

► Code of practice on safety and health in construction *

Meeting of Experts to revise the 1992 code of practice on safety and health
in construction
(Geneva, 21–25 February 2022)

Geneva, 2022

* In accordance with established procedures, this code of practice will be submitted to the 346th Session (October–November 2022) of the Governing Body of the ILO for its consideration.

► Preface

[Preface will be added following adoption of the code.]

► Sectoral codes of practice

ILO sectoral codes of practice are reference tools setting out principles that can be reflected in the design and implementation of policies, strategies, programmes, legislation, administrative measures and social dialogue mechanisms, in particular economic sectors or clusters of sectors. Sectoral codes of practice are adopted by meetings of experts comprising governments, employers and workers. They can be implemented progressively to take into account different national settings, cultures, and social, economic, environmental and political contexts.

Sectoral codes of practice draw their principles from the ILO's international labour standards (Conventions, Protocols and Recommendations) and other sources, including Declarations, codes of practice and other policy guidance adopted and endorsed by the International Labour Conference or the Governing Body of the ILO. They also draw on other international agreements and policy in the sector concerned, as well as on relevant trends and developments in regional and national law and practice.

Sectoral codes of practice focus on the issues that are priorities for governments, employers and workers, and that are unique to particular economic sectors and industries. While international labour standards normally deal with more general principles of labour law and practice, sectoral codes of practice specify the principles and processes that could be implemented to promote decent work in particular workplaces or contexts. They benefit from the expertise of practitioners in the relevant sectors to capture good industry practices and innovations.

Sectoral codes of practice are not legally binding. They are not subject to ratification or supervisory mechanisms established under the ILO's international labour standards. Sectoral codes of practice can therefore be aspirational in scope and expand on principles laid down in international labour standards and other international agreements and policy, all the while recognizing that they can be adapted to different national systems and circumstances. As such, ILO standards and other tools or guidance adopted and endorsed by the International Labour Conference and/or the Governing Body form the foundation on which sectoral codes of practice build further. It is therefore understood that sectoral codes of practice are based on the full principles, rights, and obligations set out in international labour standards, and nothing set out in these codes of practice should be understood as lowering such standards.

► Contents

	Page
Preface	3
Sectoral codes of practice	5
Acronyms and abbreviations	15
Introduction	17
Part I. General provisions related to the construction sector	19
1. General provisions	20
1.1. Objective.....	20
1.2. Application and scope	20
1.3. Definitions	22
2. General duties.....	27
2.1. General duties of competent authorities	27
Labour inspectorates	27
Competent authority	28
2.2. Cooperation, coordination and effective communication	29
2.3. General duties of employers	31
2.4. General rights and duties of workers	33
2.5. General duties of clients	34
2.6. General duties of designers, engineers, architects, suppliers and manufacturers	35
3. OSH management systems	37
3.1. Introduction	37
3.2. Occupational safety and health policy.....	38
Worker participation.....	38
3.3. Responsibility and accountability	38
3.4. Initial review and system planning	39
3.5. Hazard identification, risk assessment, and preventive and protective measures.....	40
3.6. Emergency preparedness.....	42
3.7. Management of change.....	44
3.8. Procurement and contracting.....	45
3.9. Performance monitoring and evaluation.....	45

3.10.	Safety and health officers	46
3.11.	Safety and health committees	47
3.12.	Worker safety and health representatives	47
4.	Competence, information, instruction and training	49
5.	Reporting of accidents and diseases	52
6.	PPE	56
6.1.	General provisions	56
6.2.	Types	56
6.2.1.	Clothing	56
6.2.2.	Head protection	57
6.2.3.	Face and eye protection	57
6.2.4.	Hand and foot protection	58
6.2.5.	Respiratory protective equipment	58
6.2.6.	Hearing protection	59
6.2.7.	Protectors against radioactive contamination	59
7.	Welfare	60
7.1.	General provisions	60
7.2.	Drinking water	60
7.3.	Sanitary and washing facilities	61
7.4.	Facilities for changing and storing clothing	61
7.5.	Facilities for food and drink	61
7.6.	Shelters	62
7.7.	Childcare facilities	62
7.8.	Living accommodation	63
8.	Safety of workplaces	64
8.1.	General provisions	64
8.2.	Means of access and egress	64
8.3.	Housekeeping	64
8.4.	Precautions against the fall of materials and persons, and collapse of structures	65
8.5.	Prevention of unauthorized entry	65
8.6.	Fire prevention and fire response	65
8.7.	Lighting	67

9.	Health hazards, first aid and occupational health services	68
9.1.	General requirements	68
9.2.	First aid	68
9.3.	Occupational health services	69
9.4.	Hazardous substances	71
9.5.	Asbestos	73
9.6.	Silica	74
9.7.	Dangerous atmospheres and confined spaces.....	74
9.8.	Radiation hazards	75
	Ionizing radiations	75
	Non-ionizing radiations.....	76
9.9.	Heat stress, cold and wet conditions	76
9.10.	Noise and vibration	77
9.11.	Biological agents.....	78
9.12.	Ergonomics	79
9.13.	Psychosocial risks and work-related stress.....	80
9.14.	Labour protection	80
	9.14.1. Employment and social security	80
	9.14.2. Maternity protection	80
	9.14.3. Working hours	82
	9.14.4. Night work and lone-working.....	82
	9.14.5. Fatigue.....	83
	9.14.6. Alcohol and drug use	83
	9.14.7. HIV	83
	9.14.8. Violence and harassment.....	84
	Part II. Technical guidance related to the construction sector	87
10.	Scaffolds, ladders, lifting appliances and mobile elevated working platforms	88
10.1.	General provisions	88
10.2.	Materials.....	88
10.3.	Design and construction.....	89
10.4.	Inspection and maintenance	90
10.5.	Lifting appliances on scaffolds.....	90
10.6.	Prefabricated scaffolds	91
10.7.	Use of scaffolds	91
10.8.	Suspended scaffolds.....	91

10.9. Platforms attached to lifting appliances and mobile elevated working platforms	92
10.10. Mobile scaffolding	92
10.11. Ladders	93
11. Lifting appliances and gear	95
11.1. General provisions	95
Installation	95
Examinations and tests	96
Controls, control devices and cabins	96
Operation	97
11.2. Hoists	98
11.3. Derricks	100
Guy derricks	100
11.4. Gin poles	101
11.5. Tower cranes, including remote, self-erecting or pedestrian-operated tower cranes	101
11.6. Lifting gear	102
Chains	102
Hooks	103
Wire ropes	103
Synthetic fibre ropes/slings	103
Shackles	104
12. Transport, earth-moving and materials-handling equipment	105
12.1. General provisions	105
12.2. Power shovels, excavators	107
Electric shovels	107
Operation of power shovels	108
12.3. Bulldozers	108
12.4. Scrapers	109
12.5. Mobile asphalt layers and finishers	109
12.6. Pavers	109
12.7. Road rollers	110
13. Plant, machinery, equipment and hand tools	111
13.1. General provisions	111
13.2. Hand tools	112

13.3. Pneumatic tools.....	112
13.4. Hydraulic tools.....	112
13.5. Cartridge-operated tools	113
13.6. Power tools	114
13.7. Woodworking machines	114
13.8. Engines	115
13.9. Silos	115
13.10. Concrete work equipment.....	116
13.11. Pressure plant	117
13.12. Conveyors.....	118
13.13. Crusher plants	119
13.14. Power generators	119
14. Work at heights including roof work.....	120
14.1. General provisions	120
14.2. Roof work	122
14.3. Work on tall chimneys.....	123
15. Excavations, shafts, earthworks, underground works and tunnels	125
15.1. General provisions	125
15.2. Excavations	125
15.3. Underground works	126
15.3.1. General provisions	126
15.3.2. Shaft sinking.....	127
15.3.3. Ventilation.....	128
15.3.4. Fire protection.....	129
15.3.5. Electricity.....	129
15.3.6. Underground lighting	130
15.4. Drilling	130
15.5. Transport, storage and handling of explosives.....	130
15.6. Blasting.....	130
15.7. Haulage	130
15.8. Dust control	131
16. Cofferdams and caissons and work in compressed air.....	132
16.1. General provisions	132
16.2. Work in cofferdams and caissons.....	133

