical factor, these personnel should not wait until an accident occurs to seek information from (possibly) remote sources.

C.3.8. Health/medical personnel should make it their responsibility to be aware of relevant aspects of local emergency plans and of their own roles within these plans.

C.3.9. Industry should make available, for emergency preparedness and response purposes, health-related information concerning the hazardous substance(s) it stores, handles, processes, manufactures and/or distributes, or which are otherwise used in the workplace, including information on composition, relevant physico-chemical properties, and toxicological aspects.

- (i) Arrangements should be made to guarantee the confidentiality of information considered to be a trade secret, where appropriate. However, the provision of information important for the protection of human health and safety should not be unduly hampered by the need to protect trade secrets. Furthermore, multinational enterprises should not claim trade secret protection in one country for information that is freely available in another country.
- (ii) It should be noted that many information centres already handle confidential information, including trade secrets, in their routine work.

- (iii) Health care providers (for example, hospitals, medical emergency planners, health/medical personnel, and information providers) should contact local industries to discuss the information needs of health care providers, as well as the type of advice or information they may in turn be able to provide to industry.

C.3.10. Accidents involving the transport of hazardous substances raise special issues related to access to information. In addition to international and national information requirements, vehicles transporting hazardous substances which would pose a risk to health in the event of release of their cargo should carry additional information addressing, as appropriate, hazard warnings; medical/first aid treatment for those coming into contact with the hazardous substance(s); emergency response actions in the event of an accident; and the telephone number of an emergency response contact or information centre.

D. Emergency Response

D.1 Emergency Response: General

D.1.1. Management of hazardous installations should promptly notify emergency response authorities of all incidents involving hazardous substances which result, or threaten to result, in potential harm to human health or the environment.

D.1.2. In an emergency response, health/medical personnel and facilities should be part of the overall response team and of the information chain, in order to provide and receive information, as appropriate.

D.1.3. The following types of information should be collated, disseminated and updated regularly:

- risk possibilities at the accident site;
- personal protection needs of emergency responders;
- first aid possibilities and limitations;
- the quantity and type of the hazardous substance(s) involved;
- treatment facilities available for emergency response;
- means (ambulances, helicopters, etc.) of transporting victims from the site to treatment facilities;
- medical information related to symptomology, delayed effects, specific treatments required, and decontamination;
- resources that are available or that can be obtained rapidly (for example, pharmaceutical supplies, decontamination and hospital facilities, additional medical staff, biological monitoring services, laboratory facilities, and information sources);
- the registration and triage system being used;
- identification of the hazardous substance(s) involved or, if this information is unavailable, of the category of substance(s) involved, together with information on the likely symptoms of those exposed and the best treatment approach; and
- the expected number and type of patients, the nature of their injuries, and the severity of exposure.

(See Section C.3, above.)

D.1.4. Systems should be in place for continuous updating of the information available to health/medical personnel and other parties as emergency response progresses, including the medical information or advisories provided to the public via the media.

D.1.5. The on-site co-ordinator should decide on immediate actions to take, including those intended to avoid or limit the exposure of individuals to hazardous substances, based on preliminary information concerning the site, the nature of the release, the hazardous substance(s) involved, and any related analysis of such information. Health/medical personnel should provide assistance, upon request, in arriving at such decisions.

- (i) Such immediate actions might include ensuring that shelters for the potentially affected public are in place, or that those persons most at risk are evacuated. Sheltering should be considered when the population would be placed at increased risk if evacuated during the initial phases of the release or threatened release. Decisions concerning sheltering in place should be based on consideration of the substance released; anticipated concentration; toxicity of the substance; duration of the release; release conditions; shelter ventilation; the population to be sheltered; environmental monitoring capabilities; warning time; communication systems; availability of transportation; and citizen training.
- (ii) Appropriate monitoring equipment should be available in order to assist decision-making concerning evacuation and sheltering, as well as on whether the population can freely return to affected areas. If such equipment is unavailable, a risk assessment based on toxicological information should be undertaken.
- (iii) It should be taken into account that, after a plume passes, the concentration of hazardous substances in the shelter can be higher than the concentration outside. In such a case, the population should be instructed to vacate the shelter if the risk of further release of hazardous substances is minimal.

D.1.6. The on-site co-ordinator should take measures to avoid the contamination of rescue workers if there is a possibility of continuing exposure.

- (i) In this regard, the on-site co-ordinator should determine whether there is a contaminated area that should be entered only by personnel wearing protective clothing. This decision may need to be made in co-operation with a medical co-ordinator or industrial hygienist, if available.
- (ii) It should also be determined at an early stage whether there is a need for decontamination facilities at the accident site or at hospitals and other treatment facilities.
- (iii) Consideration should also be given to whether there is a danger that response personnel will be contaminated by exposure to accident victims.

D.1.7. Arrangements should be made for the provision of first aid and other medical treatment outside the contaminated area. In principle, medical personnel should not enter contaminated areas. They should work at casualty assembly points where accident victims

are brought after decontamination. Only exceptionally should medical personnel need to enter the accident area, for example to carry out triage or give life-saving treatment.

- (i) If medical personnel are needed to assist in the contaminated area, or during decontamination procedures (either near the accident site or at a treatment facility), they should, when indicated, wear protective equipment.
- (ii) As a rule, medical personnel treating victims in contaminated areas should be guided by rescue personnel who have been trained to work in such areas.

(See paragraph C.1.7, above)

D.1.8. Triage for victims of accidents involving hazardous substances should follow the rules that apply generally in emergency situations.

- (i) Supporting vital functions should have priority over decontamination.
- (ii) Triage should be a continuous process, with each victim being re-evaluated at regular intervals where possible, taking into account changes in the victims' conditions and the available resources.
- (iii) Since children are generally more sensitive to hazardous substances than adults, they should normally be given higher priority for medical care.
- (iv) It should be recognized that exposed persons with no obvious symptoms may have delayed symptoms and, if so, will require observation, possible immediate treatment, and transport to treatment facilities.

D.1.9. Hospitals and other treatment facilities should put their emergency plans into effect as soon as they are alerted that there is a possibility of patients arriving as a consequence of an accident involving hazardous substances.

D.1.10. Hospitals and other treatment facilities that may be involved in responding to an accident should be provided, as soon as possible, with information on the hazardous substance(s) involved, the type of accident (spill, fire, etc.), the likely number of victims, and the nature of their injuries.

- (i) This information should be used to make an early determination of possible human health effects, as well as of the most appropriate therapy or care.
- (ii) Protocols for treatment should be available and in most cases should be followed, particularly if accident victims are taken to a number of separate treatment facilities (recognizing, however, that some flexibility is necessary to account for individual sensitivities to hazardous substances).

D.2 Emergency Response: Treatment of Victims

D.2.1. Initial care should be administered at the accident site in order to give the injured the treatment necessary to ensure that they are in stable condition before being taken to a main treatment facility, if necessary.

- (i) The most critical action is to remove the individual from further exposure to the hazardous substance(s). Physiological (clinical) and psychological effects may then be addressed.
- (ii) In addition to general first aid measures, it may be necessary to begin other treatment at the accident site. In a few cases, specific antidotes may be required. For this reason, special equipment and pharmaceutical supplies should be readily available at the site, as appropriate.
- (iii) Treatment of the injured should normally follow standard principles for the management of casualties, recognizing the need to take account of the special conditions following the accident.
- (iv) It should be noted that the majority of those exposed to hazardous substances require only supportive therapy until their symptoms abate.

D.2.2. For the appropriate treatment of exposed victims, emergency medical professionals should have access to specialized information and should be able to consult with a variety of specialists (for example, toxicologists, internists, lung and respiratory specialists, ophthalmologists, haematologists, and occupational health physicians).

- (i) Preparedness planning should provide for access to information concerning, *inter alia*, likely symptomology, availability of appropriate biomarkers (or other exposure or effect monitoring procedures), and specific emergency medical procedures.
- (ii) In addition, provision should be made for obtaining specialized consultations and toxicological information that may be required during patients' care including, as appropriate, assistance from information sources, academic institutions and chemical manufacturers, as well as access to specialists should any long-term health effects be anticipated.

D.2.3. Decisions concerning the decontamination of exposed persons should include consideration of the type and severity of their injuries, the nature of the contaminants, and whether decontamination may interfere with vital medical treatment.

- (i) Adequate provisions for decontamination of patients should be available and defined in the emergency plans.
- (ii) Appropriate decontamination facilities should be available for use at the accident site, and at designated hospitals and other treatment facilities to which contaminated patients might be admitted.

- (iii) If decontamination cannot be performed, every effort should be made to reduce the possibility of secondary contamination of the emergency services and treatment facilities.
- (iv) Off-site emergency medical personnel should be alerted to potential contamination and to specific decontamination procedures.

D.2.4. Following an accident, there should be psychological support at an early stage. Specifically, health/medical professionals with psychiatric, psychological or psycho-social training should be available in a timely manner.