Working chambers	133
Medical locks	134
Manlocks	134
Air supply.....	135
Signalling.....	135
Lighting.....	135
16.3. Work in tunnels in compressed air	135
17. Structural frames, formwork and concrete work.....	137
17.1. General provisions.....	137
17.2. Erection and dismantling of steel and prefabricated structures.....	137
17.3. Cast-in-situ concrete structures.....	139
17.4. Provision of temporary floors	140
17.5. Formwork.....	140
18. Pile-driving.....	142
18.1. General provisions.....	142
18.2. Inspection and maintenance of pile-driving equipment	142
18.3. Operation of pile-driving equipment.....	142
18.4. Floating pile-drivers	143
18.5. Sheet piling	143
19. Work over water	145
19.1. General provisions.....	145
19.2. Boats	146
20. Demolition	148
20.1. General provisions.....	148
20.2. Demolition of walls	150
20.3. Demolition of floors.....	150
20.4. Demolition of structural steelwork	150
20.5. Demolition of tall chimneys.....	151
20.6. Removal of asbestos and materials and articles containing asbestos	151
21. Electricity.....	152
21.1. General provisions.....	152
21.2. Inspection and maintenance	153
21.3. Testing	154

22. Explosives	155
22.1. General provisions	155
22.2. Transport, storage and handling	156
22.3. Misfires	157
22.4. Disposal of explosives	158
23. OSH, natural disasters, emergencies, extreme weather events and waste management	159
23.1. General provisions	159
23.2. Disaster preparedness	160
23.3. Just transition	160
23.4. Emissions of smoke and chemicals	160
23.5. Solid waste	160
23.6. Effluent	161
23.7. Hazardous wastes	161
Bibliography	163

Appendices

I. Workers' health surveillance (adapted from ILO, <i>Technical and Ethical Guidelines for Workers' Health Surveillance</i> , 1998)	167
II. Surveillance of the working environment (based on the Occupational Health Services Recommendation, 1985 (No. 171))	170

► Acronyms and abbreviations

AC	alternating current
CPR	cardiopulmonary resuscitation
DC	direct current
FAO	Food and Agriculture Organization
FOPS	falling object protective structures
IAEA	International Atomic Energy Agency
ICT	information and communication technology
ILO	International Labour Organization
LPG	liquefied petroleum gas
(k)N	(kilo)newton
OECD/NEA	Organisation for Economic Co-operation and Development/Nuclear Energy Agency
OSH	occupational safety and health
PAHO	Pan American Health Organization
PFAS	personal fall arrest system
PPE	personal protective equipment
V	volt
WHO	World Health Organization

► Introduction

1. In accordance with a decision taken by the Governing Body of the International Labour Organization (ILO) at its 335th Session in March 2019, a Meeting of Experts to revise the 1992 code of practice on safety and health in construction was convened in Geneva from 21 to 25 February 2022 to review and adopt a revised ILO code of practice (“code”) on safety and health in construction.
2. The original code of practice on safety and health in construction was published in 1992. This revised code reflects the many changes in the sector and the world of work, as well as changes in the roles of competent authorities, contractors, employers, workers and their organizations. The revised code also includes a bibliography listing the ILO instruments on occupational safety and health (OSH) adopted since 1992.
3. The revised code is structured as follows: Chapter 1 provides an overview of the code’s purpose, objectives and use. Chapter 2 outlines the general obligations, responsibilities, duties and rights of the stakeholders. Chapters 3–9 outline general principles, including OSH management systems, information and training, OSH reporting, personal protective equipment (PPE), welfare and safety of workplaces, as well as health hazards, first aid and occupational health services. Chapters 10–22 outline specific OSH requirements in the most common construction activities. Finally, Chapter 23 addresses waste and emissions management.

► Part I. General provisions related to the construction sector

► 1. General provisions

1.1. Objective

1.1.1. The objective of this code is to provide practical guidance for the use of all those, both in the public and private sectors, who have obligations, responsibilities, duties and rights regarding safety and health in construction.

1.1.2. This code should contribute to improved safety and health in the construction sector in the context of sustainable development by:

- (a) promoting effective implementation of prevention;
- (b) protecting all workers in construction from workplace hazards;
- (c) preventing or reducing occupational injuries, occupational diseases, ill health and dangerous occurrences arising from work in construction activities;
- (d) ensuring compensation to an injured worker and a worker suffering from occupational diseases to make up for the loss of earnings resulting from an occupational injury, as well as the costs of the medical and related care necessary to maintain, improve and restore the health of the injured worker;
- (e) ensuring appropriate planning, procurement, design and implementation of construction projects;
- (f) formulating and implementing a coherent national policy and principles on OSH and the welfare of workers and their organizations in the improvement of OSH in construction and on the protection of the general working environment;
- (g) promoting effective consultation and cooperation in line with ILO OSH standards between governments, employers, workers and their organizations and representatives, as well as business operations, in the improvement of OSH in construction;
- (h) providing guidance, in line with ILO instruments, on the respective role, obligations, responsibilities, duties and rights of all actors engaged in construction activities with regard to workplace hazards;
- (i) improving the management of OSH risks at each workplace through the implementation and integration of consistent OSH management systems; and
- (j) improving OSH knowledge and competence in construction.

1.1.3. This code also provides supplementary practical information and guidance in the implementation of the provisions of the Safety and Health in Construction Convention, 1988 (No. 167), and the Safety and Health in Construction Recommendation, 1988 (No. 175). The provisions of other relevant ILO instruments, including Conventions, Protocols, Recommendations, codes of practice and guidelines, should also be taken into account. A list of these is contained in the bibliography at the end of this code.

1.2. Application and scope

1.2.1. This code applies to:

- (a) construction activities which cover:

- (i) building, including excavation and the construction, structural alteration, renovation, repair, maintenance (including cleaning and painting) and demolition of all types of buildings or structures;
 - (ii) civil engineering, including excavation and the construction, structural alteration, repair, maintenance and demolition of, for example, airports, docks, harbours, inland waterways, dams, river and avalanche and sea defence works, roads and highways, railways, bridges, tunnels, viaducts and works related to the provision of services such as communications, drainage, sewerage, water and energy supplies; and
 - (iii) the erection and dismantling of prefabricated buildings and structures, as well as the manufacturing of prefabricated elements on the construction site; and
- (b) the fabrication and erection of oil rigs and of offshore installations while under construction on shore.

1.2.2. The provisions of this code should be considered as the minimum requirements for protecting workers' safety and health as well as other persons, where relevant, in the vicinity of construction activities.

1.2.3. The provisions of this code should be applied to the planning, procurement, design and implementation of construction projects.

1.2.4. The provisions of this code should be applied to self-employed persons as may be specified by national laws or regulations.

1.2.5. As all engaged in construction are part of the workforce in construction, employers, in consultation with workers and their representatives and in accordance with national laws and regulations, should ensure that risks are assessed with a gender perspective and that OSH policies and programmes based on sex-disaggregated data include gender-sensitive measures. Employers should also ensure that all workers, without discrimination, have equal opportunities and treatment regarding OSH measures and equal access to OSH services, including participation in OSH decision-making at all levels.

1.2.6. This code addresses most of the currently identified hazards and risks associated with construction. However, changes in the industry or in specific operations may alter the risk profile. This code cannot therefore be assumed to address every hazard or risk. While the code contains detailed provisions, its use should not inhibit the development of new technologies, better practice or the adoption of alternative measures that provide at least as effective protection to all workers involved in construction.

1.2.7. The adoption of technological or other innovations, and/or new work practices involving such innovations, may have an impact on safety and health in construction. These should be accounted for in risk management, management of change processes and in the design procurement stage and implementation of OSH policies and programmes, including on the basis of evidence and data on the innovations in question, in compliance with relevant national laws and regulations, as well as all OSH standards, and through consultations on OSH aspects between employers' and workers' and their representatives. Sufficient information and appropriate training should be provided and monitoring mechanisms established.

1.2.8. Some measures implemented to protect workers' safety and health in construction are intrinsically linked to measures to protect the environment. This relationship should be taken into account by both the competent authorities and employers in designing and implementing their respective environmental sustainability and OSH policies and programmes.

1.2.9. This code is not a legally binding instrument and its provisions are not intended to replace applicable national laws, regulations or other nationally or internationally recognized instruments. In the absence of national laws and regulations on a particular OSH issue, or where these are not up to date, guidance should be drawn from this code, as well as from relevant nationally and internationally recognized instruments. The provisions of this code should be read in the context of national conditions and technical possibilities, and the scale of operations involved.