- (i) The role of these health care workers, *inter alia*, should be to:
 - . provide emotional support to victims, relatives and friends of victims, and response personnel;
 - . collaborate closely with information services;
 - . assist in screening for potential mental health problems in groups involved with the accident (including response personnel, workers at the installation, and the affected public); and
 - . assist in establishing a follow-up network to identify and treat those with psychological reactions such as stress.
- (ii) The planning process should take into account the role of other care-givers (including, for example, clergy and funeral directors) in helping a community address the psychological impacts of an accident. Their role is likely to be particularly important in communities which do not have access to an adequate number of psychologists or psychiatrists.

D.2.5. Appropriate follow-up procedures should be put into place for monitoring and observation of persons seemingly unaffected by exposure to hazardous substances.

- (i) Following exposure to certain hazardous chemicals, individuals may not immediately manifest symptoms of exposure. However, they still may be affected by sub-acute exposures and so should be placed under observation for one or more days in case of delayed health effects. Plans should make provision for setting up suitable observation units in, for example, hotels or schools.
- (ii) Samples should be taken as soon as possible from everyone who was exposed, or may have been exposed, to the hazardous substance(s), for both treatment and follow-up.

(iii) All reasonable efforts should be made to determine the level of exposure and detect latent symptoms. These efforts should include the following:

- . **Air monitoring** should be carried out to assess potential exposure (through inhalation, or skin or eye absorption) to the ambient chemical concentration at the time of exposure.
- . When measurements of the ambient chemical concentration are not possible due to the amount of time which has elapsed, as is frequently the case, **biological monitoring** may still be undertaken. This type of monitoring is used to assess overall exposure to chemicals that may have been present, through the measurement of appropriate determinants in biological specimens (urine, exhaled breath, blood) collected within a specified time frame.
- . If competent public health experts at the scene still have reason to suspect exposure, the acute and sub-acute symptoms of overexposure to the chemicals in question should be identified and the individuals **placed under observation** for a suitable period.

D.2.6. When the release of a hazardous substance results in death, personnel handling the remains (pathologists, morticians, medical and legal examiners, volunteers, etc.) should be suitably protected. If decontamination has not already taken place, the body should be decontaminated in a properly ventilated and protected area prior to transportation, release or disposal (including burial).

E. Training and Education

E.1. Public health and education authorities should ensure that health/medical personnel involved in emergency response activities are well trained and educated, so that they will be able to function effectively under stressful circumstances. Specialist courses should be provided for the health/medical personnel, in order to give them an understanding of their responsibilities as well as those of others involved in emergency response.

- (i) Health/medical personnel who take part in emergency response are, for the most part, highly educated. However, they may not have received sufficient specific training for responding to chemical accidents.
- (ii) The training and education programmes for health/medical personnel should include, *inter alia*, principles of medical toxicology and emergency medicine, including the use of antidotes. Relevant health/medical personnel should also be familiar with: the chain of command during an emergency; models of in-hospital command and control; means of identifying decontaminated and non-decontaminated patients; the use of triage for diagnosing and treating a large number of potential patients; health-related information likely to be available during the emergency response procedures; and means of protecting themselves from contamination.
- (iii) Emergency medical personnel should familiarize themselves with the types of injuries that might occur in their community as the result of exposure to hazardous substances, including health effects related to different routes of exposure.
- (iii) In addition to dealing with the physical effects of exposure to hazardous substances, the health/medical personnel should be trained to be aware of psychological effects on victims, emergency responders, employees and the public.
- (iv) Training and education of health/medical personnel should be continuous, with regular updating, taking account of changes in emergency plans and arrangements, risks in the community, available resources, and other relevant factors.

E.2. Health/medical personnel should also contribute, where appropriate, to the training of those outside the health sector who are likely to be involved in emergency response activities.

E.3. First responders (police, fire and ambulance personnel) should be trained and educated to be able to take appropriate actions to minimize the human health effects of accidents involving hazardous substances.

- (i) This health-related training and education should, as a minimum, allow first responders to become familiar with: the characteristics of different types of accidents; the need for protective measures, including use of protective clothing and equipment; contamination hazards and procedures for

decontamination; specific first aid measures; and possible adverse psychological effects on victims, emergency responders and the public.

- (ii) Detailed information should be provided to first responders concerning, *inter alia*, how the various response groups, including medical personnel, should work together and the identification, triage and initial treatment of accident victims.
- (iii) Training of first responders should also be continuous, with regular updating, taking account of changes in emergency plans and arrangements, risks in the community, available resources, and other relevant factors.

E.4. Management should ensure that everyone employed at a hazardous installation, including temporary employees and contractors, receives appropriate training and education on how to handle hazardous substances, on procedures to follow to avoid accidents, and on actions to take should an accident occur, so as to minimize adverse health consequences for those at the installation and for the public. This training and education should be part of the employees' overall job training, to ensure that they are competent to carry out their tasks in both normal or abnormal circumstances. (See Section B.5 of the *Guiding Principles*.)