1.2.10. This code contains references to those institutions responsible for the delivery and award of vocational qualifications. Such institutions are urged to review existing curricula in the light of the code's recommendations for training and the allocation of worksite responsibilities.

1.2.11. In the establishment, implementation and review of policies and programmes on OSH under this code, competent authorities and employers' and workers' organizations, as well as clients, contractors, suppliers and other stakeholders, should take into account ratified international labour standards and that the fundamental principles and rights at work apply to all workers and employers. They should also take account of the provisions of other relevant ILO instruments, including Conventions, Protocols, Recommendations, codes of practice and guidelines. A list of these is contained in the bibliography at the end of this code.

1.2.12. In line with the ILO Declaration on Fundamental Principles and Rights at Work, all ILO Members have an obligation arising from the very fact of membership in the Organization to respect, to promote and to realize, in good faith and in accordance with the Constitution, the principles concerning the fundamental principles and rights at work, which are the subject of those Conventions.

1.3. Definitions

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

Adequate, appropriate or suitable are used to describe qualitatively or quantitatively the means or method used to protect the worker.

Bearer: see *putlog*.

Brace: A structural member that holds one point in a fixed position with respect to another point; bracing is a system of structural members designed to prevent distortion of a structure.

By hand: The work is done without the help of a mechanized tool.

Cartridge-operated: A device in which an explosive drives a projectile such as a nail or a stud into materials; they are of three types:

- (i) "*high-velocity type*", in which the projectile is driven directly by the gases from the explosive charge;
- (ii) "*low-velocity piston type*", in which the gases from the explosive charge drive a piston which propels the projectile; and
- (iii) "*hammer-operated low-velocity piston type*", in which the piston is driven by a hammer blow in addition to the gases from the explosive charge.

Client: Any natural or legal person for whom a project is carried out.

Code of practice: A document offering practical guidance on the policy and standard setting in occupational safety and health for use by governments, employers, workers and any other

persons involved in the construction process in order to promote safety and health at the national level and at the level of the enterprise.

Compensation: A payment made to an injured worker and a worker suffering from occupational diseases to make up for the loss of earnings resulting from an occupational injury, as well as the costs of the medical and related care necessary to maintain, improve and restore the health of the injured worker, as prescribed in the Employment Injury Benefits Convention, 1964 [Schedule I amended in 1980] (No. 121).

Competence: Having the necessary skills, knowledge, experience and training (and if they are an organization the organizational capability) to fulfil the role or task that they have appointed to undertake.

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

Competent person: A person possessing adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. The competent authorities may define appropriate criteria for the designation of such persons and may determine the duties to be assigned to them.

Contractor: A person or enterprise providing services to an employer in accordance with national laws and regulations, or with agreed specifications, terms and conditions. For the purpose of this code of practice, contractors include principal contractors and labour supply agents.

Construction: Those activities as defined in paragraph 1.2.1.

Construction project: A construction project is the organized process of constructing, renovating, refurbishing, etc. a building, structure or infrastructure. This includes the planning, procurement, design, implementation and handover phases as well as the construction site.

Construction site: Any site at which any of the processes or operations described in paragraph 1.2.1. are carried on.

Dangerous occurrence: A readily identifiable event as defined under national laws and regulations, with potential to cause an injury or disease to persons at work or to the public.

Employer:

- (i) Any physical or legal person who employs one or more workers on a construction site; and
- (ii) as the context requires, the principal contractor, the contractor or the subcontractor.

Engineering controls: Use of technical measures, such as enclosure, ventilation and workplace design, to minimize exposure to hazards.

Gin pole: Derrick without a boom. Its guys are so arranged from its top as to permit leaning the mast in any direction. The load is raised and lowered by ropes reeved through sheaves or blocks at the top of the mast.

Guard rail: An adequately secured rail erected along an exposed edge to prevent persons from falling.

Guy derrick: Fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by guys, and a boom whose bottom end is hinged or pivoted to move in a vertical plane with a reeved rope between the head of the mast and the boom point for raising and lowering the boom, and a reeved rope from the boom point for raising and lowering the load.

Hazard: The inherent potential to cause injury or damage to people's health.

Hoist: A machine which lifts materials or persons by means of a platform which runs on guides.

Ledger: A scaffold member which extends longitudinally and horizontally parallel to the face of a structure, at right angles to the putlogs and which supports the putlogs, forms a tie between the posts, and becomes a part of the scaffold bracing; ledgers which do not support putlogs are also called stringers.

Lifting appliance: Any stationary or mobile appliance used for raising or lowering persons or loads.

Lifting gear: Any gear or tackle by means of which a load can be attached to a lifting appliance but which does not form an integral part of the appliance or load.

Means of access or egress: Passageways, corridors, stairs, platforms, ladders and any other means to be used by persons for normally entering or leaving the workplace or for escaping in case of danger.

Near-miss: An unplanned event not causing harm, but with the potential to cause injury or ill health.

Occupational accident: An unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death; may include commuting accidents, as prescribed in the national legislation.

Occupational disease: Any disease contracted as a result of an exposure to risk factors arising from work activity.

Occupational health services: Services entrusted with essentially preventive functions and responsible for advising the employer, the workers and their representatives at the construction site on the requirements for establishing and maintaining a safe and healthy working environment, which will facilitate optimal physical and mental health in relation to work, and on the adaptation of work to the capabilities of workers in the light of their state of physical and mental health.

Occupational injury: Any personal injury, disease or death resulting from a work accident or an occupational disease.

OSH management system: A set of interrelated or interacting elements to establish OSH policy and objectives and to achieve those objectives.

PPE (Personal protective equipment): Any device or appliance to be worn or used by an individual for protection against one or more health and safety hazards.

PFAS (Personal Fall Arrest Systems): A system used to arrest an employee in a fall from a walking-working surface. It consists of a body harness, anchorage, and connector. The means of connection may include a lanyard, deceleration device, lifeline, or a suitable combination of these.

Putlog or bearer: A scaffold member upon which the platform rests. In a single pole scaffold the outer end of the putlog rests on a ledger and the inner end rests in the wall; in an independent pole scaffold each end of the putlog rests on a ledger; in an independent pole scaffold a putlog is known as a bearer.

Raker: An inclined load-bearing tube or pole.

Risk: A combination of the likelihood of an occurrence of a hazardous event and the severity of injury or damage to the health of people caused by this event.

Risk assessment: The process of evaluating the risks to safety and health arising from hazards at work.

Safety and health committee: A committee with equal representation of workers' OSH representatives and employers' representatives, established and functioning according to national laws, regulations or practice.

Safety and health officer: A person with sufficient skills, knowledge and experience who assists employers and workers in assessing, designing, planning and implementing safety and health activities and helps maintain an effective OSH management system.

Safety extra-low voltage: A nominal voltage not exceeding 50 V AC or 120 V ripple-free DC, whether between conductors or to earth.

Scaffold: Any temporary structure, fixed, suspended or mobile, and its supporting components which is used for supporting workers and materials or to gain access to any such structure, and which is not a "lifting appliance" as defined above.

Sound or good construction: Construction conforming to any relevant standards issued by a national standardizing institution or other body recognized by the competent authority, or to generally accepted international engineering practices or other technical standards.

Sound or good material: Material of a quality conforming to any relevant standards issued by a national standardizing institution or other body recognized by the competent authority or to generally accepted international engineering practices or other technical standards.

Standard (upright or post): In relation to a scaffold, a vertical or near vertical tube which bears the weight of a scaffold and its load and includes a through tie or a reveal tie or a bore tie; a through tie is a tie assembly through a window or other opening in a wall; a reveal tie is an assembly of a reveal tube with wedges or screwed fittings or pads fixed between the opposing faces of an opening in a wall together with the tie tube; a bore tie is where a hole is drilled into the structure facing to insert a ring or eye bolt.

Toe board: A barrier placed along the edge of a scaffold platform, runway, etc., and secured there to guard against the slipping and falling of persons or the falling of material.

Transom: A tube spanning across ledger to form the support for boards forming the working platform or to connect the outer standards to the inner standards.

Welfare facilities: Facilities that are necessary for the well-being of workers: (a) feeding facilities in or near the undertaking; (b) rest facilities in or near the undertaking and recreation facilities excluding holiday facilities; and (c) transportation facilities to and from work where ordinary public transport is inadequate or impracticable, in accordance with the Welfare Facilities Recommendation, 1956 (No. 102).

Worker: Any person engaged in construction.

Worker representative: In accordance with the Workers' Representatives Convention, 1971 (No. 135), any person who is recognized as such by national law or practice, whether they are:

- (a) trade union representatives, namely, representatives designated or elected by trade unions or by members of such unions; or
- (b) elected representatives, namely, representatives who are freely elected by the workers of the enterprise in accordance with provisions of national laws or regulations

or of collective agreements, and whose functions do not include activities which are recognized as the exclusive prerogative of trade unions in the country concerned.

Workplace: All places where workers need to be or to go by reason of their work and which are under the control of an employer as defined in “employer”.

► 2. General duties

2.1. General duties of competent authorities

2.1.1. The competent authorities, in the light of national conditions and practice and the provisions of this code, and based on an assessment of the safety and health hazards involved and in consultation with the most representative organizations of employers and workers concerned, should:

- (a) develop, maintain and control the application of national laws and regulations to ensure the safety and health of workers in construction projects and to protect persons at, or in the vicinity of, a construction site from all risks which may arise from such site; and
- (b) formulate, implement and periodically review a coherent national policy on OSH, including the promotion of a systematic approach through OSH management systems in accordance with national laws and regulations.

2.1.2. The national laws and regulations adopted in pursuance of paragraph 2.1.1 should provide for their practical application through technical standards, codes of practice, exposure limits, standards of competency and training for all workers or by other appropriate methods consistent with national conditions and practices; and should establish a process for consultation with and dissemination of information to employers, workers and their representatives.

Labour inspectorates

2.1.3. Taking into consideration the provisions of the Labour Inspection Convention (No. 81), its Protocol of 1995, and Recommendation (No. 81), 1947, inspectorates designated by the competent authority should, in a manner prescribed by national laws and regulations:

- (a) enforce all relevant laws and regulations on construction sites;
- (b) periodically carry out inspections in the presence of the employer and worker representatives, where appropriate, and monitor compliance with all relevant laws and regulations;
- (c) provide technical information and advice to assist employers, workers and their representatives with respect to their OSH responsibilities, duties and rights;
- (d) keep abreast of the OSH requirements and performance of comparable national or international construction sites to provide feedback for further development and improvement of safety measures;
- (e) monitor compliance with social security/workers' compensation schemes; and
- (f) participate, in cooperation with the recognized organizations of employers and workers, in formulating and updating safety rules and measures to be adopted at the national and enterprise levels.

2.1.4. Labour inspectors should, in a manner prescribed by national laws and regulations:

- (a) be competent to deal with the OSH issues for all workers associated with construction and be able to provide support and advice;
- (b) have the authority to investigate accidents, dangerous occurrences and diseases; notify the employer, the workers concerned and their representatives, as well as

safety and health committees, of the findings of inspections and the required remedial action;

- (c) notify the employer, the workers concerned and their representatives, as well as safety and health committees, of the findings of inspections and the required remedial action;
- (d) have the authority to remove workers from situations involving an imminent and/or serious danger to life or health;
- (e) periodically determine whether an existing OSH management system or OSH elements are in place, adequate and effective;
- (f) have authority to suspend or restrict construction activities on safety and health grounds, until the condition giving rise to the suspension or restriction has been corrected;
- (g) cooperate with other government authorities to take appropriate action; and
- (h) have access to all worker health and safety education and training records.

2.1.5. The authority, rights, procedures and responsibilities of labour inspectors should be communicated to all affected parties.

Competent authority

2.1.6. The measures to be taken to ensure that there is organized cooperation between employers and workers to promote safety and health at construction sites should be prescribed by national laws or regulations or by the competent authority. Such measures should include:

- (a) the establishment of safety and health committees comprised of representatives of employers and workers with such powers and duties as may be prescribed;
- (b) the election or appointment of workers' safety and health representatives with such powers and duties as may be prescribed and supported with appropriate training;
- (c) the appointment by the employer of suitably qualified and experienced persons with appropriate training to promote safety and health; and
- (d) the training of workers' safety and health representatives and safety and health committee members.

2.1.7. National laws or regulations should provide for the notification by the client to the competent authority of construction sites of such size, duration or characteristics in accordance with such time schedule as may be prescribed.

2.1.8. National laws or regulations should provide for general duties of clients, designers, engineers and architects to take into consideration the principles of prevention when designing buildings, structures or construction projects and the ongoing maintenance to achieve effective management of risks.

2.1.9. The competent authority should establish in accordance with the provisions of relevant ILO international labour standards and considering the need to harmonize such systems internationally:

- (a) systems, including criteria, for classifying substances that may be hazardous to health;
- (b) systems and criteria for assessing the relevance of the information required to determine whether a substance is hazardous;

- (c) requirements for marking and labelling substances. Substances for use in construction should be marked and labelled according to these requirements;
- (d) criteria for the information contained in the substance safety data sheets received by employers; and
- (e) systems and criteria for identifying safety hazards and appropriate risk control measures relating to structures, facilities, machinery, equipment, processes and operations used in construction.

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

2.1.11. If justified on safety and health grounds, the competent authority should:

- (a) prohibit or restrict the use of certain hazardous practices, processes or substances; or
- (b) require advance notification and authorization before any such restricted practices, processes and substances are used; or
- (c) without discrimination, specify categories of workers who, for reasons of safety and health, are not allowed to use specified processes or substances, or are allowed to use them but only under conditions prescribed in accordance with national laws or regulations, taking into account international labour standards and guidance.

2.1.12. The competent authority should ensure the enforcement of national laws and regulations on OSH mentioned above through an adequate and appropriate system of inspection. The system of enforcement should provide for corrective measures and adequate penalties for violations of national laws and regulations on OSH.

2.1.13. The competent authority should ensure that guidance is provided to employers, workers and their representatives to help them comply with their legal obligations. The competent authority should provide assistance to employers, workers and their representatives with respect to their OSH responsibilities, duties and rights.

2.1.14. The competent authority should establish, apply and periodically review a system for the sex- and age-disaggregated recording and notification by employers of occupational accidents, occupational diseases and dangerous occurrences in the construction sector.

2.1.15. The competent authority should make provisions for workers in the construction sector to have access to work injury benefits schemes with a view to ensuring compensation in case of occupational accidents, disease and ill health, as required.

2.2. Cooperation, coordination and effective communication

2.2.1. This code recognizes that effective OSH systems require social dialogue, joint commitment and consultation between the competent authority, clients, employers, workers and their representatives. The parties should cooperate in a constructive manner to ensure that the objectives of this code are achieved.

2.2.2. Measures for cooperation should be taken relating to the identification of hazards and the elimination, reduction or control of risks to safety and health in construction throughout its life cycle – from planning, design, tendering and the construction process itself to the final handover and evaluation. These measures should include the following:

- (a) clients should include OSH criteria in procedures for evaluating and selecting contractors in the tendering process through requirements in bidding documents and conditions of contract. This should include details about proposed OSH management systems and their budget as well as previous OSH performance (accident and ill-health data);
- (b) employers, in discharging their responsibilities, should cooperate as closely as possible with workers and their representatives;
- (c) workers should cooperate with their fellow workers and their employers in the discharge by the employers of their responsibilities, and should comply with all prescribed procedures and practices and receive the necessary information, instruction and training to do so;
- (d) in line with national law, workers and their representatives at a construction site should be given adequate information on measures taken by the employer to secure OSH;
- (e) manufacturers and suppliers should provide employers with all necessary information as is available and required for the evaluation of safety and health risks that are likely to be present during a relevant work activity;
- (f) designers, engineers and architects should cooperate with clients and employers during the design, construction and handover phases of the construction project to eliminate safety and health hazards or reduce risk, as far as practicable, and provide employers with all necessary information and required for the evaluation of safety and health risks that are likely to be present during a relevant work activity; and
- (g) the competent authority should endeavour to promote close cooperation between employers, engineers, designers, manufacturers, suppliers, workers and their representatives on safety and health in construction.

2.2.3. Whenever two or more employers undertake activities at one construction site, they should cooperate with one another as well as with the client or client's representative and with other persons participating in the construction work being undertaken in the application of the prescribed safety and health measures.

2.2.4. Whenever two or more employers undertake activities simultaneously or successively at one construction site, the principal contractor, or other person or body with actual control over or primary responsibility for overall construction site activities, should be responsible for planning, coordinating and monitoring safety and health measures and, in so far as is compatible with national laws and regulations, for ensuring compliance with such measures.