- (i) Occupational health and safety specialists, where available, should play an important role in such training.
- (ii) Members of the health/medical professions should be prepared to provide advice and assistance concerning the incorporation of health information into the safety training of employees at hazardous installations.
- (iii) Training of employees could be provided, in part, by public authorities, trade union organizations, trade associations or academic institutions.
- (iv) Training programmes should take into account the roles of safety committees and safety representatives. (See paragraphs B.5.19-B.5.20 of the *Guiding Principles*.)

E.5. The effectiveness of training and education programmes should be regularly assessed. As part of this process, simulation exercises should be carried out to test the competency of those likely to be involved in an accident response. (See Section E.1 of the *Guiding Principles*.)

F. Communication with the Public

F.1. Efforts should be made by public authorities and industry to improve public awareness of chemical hazards in the community and of how to respond in the event of an accident (for example, how to understand procedures related to possible evacuations and sheltering in place). (See Section D of the *Guiding Principles*.)

- (i) Information given to the public should emphasize avoiding exposure to, or any type of contact with, hazardous substances.
- (ii) Members of the health/medical professions should be prepared to contribute to the provision of information to the community (including public health advisories).

F.2. All members of the response community, including members of the health/medical professions, should co-ordinate with the media in order to ensure that any health-related information disseminated in regard to accidents involving hazardous substances is accurate and consistent.

- (i) Public health authorities should participate in the preparation of statements issued to the media concerning health aspects of such accidents.
- (ii) Relations with the media in this regard should be addressed in the emergency plan, and should be tested.

F.3. Should an accident occur, the public should be given, on a continuing basis, specific information on the appropriate behaviour and safety measures to adopt.

- (i) There should be regular reports on developments, even if the situation has not changed measurably.
- (ii) It is critical for industry and public authority officials to be truthful and straightforward in the provision of information to the public, and to admit when information does not exist or is unavailable.
- (iii) To the extent possible, information should come from a "credible" source, recognizing that differences will exist among communities concerning who should be the focal point for provision of information to the public.

G. Accident Investigation and Follow-up

G.1. Persons who may have been exposed to toxic chemicals during an accident, whether they appear to be affected or not, should be examined and properly registered to allow for short- and long-term follow-up.

- (i) It should be recognized that, following exposure, the onset of symptoms may be delayed for hours or days and that early examination will assist health/medical personnel to diagnose and treat any symptoms as they arise.
- (ii) Biological samples of those directly exposed or likely to have been exposed should be taken as soon as possible after exposure and, where appropriate, at regular intervals even if these persons do not have any symptoms. It is advisable to store some of the collected samples for future investigations.
- (iii) It may be necessary to seek out, in various ways, individuals likely to have been exposed in order to ensure adequate observation and, where necessary, appropriate medical treatment.
- (iv) The follow-up of those exposed to hazardous substances is very important for medical reasons, as well as in order to increase toxicological knowledge, since for many chemicals little or no information is available regarding short- and long-term human health effects of acute exposure.
- (v) Epidemiological studies should be undertaken during the follow-up to a chemical accident, if appropriate, and should consist of: design and maintenance of surveillance programmes for exposed populations; determination of the incidence, pattern and severity of health effects linked to specific exposures; assessment of dose-response and dose-effect relationships; revision of contingency plans; and provision of reference information for the management of similar future incidents.
- (vi) There should be an accurate record of follow-up activities, including notes of interviews and the identification of subsequent health (including psychological) effects. This record should be kept for future reference and should be available for public inspection.

(See paragraph D.2.5 above)

G.2. As part of accident investigations, victims should be interviewed as soon as possible after the accident.

G.3. Management should support active participation by employees and others in accident investigations.

G.4. Professionals trained in evaluating human behaviour should be included as part of the team investigating the causes of an accident (in particular, to consider the "human factor"). They may be able to provide insights which could help avoid future accidents.

H. Research and Development

H.1. Research should be undertaken by health care providers and academic institutions to reduce the likelihood of adverse health effects in connection with accidents involving hazardous substances, and to improve treatment should such adverse effects occur. These activities should be encouraged and supported by public authorities and by industry.

- (i) Such research should address, *inter alia*: improved patient treatment; development of adequate information systems; factors which might increase susceptibility to toxic substances; development and application of appropriate medical management strategies; disabling concentrations of various chemicals; and improved biomarkers and other monitoring techniques which could prove useful in assessing the overall exposure of individuals.
- (ii) The conduct and use of epidemiological studies of exposed and potentially exposed populations, and investigations of causes of accidents, could lead to improved prevention and response strategies and should therefore be promoted.