2.2.5. In so far as is compatible with national laws and regulations, where the principal contractor, or other person or body with actual control over or primary responsibility for overall construction site activities, is not present at the site, they should nominate a competent person or body at the site with the authority and means necessary to ensure on their behalf coordination and compliance with safety and health measures.

2.2.6. Employers should remain responsible for the application of the safety and health measures in respect of the workers placed under their authority.

2.2.7. Employers and designers should liaise effectively on factors affecting safety and health.

2.3. General duties of employers

2.3.1. Employers should provide adequate means and organization and should establish a suitable programme on the safety and health of workers consistent with national laws and regulations, and should comply with the prescribed safety and health measures at the workplace regarding hazards or risks to safety and health in construction, including technical standards, codes of practice and guidelines as prescribed, approved and recognized by the competent authority.

2.3.2. Employers should, in consultation with workers and their representatives in line with national law, conduct a risk assessment of all work activities carried out on the construction site so as to provide and maintain workplaces, plant, equipment, tools and machinery, and so organize construction work to ensure that as far as is reasonably practicable, there is no risk of accident or injury to the health of workers as well as other persons, where relevant, in the vicinity of construction activities. Any residual risk should be addressed in accordance with the hierarchy of controls set out in paragraph 3.5.1 below. If the employers and workers and their representatives cannot agree on risk control measures, the issue should be referred to the competent authority. In particular, construction work should be so planned, prepared and undertaken to ensure that:

- (a) risks liable to arise at the workplace are eliminated, controlled and minimized as far as possible;
- (b) excessively or unnecessarily strenuous work positions and movements are avoided;
- (c) organization of work takes into account the safety and health of workers;
- (d) materials and equipment used are suitable from a safety and health point of view;
- (e) working methods are employed which protect workers against the harmful effects of chemical, physical, biological and psychosocial risks;
- (f) full compliance with safety regulations is achieved; and
- (g) all personnel (managers, supervisors and workers) are competent to conduct their allocated tasks (or fulfil their duties).

2.3.3. In line with national law, employers should initiate and maintain a process of consultation and cooperation with workers and their representatives concerning all aspects of safety and health in construction, in particular as regards the measures of prevention and protection specified in this code. This process should be carried out within the framework of safety and health committees, in accordance with the Occupational Safety and Health Convention, 1981 (No. 155), Paragraph 12 of the Occupational Safety and Health Recommendation, 1981 (No. 164), or through another mechanism determined by the competent authority or by agreements.

2.3.4. Employers should take all appropriate precautions to protect persons and the environment, where practicable, at, or in the vicinity of, a construction site from all risks which may arise from such site.

2.3.5. Employers should arrange for regular safety inspections by competent persons at suitable intervals of all buildings, plant, equipment, tools, machinery, workplaces and systems of work under the control of the employer at construction sites in accordance with national laws, regulations, technical standards or codes of practice. As appropriate, the competent person should examine, test and record by type or individually to ascertain the safety of construction machinery and equipment.

2.3.6. When acquiring plant, equipment or machinery, employers should ensure that it takes account of ergonomic principles in its design and conforms to relevant national laws,

regulations, standards or codes of practice and, if there are none, that it is so designed or protected that it can be operated safely and without risk to health.

2.3.7. Employers should provide adequate and competent supervision of work. Such supervision should ensure that workers perform their work with due regard to their safety and health.

2.3.8. Employers should assign workers only to employment for which they are competent to undertake.

2.3.9. Employers should ensure that all managers, supervisors, workers, and worker safety and health representatives are suitably instructed in the hazards connected with their work and environment and trained in the measures necessary to avoid accidents and injury to health.

2.3.10. Employers should make the necessary arrangements to investigate occupational accidents, illnesses and incidents, in cooperation with safety and health committees and/or workers and their representatives, to identify all causes, and should take the measures necessary to prevent recurrences of similar occupational accidents, illnesses and incidents. The employer should also report, as specified by national laws and regulations, to the competent authority on occupational accidents, occupational diseases and dangerous occurrences.

2.3.11. Employers should register workers with the institution responsible for workers' compensation, employment or work injury benefits or social security, as appropriate in the national context, to ensure that workers are effectively covered against work accidents and occupational diseases. They should pay the contributions or premiums due in this respect, and should notify the responsible institution in case of an occupational accident or occupational disease.

2.3.12. Employers should take all practicable steps to ensure that workers are made aware of and comply with the relevant national or local laws, regulations, technical standards, codes of practice, instructions and advice relating to prevention of accidents and injuries to health.

2.3.13. Employers should ensure that buildings, plant, equipment, tools, machinery or workplaces in which a dangerous defect has been found should not be used until the defect has been remedied.

2.3.14. Where there is an imminent danger to the safety or health of workers, the employer should take immediate steps to stop the operation and evacuate workers, as appropriate, and cannot require workers to return to a work situation in which there is a continuing imminent and serious danger to life or health.

2.3.15. On dispersed sites and where small groups of workers operate in isolation, employers should establish communication systems, along with a checking system, by which it can be ascertained that all the members of a shift, including operators of mobile equipment, have returned to the camp or base at the close of work.

2.3.16. Employers should provide appropriate first aid, training and welfare facilities to workers. Employers should also ensure access for workers to occupational health services and health surveillance.

2.3.17. Where risks cannot be adequately controlled by other means, employers should provide suitable PPE, at no cost for the worker, and ensure its proper use.

2.3.18. Employers should ensure that systems are in place so that when managers, supervisors, safety and health officers and workers observe non-compliance with safety and health regulations, technical standards and applicable codes of practice by any person, they should take appropriate corrective action immediately.

2.4. General rights and duties of workers

2.4.1. Governments have the duty to adopt, implement and effectively enforce national law and regulation and to ensure that fundamental principles and rights at work and ratified international labour standards protect and are applied to all workers in the construction sector, taking into account their obligations under other international labour standards.

2.4.2. Workers should have the right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on working procedures adopted as they may affect safety and health.

2.4.3. Workers should have the right to obtain proper information from the employer regarding safety and health hazards and associated risk control measures related to the work processes. Workers also have the right to obtain proper information from the competent authority on, as well as on their right to compensation and medical care in case of occurrence of occupational accident, disease or ill health, and to the recourse and remedies available to them in case of non-respect of such rights. This information should be presented in forms and languages which the workers easily understand.

2.4.4. Workers should have the right to remove themselves and inform their co-workers in the vicinity from danger when they have reasonable justification to believe that there is an imminent and/or serious risk to their safety or health. They should have the duty to inform their supervisor and safety and health representative immediately.

2.4.5. In accordance with national legislation, workers should:

- (a) cooperate as closely as possible with their employer in the application of the prescribed risk control measures;
- (b) take reasonable care for their own safety and health and that of other persons who may be affected by their acts or omissions at work;
- (c) use and take care of PPE and facilities placed at their disposal and not misuse anything provided for their own protection or the protection of others;
- (d) report forthwith to their immediate supervisor, and to the workers' safety representative where one exists, any situation which they believe could present a risk and which they cannot properly deal with themselves, as well as reporting accidents, occupational illnesses, dangerous occurrences, and near-miss events;
- (e) comply with the prescribed risk control measures; and
- (f) participate in regular safety and health meetings.

2.4.6. Except in an emergency, workers, unless duly authorized, should not interfere with, remove, alter or displace any safety device or other appliance furnished for their protection or the protection of others, or interfere with any method or process adopted with a view to avoiding accidents and injury to health.

2.4.7. Workers should not operate or interfere with plant and equipment that they have not been duly authorized to operate, maintain or use, nor be required to undertake such work.

2.4.8. Workers should have designated areas to rest or sleep away from dangerous places such as scaffolds, railway tracks, garages, under vehicles, or in the vicinity of fires, dangerous or toxic substances, running machines or vehicles and heavy equipment.

2.5. General duties of clients

2.5.1. Clients should:

- (a) coordinate or nominate a competent person to coordinate all activities relating to safety and health on their construction projects, ensuring that the following matters are covered:
 - (i) procedures to ensure that the employer, including contractors and subcontractors, performs a risk assessment, establishes risk controls for their work and submits a workplan, and informs the client of any significant changes;
 - (ii) procedures to ensure that other parties appointed to a construction project comply with their duties as set out in section 2.6 of this code;
 - (iii) procedures for evaluating and selecting contractors and subcontractors that include OSH criteria; through requirements contained in bidding documents, conditions of contract, and technical specifications. Those criteria should include details on the contractor's OSH management system, and a project-specific health and safety plan. The client should ensure that all contractors have the requisite knowledge and skills to perform their work;
 - (iv) The client should obtain information and documents concerning their OSH procedures, personnel qualifications and workers' skills certifications as well as the health and safety performance;
 - (v) effective ongoing communication and coordination between appropriate levels of the construction site and the employer, including contractors and subcontractors, prior to commencing work, which should include provisions to identify hazards and measures to eliminate and control risks;
 - (vi) arrangements for reporting, recording and notification of occupational injuries and occupational diseases, ill health and dangerous occurrences among the workers, including those of contractors and subcontractors, while performing work for the construction site;
 - (vii) provision of relevant workplace safety and health hazard awareness, information, instruction and training to the employer, including contractors and subcontractors, and their workers prior to commencing work and as work progresses, as necessary;
 - (viii) regular monitoring of the contractor's OSH performance;
 - (ix) periodic joint safety and health inspections by employers, contractors and subcontractors involved in the work at the site to identify and control harm and hazards at work; and
 - (x) follow-up of on-site OSH policies, procedures and arrangements by the employer, including contractors and subcontractors;
- (b) inform all contractors and other involved parties on the project of relevant risks to health and safety of workers which the clients are or should be aware; and
- (c) require those submitting tenders to make provision for the cost of safety and health measures during the construction process. These costs should be budgeted.

2.5.2. When using contractors and subcontractors, clients should ensure that:

- (a) contractors and subcontractors develop a safety and health management plan in accordance with the OSH management system at the construction site that is approved by the client prior to commencing work;
- (b) The client should be responsible for ensuring that all contractors meet the requirements of the safety and health management plan. The management plan should set out the contractor's and subcontractors' responsibilities on OSH including monitoring and enforcement procedures;
- (c) The management plan should identify potential OSH construction risks and set out with technical details the mitigation or preventive measures that will be put in place, including equipment descriptions and operating procedures;
- (d) The management plan should include the cost estimates for implementing the measures identified and specify which party is responsible for operation, supervision, enforcement, monitoring and remedial actions;
- (e) the same safety and health rights outlined in paragraph 2.1.6 apply to contractors and subcontractors and their workers as to the workers in the establishment, including training requirements and procedures to investigate accidents, occupational illnesses and dangerous occurrences;
- (f) where required, only such contractors and subcontractors are used that have been duly registered or hold licenses; and
- (g) contracts specify safety and health requirements as well as sanctions and penalties in case of non-compliance. Contracts should include the right for supervisors mandated by the client to inspect work, stop work whenever a risk of serious injury is apparent and suspend operations until the necessary remedies have been put in place.

2.5.3. In estimating the periods for completion of work stages and overall completion of the construction project, clients should take account of safety and health requirements during the construction process.

2.6. General duties of designers, engineers, architects, suppliers and manufacturers

2.6.1. Those concerned with the design and planning of a construction project should receive training in safety and health and should integrate the safety and health of the construction workers into the design and planning process, in accordance with national laws, regulations and practice.

2.6.2. Care should be exercised by engineers, architects and other professional persons, not to include anything in the design which would necessitate the use of dangerous structural or other procedures or materials hazardous to health or safety which could be avoided by design modifications or by substitute materials and, where applicable, favouring the use of sustainable materials.

2.6.3. Those designing buildings, structures or other construction projects should take into account the safety problems associated with subsequent maintenance and upkeep where maintenance and upkeep would involve special hazards.

2.6.4. Facilities should be included in the design for such work to be performed with the minimum risk.

2.6.5. In accordance with the guidance contained in the ILO code of practice on safety and health in the use of machinery (2013), national laws and regulations should be in place to ensure that those who design, manufacture, import, provide or transfer machinery, equipment, components, materials or substances for use in construction:

- (a) ensure that the machinery, equipment, components, materials or substances do not entail dangers for the safety and health of those using them correctly and are in compliance with national laws and regulations applicable; and
- (b) facilitate information concerning their requirements for the correct set-up, use and maintenance of machinery and equipment and the correct use of substances, including information about the hazards and risk control measures to be followed.

► 3. OSH management systems

3.1. Introduction

3.1.1. The process of improving working conditions on a construction project should be approached in an inclusive and systematic way. With a view to achieving acceptable and environmentally sound OSH conditions, it is necessary to continually invest in permanent structures for their continuous review, planning, implementation, evaluation and action. This should be done through the implementation of OSH management systems and in line with the construction project life cycle. The systems should be specific to the construction project and appropriate to their size and the nature of their activities. Their design and application should be guided by the *Guidelines on Occupational Safety and Health Management Systems* (ILO-OSH 2001) and also by the *10 Keys for Gender Sensitive OSH Practice – Guidelines for Gender Mainstreaming in Occupational Safety and Health* (ILO, 2013).

3.1.2. The OSH management system should contain the main elements of policy, organizing, planning and implementation, evaluation and action for improvement as shown in the figure.

► **Figure** Main elements of the OSH management system



3.1.3. OSH measures and measures to protect the environment are intrinsically linked. It is strongly recommended that construction projects, in conjunction with the OSH management system, should have an environmental management system in place that identifies the environmental impact and facilitates the setting of environmental performance targets and the measurement of progress.

3.2. Occupational safety and health policy

3.2.1. The employer, in consultation with workers and their representatives, should set out to write an OSH policy, which should be:

- (a) specific to the construction project and appropriate to its size and the nature of its activities;
- (b) concise, clearly written, dated and made effective by the signature or endorsement of the employer or the most senior accountable person in the construction project;
- (c) communicated and readily accessible to all persons at their place of work;
- (d) reviewed for continuing suitability; and
- (e) made available to relevant external interested parties, as appropriate.

3.2.2. The OSH policy should include, at a minimum, the following key principles and objectives to which the construction project is committed:

- (a) protecting the safety and health of all workers on the construction project by preventing occupational injuries, occupational diseases, ill health and incidents;
- (b) complying with relevant OSH national laws and regulations, voluntary programmes, collective agreements on OSH and other requirements to which the construction project subscribes;
- (c) ensuring that workers and their representatives are consulted and encouraged to participate actively in all elements of the OSH management system; and
- (d) continually improving the performance of the OSH management system.

3.2.3. The OSH management system should be compatible with or integrated in other management systems on the construction project.

Worker participation

3.2.4. Worker participation is an essential element of the OSH management system on the construction project.

3.2.5. The employer should ensure that workers and their safety and health representatives are consulted, informed and trained on all aspects of OSH, including emergency arrangements, associated with their work.

3.2.6. The employer should make arrangements for workers and their safety and health representatives to have the time and resources to participate actively in the processes of organizing, planning and implementation, evaluation and action for improvement of the OSH management system.

3.2.7. The employer should ensure, as appropriate, the establishment and efficient functioning of a safety and health committee and the recognition of workers' safety and health representatives, in accordance with national laws and practice.

3.3. Responsibility and accountability

3.3.1. The employer should have overall responsibility for the protection of workers' safety and health and provide leadership for OSH activities on the construction project.

3.3.2. The employer should allocate resources, responsibility, accountability and authority for the development, implementation and performance of the OSH management system and the achievement of the relevant OSH objectives. Structures and processes should be established which:

- (a) ensure that OSH is a line-management responsibility that is known and accepted at all levels;
- (b) define and communicate the responsibility, accountability and authority of persons who identify, evaluate or control OSH hazards and risks on the construction project;
- (c) provide effective supervision, as necessary, to ensure the protection of workers' safety and health;
- (d) promote cooperation and communication among all stakeholders on the construction project, including workers and their representatives, and, as relevant, in coordination with other employers, as well as clients, designers, engineers, architects, suppliers and manufacturers, to implement the elements of the construction project's OSH management system;
- (e) fulfil the principles of OSH management systems contained in relevant national guidelines, tailored guidelines or voluntary programmes, as appropriate, to which the construction project subscribes;
- (f) establish and implement a clear OSH policy and measurable objectives;
- (g) establish effective arrangements to identify and eliminate or control work-related hazards and risks, and promote health at work;
- (h) establish prevention and health promotion programmes;
- (i) ensure effective arrangements for the full participation of workers and their representatives in the fulfilment of the OSH policy;
- (j) provide appropriate resources to ensure that persons responsible for OSH, including the safety and health committee, can perform their functions properly; and
- (k) ensure effective arrangements for the full participation of workers and their representatives in safety and health committees, where they exist.