I. Acronyms

APELL:	Awareness and Preparedness for Emergencies at Local Level (a UNEP Programme)
CEFIC:	Conseil Europeen des Fédérations de l'Industrie Chimique (European Chemical Industry Council)
EPA:	(US) Environmental Protection Agency
ILO:	International Labour Organisation
IPCS:	International Programme on Chemical Safety
OECD:	Organisation for Economic Co-operation and Development
UNEP:	United Nations Environment Programme
UNEP IE:	UNEP Industry and Environment centre
WHO:	World Health Organization
WHO-ECEH:	WHO European Centre for Environment and Health

J. Glossary

These terms are defined for the purposes of this document only. They have been taken, for the most part, from the OECD Guiding Principles and from relevant WHO documents.

Accident: Any unplanned, sudden event which causes or is liable to cause injury to people or damage to buildings, plant, material or the environment.

Antidote: A therapeutic substance used to counteract the toxic action(s) of a specified xenotoxic.

Biomarker: A xenobiotically induced variation in cellular or biochemical components, processes, structures or functions that is measurable in a biological system or samples. Such variations can indicate the magnitude of the organism's response to contaminants, as well as provide the causal link between the presence of a chemical and biological effect.

Consequence: Result of a specific event.

Emergency preparedness plan (or) emergency plan: A formal written plan which, on the basis of identified potential accidents together with their consequences, describes how such accidents and their consequences should be handled either on-site or off-site.

Employee: A person who is under a contract of employment with an enterprise, including management.

Enterprise: A company or corporation (including a transnational corporation) which has operations involving the production, processing, handling, storage, use or disposal of hazardous substances.

Epidemiology: The study of the distribution and determinants of health-related states or events in populations, and the application of this study to control of health problems.

Event: The realization of a hazard.

Hazard: An inherent property of a substance, agent, source of energy or situation having the potential of causing undesirable consequences.

Hazardous installation: A fixed industrial plant/site at which hazardous substances are produced, processed, handled, stored, used or disposed of in such a form and quantity that there is a risk of a major accident involving hazardous substance(s) which could cause serious harm to human health or damage to the environment, including property.

Hazardous substance: An element, compound, mixture or preparation which, by virtue of its chemical, physical or (eco)toxicological properties, constitutes a hazard.

Incident: Accidents and/or near misses.

Information: Facts, data or other knowledge which can be provided by any means including, for example, electronic, print, audio or visual.

Major accident: Any unplanned, sudden event which causes or is liable to cause serious injury to people or damage to buildings, plant, material or the environment.

Management: Employees at, or owners of, a hazardous installation who have the responsibility and authority to take decisions concerning the operation of the installation, including decisions relevant to safety, and, where appropriate, employees at a corporate level in the enterprise having such authority.

Monitor (or) Monitoring: Use of checks, inspections, tours, visits, sampling and measurements, surveys, reviews or audits to measure compliance with relevant laws, regulations, standards, codes, procedures and/or practices; includes activities of public authorities, industry and independent bodies.

Near miss: Any unplanned, sudden event which, but for the mitigation effects of safety systems or procedures, could have caused serious injury to people or serious damage to buildings, plant, material or the environment, or could have involved a loss of containment possibly giving rise to significant adverse effects.

Notification: A requirement to provide specified information related to a hazardous installation in an appropriate manner to competent authorities.

Probability: The likelihood that a considered occurrence will take place.

Public authorities: Government bodies at national, regional, local and international level with the authority to issue licenses, regulations, standards or other instructions having the force of law.

Risk: The combination of a consequence and the probability of its occurrence.

Risk assessment: The value judgment of the significance of the risk, identified by a risk analysis taking into account any relevant criteria.

Risk management: Actions taken to achieve or improve the safety of an installation and its operation.

Safety: A situation without unacceptable risks. For purposes of this text, "safety" embraces health, safety and environmental protection, including protection of property.

Symptomology: The aggregate of signs and symptoms of a disease.

Toxicity: The toxicity of a substance is the capacity to cause injury to a living organism. A highly toxic substance will cause damage to an organism if administered in very small amounts, and a substance of low toxicity will not produce an effect unless the amount is very large. However, toxicity cannot be defined in quantitative terms without reference to the quantity of the substance administered or absorbed, the way in which this quantity is administered (for example, inhalation, ingestion) and distributed in time (for example, single or repeated doses), the type and severity of injury, and the time needed to produce the injury.

Triage: A screening process for patients to determine management priority by assigning degrees of urgency.

Transfrontier damage: Any serious damage to human health or the environment, including property, in the event of an accident suffered by a country other than the country where the accident originated.

K. Bibliography

Note: The publications listed in this Section are considered to be particularly relevant and generally available to the public. This list is not intended to be comprehensive. A more complete bibliography is included in *Health Aspects of Chemical Accidents (1994)*, published jointly by IPCS, OECD, UNEP IE and WHO-ECEH.

These publications have not been organized into categories. They are listed in alphabetical order, and under authors' names (rather than, for example, the names of the responsible agencies or organizations) where available.

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OECD (1992) *Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry, Labour and Others for the Establishment of Programmes and Policies related to Prevention of, Preparedness for, and Response to Accidents Involving Hazardous Substances*. OECD Environment Monograph No. 51. GD(92)43. OECD, Paris. (Available in English, French and Russian.)

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For more information on the UNEP APELL programme, contact: UNEP IE, 39-43 quai André-Citöen, 75739 Paris Cedex 16, France. Fax: (33) (1) 44.37.14.74. E-mail: unepie@unep.fr.

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ERO/EPR 90.1.9 *Rapid Health Assessment in Chemical Emergencies*

(Practical guidance covering the purpose of assessment, the importance of preparedness, conducting the rapid assessment, and techniques for surveys during rapid assessment.)

L. Key Word Index

Antidotes: A.2.7; C.2.6; C.3.2; D.2.1; E.1

Contamination or contaminated (areas): C.1.7; C.2.4; C.3.3; D.1.6; D.1.7; E.3

Decontaminate or decontamination: C.1.7; C.2.1; C.2.2; C.2.6; C.3.2; C.3.3; D.1.3; D.1.6; D.1.7; D.1.8; D.2.3; D.2.6; E.1; E.3

Emergency plan or emergency preparedness plan: A.2.2; A.2.5; A.2.10; A.2.13; A.3.7; B.8; C.1.1; C.1.2; C.1.4; C.1.5; C.1.6; C.1.8; C.1.9; C.2.1; C.2.4; C.3.1; C.3.8; D.1.9; D.2.3; E.1; E.3; F.2

Emergency planning: A.2.1, A.2.3, A.2.6, A.2.12

Emergency preparedness programme (see emergency preparedness plan): A.2.1

Epidemiological: A.6.1; B.8; C.1.2; C.1.6; G.1; H.1

Employee(s): A.1.3; A.2.2; A.2.4; A.6.3; B.1; B.3; B.6; B.9; C.1.6; E.1; E.4; G.3; J

First responders: A.4.3; C.3.3; E.3

Guidelines: C.1.1

Health authorities (see also public authorities): A.2.1; A.2.2; A.4.1; B.1; B.5; C.1.2; C.1.4; C.1.9; C.1.12; E.1; F.2

Health care providers: C.1.7; H.1

Health care sector: B.1

Health care workers: C.1.7; D.2.4

Health ministries: A.2.2; C.1.4

Health personnel: C.3.3

Health/medical personnel (see also health/medical professionals): A.2.1; A.2.2; A.2.13; A.3.1; A.3.2; A.3.3; A.4.1; A.4.2; B.8; C.1.2; C.1.9; C.2.1; C.2.2; C.2.5; C.2.6; C.3.3; C.3.4; C.3.7; C.3.8; C.3.9; D.1.2; D.1.4; D.1.5; D.1.7; E.1; E.2; E.3; G.1

Health medical professionals (see also health medical personnel): A.1.5; A.1.6; A.2.2; A.5.2; B.3; B.7; C.1.4; D.2.2; E.4; F.1; F.2

Hospitals/treatment facilities: A.2.2; A.2.8; A.3.5; A.3.7; B.4; C.1.4; C.1.5; C.2.1; C.2.2; C.2.3; C.2.4; C.2.6; C.3.2; C.3.3; C.3.9; D.1.3; D.1.6; D.1.9; D.1.10; D.2.1, D.2.3; E.1

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Land use plan(ning): B.4

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Medical equipment: A.2.2; A.2.6; A.2.7; C.1.4; C.1.9; C.2.1; C.2.2; C.2.5

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Patients: A.2.7.; A.2.8; A.3.7; C.2.2; D.1.3; D.1.9; D.2.2; D.2.3; E.1; H.1; J

Pharmaceuticals or pharmaceutical supplies: A.2.2; A.2.7; C.1.4; C.2.1; C.2.6; C.3.2; D.1.3; D.2.1

Poison information centres: C.3.5(i)