3.3.3. A person or persons at the senior management level should be appointed, where appropriate, with responsibility, accountability and authority for:

- (a) the development, implementation, periodic review and evaluation of the OSH management system;
- (b) periodic reporting to the senior management on the performance of the OSH management system; and
- (c) promoting the participation of all members on the construction project.

3.4. Initial review and system planning

3.4.1. Before work begins, the employer should ensure that an initial review of the existing OSH management system is carried out by competent persons, in consultation with workers and their representatives, as appropriate; or if the construction project is newly established, the initial review should serve as a basis for establishing an OSH management system. It should:

- (a) identify the current applicable national laws and regulations, national guidelines, specific guidelines, voluntary programmes and other relevant requirements for the activities to be carried out;
- (b) identify, anticipate and assess hazards and risks to safety and health arising from the existing or proposed work environment and work organization;
- (c) determine whether planned or existing controls are adequate to eliminate hazards or control risks; and
- (d) analyse other available data, including data disaggregated by sex and age, and in particular data provided from workers' health surveillance (see Appendix I to this code), the surveillance of the working environment (see Appendix II to this code) and active and reactive monitoring, if available.

3.4.2. The initial review should:

- (a) be documented;
- (b) used in the systematic development of safety and health arrangements for the construction project;
- (c) become the basis for the planning and practical implementation of the OSH management system; and
- (d) provide a baseline from which continual improvement of the construction project's OSH management system can be measured.

3.4.3. Arrangements should be made for adequate and appropriate OSH planning, based on the results of the initial review, subsequent reviews or other available data, and covering the development and implementation of all the OSH management system elements, as described in paragraph 3.1.2 and illustrated in the figure. These planning arrangements should contribute to the protection of safety and health at work in compliance with national laws and regulations and aiming at the continual improvement in OSH performance, and should include:

- (a) a clear definition, priority-setting and quantification, where appropriate, of the construction site's OSH objectives;
- (b) the preparation of a plan for achieving each objective, with defined responsibility and clear performance criteria indicating what is to be done by whom and when;
- (c) the selection of measurement criteria for confirming that the objectives are achieved; and
- (d) the provision of adequate resources, including human and financial resources and technical support, as appropriate.

3.5. Hazard identification, risk assessment, and preventive and protective measures

3.5.1. Employers should have a system in place, in consultation with all workers and their representatives, to identify hazards, assess risks to safety and health and apply risk control measures, on an ongoing basis and in conformity with national laws and regulations. These measures should be implemented in the following order of priority:

- (a) eliminate the hazard;

- (b) control the risk at source, through measures such as substitution (for example, replacing hazardous equipment or substances with less hazardous equipment or substances) or engineering controls;
- (c) minimize the risk through the design of safe work systems; and
- (d) in so far as the risk remains, the employer should provide for the use of adequate PPE, including protective clothing, in various sizes, adaptable to both women and men and at no cost to workers, and implement measures and training to ensure its appropriate use and maintenance.

3.5.2. In giving effect to the above, the employer should establish, implement and maintain documented procedures to ensure that the following activities take place:

- (a) hazard identification;
- (b) risk assessment;
- (c) control of risks; and
- (d) a process to monitor and evaluate the effectiveness of these activities.

3.5.3. The identification of hazards in the workplace should take into account:

- (a) the situation or events or combination of circumstances that have the potential to give rise to occupational accident, disease, ill health or dangerous occurrences;
- (b) the nature of potential occupational injury or illness or ill health relevant to the activity, product or service;
- (c) past occupational injuries, near misses, dangerous occurrences and illness or ill health;
- (d) the way work is organized, managed, carried out and any related changes;
- (e) the design of workplaces, work processes, materials, plant and equipment;
- (f) the fabrication, installation, commissioning, handling and disposal of materials, workplaces, plant and equipment;
- (g) the purchasing of goods and services;
- (h) the contracting of plant, equipment, services and labour, including contract specification and responsibilities in relation to and of contractors and their subcontractors; and
- (i) the inspection, maintenance, testing, repair and replacement of plant and equipment.

3.5.4. The employer should perform a risk assessment to determine the level of risk of injury or illness associated with each identified hazard, for the purpose of control. All risks should be assessed in consultation with workers and their representatives and should have control measures assigned, based on the assessed level of risk, that account for the likelihood and severity of injury or illness from the identified hazard. The priority for control increases as the assessed level of risk rises. For practical examples and guidance, see *Conducting Labour Inspections on Construction: A Guide for Labour Inspectors* (ILO, 2017); *A 5 Step Guide for Employers, Workers and their Representatives on Conducting Workplace Risk Assessments* (ILO, 2014); and the *Training Package on Workplace Risk Assessment and Management for Small and Medium-Sized Enterprises* (ILO, 2013).

3.5.5. Risk control measures should be monitored and reviewed at regular intervals and, if necessary, revised, especially when circumstances change or if new information becomes available about the risks identified or the suitability of existing control measures. Risk control measures should also be reviewed and, if necessary, revised following any occupational accidents, ill health, diseases, dangerous occurrences and near misses.

3.5.6. Consideration should be given to introducing specific safety and health measures, controls or adaptations necessary to protect persons in vulnerable situations, including but not limited to women who are pregnant or breastfeeding, inexperienced workers, apprentices, people with disabilities or older workers.

3.6. Emergency preparedness

3.6.1. Emergency planning, prevention, preparedness and response arrangements should be established, periodically reviewed and maintained throughout the construction project life cycle by the employer in cooperation with workers, external emergency services and other bodies, where applicable. These arrangements should identify the potential for accidents and emergency situations and address the prevention of OSH risks associated with them. Arrangements should be made according to the location and environment of the construction project and should take into account the size and nature of the activities associated with each construction project.

3.6.2. In consultation with the relevant competent authorities, emergency plans should take account of the risks of extreme weather events, including floods, extreme heat or cold, wild fires and natural disasters, where appropriate.

3.6.3. In consultation with the relevant competent authorities, emergency plans should take account of other public health risks that could impact the workforce, including communicable and vector-borne diseases, particularly endemic and pandemic infections, where appropriate.

3.6.4. Emergency plans should be made and updated for every construction project in accordance with relevant internationally recognized instruments and national laws and regulations, taking into account the size and nature of the activities on the construction project at each location. They should:

- (a) ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency on the construction project;
- (b) provide information to, and communication with, the relevant competent authorities, and the neighbourhood and emergency response services;
- (c) address first aid and medical assistance, fire response and evacuation of all people at the construction project; and
- (d) provide relevant information, instruction and training to all workers at the construction project and any person who may be involved in an emergency, at all levels and according to their competence, including regular exercises in emergency prevention, preparedness and response procedures.

3.6.5. The emergency response plan should be developed for each construction project and should be sufficiently comprehensive to deal with all types of emergencies. The emergency response plan should be evaluated periodically and the necessary improvements should be recorded and implemented.

3.6.6. The emergency response plan should include, for each foreseeable scenario, at a minimum:

- (a) emergency escape routes and procedures, including signings and markings indicating the escape routes to be used;
- (b) procedures to be followed by workers who remain to perform critical operations before evacuation;
- (c) the evacuation of the construction site and the surrounding area;
- (d) procedures to account for all workers after the emergency evacuation is complete;
- (e) rescue and medical duties for workers who are assigned to perform them;
- (f) the means for reporting and raising the alarm in the event of fire and other emergencies;
- (g) the provision of relevant information, instruction and training to all persons engaged in work at the construction project, at all levels, including regular exercises, at least annually, in emergency prevention, preparedness and response procedures;
- (h) the provision of protected means of escape for high-risk sites to allow a safe evacuation; and
- (i) all necessary emergency equipment identified in the emergency plan should be in place and in good repair, with staff aware of its location and, where appropriate, trained in its safe use.

3.6.7. A chain of command should be established to ensure that workers have no doubt about who has the authority to make decisions. Emergency response teams should be established and responsible individuals should be selected to coordinate their work. The responsibilities of the coordinator(s) should include:

- (a) assessing the situation and determining whether an emergency exists that requires activation of the emergency procedures;
- (b) acting to minimize the event, for example controlling a fire, controlling leaks and spills, directing an emergency shutdown or suspending action specifically prohibited if persons are at risk;
- (c) directing all efforts in the area, including evacuating personnel and minimizing the loss of property;
- (d) ensuring that emergency response services, such as medical aid and fire response, are summoned when necessary;
- (e) providing information to, and communication with, the relevant competent authorities and the neighbourhood and emergency response services; and
- (f) directing the shutdown of operations when necessary.