Public (potentially affected): A.2.4, C.1.5; C.1.6; C.3.3; D.1.5; D.2.4

Public authorities (see also public health authorities): A.1.1; A.1.2;; A.1.4; A.2.1; A.2.2; A.2.12; A.5.1; B.1; B.2; B.3; B.4; B.5; C.1.1; C.1.2; C.1.12; C.3.2; C.3.5; E.5; F.1; F.3; H.1; J

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Response/rescue personnel: A.2.4; C.1.6; C.1.7; C.1.9; C.2.1; C.3.1; C.3.2; D.1.6; D.2.4

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ENVIRONMENTAL HEALTH AND SAFETY PUBLICATIONS

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Please note:

^F indicates that the entire publication is available from the OECD in a separate French translation. The other publications on this list are generally available in English only, but they often include a French summary.

The OECD Environment Monograph Series

Since 1988, the Environment Monograph Series has made technical documents prepared by the OECD Environment Directorate available to the public. In mid 1996, this well received series was discontinued. The Environmental Health and Safety Division now publishes its complimentary documents in six different series:

*Testing and Assessment;
Good Laboratory Practice and Compliance Monitoring;
Pesticides;
Risk Management;
Harmonization of Regulatory Oversight in Biotechnology; and
Chemical Accident Prevention, Preparation and Response.*

Translations of the Series on Good Laboratory Practice and Compliance Monitoring into German, Russian, Polish, Czech, Slovak, Hebrew, Spanish and Italian exist or are planned.

*Some of the publications on this list are shown with an Environment Monograph number **and** one of the new series numbers. Either number can be used to order these documents. All the documents listed here were prepared by the Environmental Health and Safety Division. With the exception of publications on sale through the OECD Publications Service, copies of all these documents are available upon request at no charge directly from the Environmental Health and Safety Division (see page 1).*

Environment Monograph No. 14, *Final Report of the Expert Group on Model Forms of Agreement for the Exchange of Confidential Data on Chemicals (1988)^F*

No. 15, *Final Report of the Working Group on Mutual Recognition of Compliance with Good Laboratory Practice (1988)^F*

No. 17, *The Use of Industry Category Documents in Source Assessment of Chemicals (1989)^F*

No. 24, *Accidents Involving Hazardous Substances (1989)^F*

No. 25, *A Survey of Information Systems in OECD Member Countries Covering Accidents Involving Hazardous Substances (1989)^F [out of print]*

No. 26, *Report of the OECD Workshop on Ecological Effects Assessment (1989)^F*

No. 27, *Compendium of Environmental Exposure Assessment Methods for Chemicals (1989)^F*

No. 28, *Workshop on Prevention of Accidents Involving Hazardous Substances: Good Management Practice (1990)^F*

No. 29, *Workshop on the Provision of Information to the Public and on the Role of Workers in Accident Prevention and Response* (1990)^F

No. 30, *Workshop on the Role of Public Authorities in Preventing Major Accidents and in Major Accident Land-Use Planning* (1990)^F

No. 31, *Workshop on Emergency Preparedness and Response and on Research in Accident Prevention, Preparedness and Response* (1990)^F

No. 35, *A Survey of New Chemicals Notification Procedures in OECD Member Countries* (1990)^F

No. 36, *Scientific Criteria for Validation of In Vitro Toxicity Tests* (1990)^F

No. 39, *International Survey on Biotechnology Use and Regulations* (1990)^F

OCDE/GD(91)102 *Users Guide to Hazardous Substance Data Banks Available in OECD Member Countries* (1991)^F **[out of print]**

OCDE/GD(91)103 *Users Guide to Information Systems Useful to Emergency Planners and Responders Available in OECD Member Countries* (1991)^F **[out of print]**

[The two Users Guides above were translated into Spanish by UNEP IE.]

No. 43, *International Directory of Emergency Response Centres* (1992)^F
[under revision by the OECD and UNEP IE]

[The International Directory is a co-operative project of OECD and UNEP IE. The emergency response centres in the Directory are located in OECD and non-OECD countries.]

No. 44, *Workshop on Prevention of Accidents Involving Hazardous Substances: The Role of the Human Factor in Plant Operations* (1992)

No. 45, *The OECD Principles of Good Laboratory Practice [Series on Good Laboratory Practice and Compliance Monitoring No. 1]* (1992)^F

No. 46, *Guides for Compliance Monitoring Procedures for Good Laboratory Practice* (1992)^F

[**superseded** by Environment Monograph No. 110, *Revised Guides for Compliance Monitoring Procedures for Good Laboratory Practice* (1995)]

No. 47, *Guidance for the Conduct of Laboratory Inspections and Study Audits* (1992)^F

[**superseded** by Environment Monograph No. 111, *Revised Guidance for the Conduct of Laboratory Inspections and Study Audits* (1995)]

No. 48, *Quality Assurance and GLP [Series on Good Laboratory Practice and Compliance Monitoring No. 4]* (1992)^F

No. 49, *Compliance of Laboratory Suppliers with GLP Principles [Series on Good Laboratory Practice and Compliance Monitoring No. 5]* (1992)^F

No. 50, *The Application of the GLP Principles to Field Studies [Series on Good Laboratory Practice and Compliance Monitoring No. 6]* (1992)^F

No. 51, *Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry, Labour and Others for the Establishment of Programmes and Policies related to Prevention of, Preparedness for, and Response to Accidents Involving Hazardous Substances Areas* (1992)^F

[The Guiding Principles are also available from the OECD in Russian and may be translated into other languages. In 1996, two Guidance Documents to be used in conjunction with the Guiding Principles were published (see below). For more information, please contact the Environmental Health and Safety Division.]

No. 52, *Report of the OECD Workshop on Monitoring of Organisms Introduced into the Environment* (1992)

No. 58, *Report of the OECD Workshop on Quantitative Structure Activity Relationships (QSARS) in Aquatic Effects Assessment* (1992)

No. 59, *Report of the OECD Workshop on the Extrapolation of Laboratory Aquatic Toxicity Data to the Real Environment* (1992)

No. 60, *Report of the OECD Workshop on Effects Assessment of Chemicals in Sediment* (1992)

No. 65, *Risk Reduction Monograph No. 1: Lead. Background and National Experience with Reducing Risk* [**Series on Risk Reduction No. 1**] (1993)

No. 66, *Report of the OECD Workshop on Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection* (1993)

[The OECD's Chemical Accidents Programme and Road Transport Research Programme co-operated in organising this workshop.]

No. 67, *Application of Structure-Activity Relationships to the Estimation of Properties Important in Exposure Assessment* (1993)

No. 68, *Structure-Activity Relationships for Biodegradation* (1993)

No. 69, *Report of the OECD Workshop on the Application of Simple Models for Exposure Assessment* (1993)

No. 70, *Occupational and Consumer Exposure Assessments* (1993)

No. 73, *The Application of the GLP Principles to Short-term Studies* [**Series on Good Laboratory Practice and Compliance Monitoring No. 7**] (1993)^F

No. 74, *The Role and Responsibilities of the Study Director in GLP Studies* [**Series on Good Laboratory Practice and Compliance Monitoring No. 8**] (1993)^F

No. 76, *Guidance Document for the Development of OECD Guidelines for Testing of Chemicals* (1993; reformatted 1995) [**Series on Testing and Assessment No. 1**]^F

No. 77, *Data Requirements for Pesticide Registration in OECD Member Countries: Survey Results* [**Series on Pesticides No. 1**] (1993)

No. 81, *Health Aspects of Chemical Accidents: Guidance on Chemical Accident Awareness, Preparedness and Response for Health Professionals and Emergency Responders Areas* (1994)^F

[Four international organisations collaborated in the preparation of this publication: the International Programme on Chemical Safety (IPCS), OECD, UNEP IE, and the World Health Organization – European Centre for Environment and Health (WHO-ECEH).]

No. 88, *US EPA/EC Joint Project on the Evaluation of (Quantitative) Structure Activity Relationships* (1994)

No. 90, *Ottawa '92: The OECD Workshop on Methods for Monitoring Organisms in the Environment* (1994)

No. 91, *Compendium of Methods for Monitoring Organisms in the Environment* (1994)

[Monographs No. 90 and 91 are companion documents.]

No. 92, *Guidance Document for Aquatic Effects Assessment [Series on Testing and Assessment No. 3]* (1995)

No. 93, *Report of the OECD Workshop on Chemical Safety in Port Areas* (1994)

[This Workshop was co-sponsored by OECD, the International Maritime Organization (IMO) and UNEP. Also see Monograph No. 188.]

No. 94, *Report of the OECD Special Session on Chemical Accident Prevention, Preparedness and Response at Transport Interfaces Areas* (1995)

No. 95, *Report of the OECD Workshop on Small and Medium-sized Enterprises in Relation to Chemical Accident Prevention, Preparedness and Response Areas* (1995)

No. 98, *Detailed Review Paper on Biodegradability Testing [Series on Testing and Assessment No. 2]* (1995)

No. 99, *Commercialisation of Agricultural Products Derived through Modern Biotechnology: Survey Results [Series on Harmonization of Regulatory Oversight in Biotechnology No. 1]* (1995)

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