3.6.8. Emergency alarms should be distinguishable from other alarms and capable of being seen and/or heard by everyone, including persons with disabilities and those working at remote locations.

3.6.9. All workers on the construction project should be informed of the procedures to be followed in case of emergency through the provision of up-to-date information, including information on the location of meeting points for evacuation, which are areas of safety where workers should assemble in the event of an emergency.

3.6.10. Workers working alone on construction sites in enclosed premises or in remote or inaccessible places should be provided adequate means of communication to raise the alarm and the means of rapidly summoning assistance in an emergency.

3.6.11. Notwithstanding the paragraphs above, emergency procedures, first aid and fire response for the handling, storage and transport of chemicals, disposal and treatment of waste chemicals, the release of chemicals resulting from work activities and containers for chemicals at construction sites should be established and based on the provisions of Chapter 14 of the ILO code of practice on safety in the use of chemicals at work (1993). At construction sites where chemicals are stored, transported or processed in such a form and such a quantity that they possess the potential to cause a major accident, the provisions on emergency planning in Chapters 8 and 9 of the ILO code of practice on prevention of major industrial accidents (1991) should apply.

3.7. Management of change

3.7.1. The impact on OSH of internal changes (for example, in staffing, processes, working procedures, organizational structures or acquisitions) and external changes (for example, in national laws and regulations, organizational mergers and developments in OSH knowledge and technology) should be evaluated and appropriate preventive steps taken prior to the introduction of changes.

3.7.2. A risk assessment should be carried out before any modification of the project schedule or introduction of new contractors, work methods, materials, processes or equipment in order to ensure that all risks are at an acceptable level.

3.7.3. While much of the work in construction should be covered by established controls developed through the risk management process, there will always be situations that may not be adequately covered by those arrangements. This gives rise to the need to develop and implement processes to identify such “non-routine” work or instances for which established procedures are seen as inadequate and to ensure that a risk assessment is carried out for these activities before they take place.

3.7.4. Such non-routine work might include:

- (a) a type of work that has never been performed before by the team or at the site;
- (b) work that is only performed infrequently;
- (c) work that is outside normal duties;
- (d) work that does not have a documented procedure or safe workplan; and
- (e) work that must be performed in a different way to a documented procedure (including due to an approaching deadline or instances for which a procedure is identified as inadequate).

3.7.5. Responses to the identification of non-routine work should include to conduct a formal risk assessment to ensure that residual risks are at an acceptable level; and, if not, to implement additional risk control measures following the hierarchy of controls (see paragraph 3.5.1).

3.7.6. Whenever new materials, processes or equipment are introduced and new working methods are needed, special attention should be paid to informing and training workers on their implications for safety and health (see Chapter 5 of this code).

3.7.7. Arrangements to support this approach to non-routine work should be in place very early on in the development and operation of a construction project. It should be made clear and accepted by management, supervisors and workers that the only acceptable response to non-routine work should be based on section 3.7 of this code.

3.8. Procurement and contracting

3.8.1. Procurement procedures should be established and maintained to ensure that:

- (a) compliance with safety and health requirements and the OSH management plan for the construction site is identified, evaluated and incorporated in purchasing and leasing specifications;
- (b) national laws and regulations and the construction site's own OSH requirements are identified prior to the procurement of goods and services; and
- (c) arrangements are made to achieve conformity with the requirements prior to their use.

3.8.2. Arrangements for contracting should be established and maintained to ensure that the construction site's safety and health requirements, or at least their equivalent, are applied to contractors and their workers.

3.8.3. Arrangements for contractors working on site should:

- (a) include OSH criteria in procedures for evaluating and selecting contractors;
- (b) establish effective ongoing communication and coordination between appropriate levels of the construction site and the contractor prior to commencing work. This should include provisions for communicating hazards and the measures to prevent and control them;
- (c) include arrangements for the reporting of occupational injuries, ill health, occupational diseases and incidents among the contractors' workers while performing work for the construction site;
- (d) provide relevant workplace safety and health hazard awareness and training to contractors or their workers prior to commencing work and as work progresses, as necessary;
- (e) regularly monitor the OSH performance of contractor activities on site; and
- (f) ensure that on-site OSH procedures and arrangements are followed by the contractor(s).

3.9. Performance monitoring and evaluation

3.9.1. The processes of hazard identification, risk assessment and control should be subject to periodical monitoring and evaluation of performance and modified, as necessary, to establish an ongoing process for continual improvement. This should be carried out by the employer, in consultation with the workers' and their representatives.

3.9.2. In line with section 3.11 of ILO-OSH 2001, performance monitoring and evaluation of the OSH management system should:

- (a) be used as a means of determining the extent to which OSH policy and objectives are being implemented and risks are controlled;

- (b) include both active and reactive monitoring and should not be based only on occupational injury and diseases, ill health and dangerous occurrences statistics;
- (c) consider both quantitative and qualitative measures appropriate to the needs of the construction site; and
- (d) be recorded.

3.10. Safety and health officers

3.10.1. At every construction site, notwithstanding the employer's overall duties and responsibilities and in line with national law and regulation, the employer should appoint one or more safety and health officers to coordinate all matters relating to safety and hygiene on the site.

3.10.2. Only competent persons should be appointed as safety and health officers.

3.10.3. At all construction sites at which a minimum number of workers, as prescribed by national laws or regulations, are regularly employed, a safety and health officer should be employed full-time to be responsible for safety and health activities.

3.10.4. Safety and health officers should assist in the prevention of occupational accidents and occupational diseases and in particular should:

- (a) advise management and other persons responsible for OSH, especially on:
 - (i) the planning and installation of plant facilities, including welfare and sanitary facilities;
 - (ii) the acquisition of working equipment and the introduction of work processes;
 - (iii) the selection, supply maintenance and safe use of PPE;
 - (iv) the organization of workshops, methods of work and the working environment; and
 - (v) other general preventive and protective measures described in this code;
- (b) conduct safety inspections:
 - (i) of working installations and technical devices, especially before they are put into service, and of processes, especially before they are brought into operation;
 - (ii) of systems of work at regular intervals, reporting any deficiencies to the employer or to other persons responsible for OSH and proposing measures for remedying such deficiencies;
 - (iii) to investigate the causes of accidents and diseases and compile reports on the causes and circumstances of every lost-time accident, minor accident and dangerous occurrence, as well as the statistics produced, ensuring their comparability with those of other construction sites;
 - (iv) to observe whether PPE is being provided, maintained and used adequately;
 - (v) to compile and evaluate the results of investigations and propose to management measures to prevent the occurrence and recurrence of accidents;
 - (vi) to exercise surveillance over the execution of specific accident prevention measures; and

- (vii) to ensure that official regulations and instructions relating to health, safety and welfare facilities are complied with;
- (c) assist workers to comply with the requirements of OSH, and especially to instruct them in the occupational hazards to which they are exposed and in the use of the equipment and measures for reducing associated risks, and cooperate and participate in the periodic training of first-aid workers;
- (d) if necessary to prevent danger, report to the official occupational health services and/or labour inspectorate, as prescribed in national laws and regulations, any unsatisfactory conditions as regards safety and health that the employer fails to remedy within a reasonable time; and
- (e) work in close collaboration with the members of the safety and health committee and worker safety representatives, and inform them of all important occurrences and all proposals made.

3.11. Safety and health committees

3.11.1. Employers should establish safety and health committees with equal representation of workers and management consistent with national laws and regulations for the participation of workers in ensuring safe working conditions. Representatives of workers and management should meet regularly, and whenever necessary, to discuss all aspects of safety and health at the construction site.

3.11.2. The employer should provide the safety and health committee with the facilities, training and assistance necessary to perform its functions, including all necessary safety and health information required for committee representatives, and to educate workers on:

- (a) their right to refuse unsafe work without fear of reprisals;
- (b) their right to participate in all aspects of their safety and health; and
- (c) their right to know how their work activities may affect their safety and health.

3.11.3. The employer should notify the safety and health committee:

- (a) as soon as practicable, of any occupational accident, occupational disease or dangerous occurrences at the construction site; and
- (b) in good time before any inspection or investigation by the competent authority at the construction site regarding which the employer has received advance notice.

3.11.4. National laws or regulations should specify the powers and functions of safety and health committees.

3.12. Worker safety and health representatives

3.12.1. Workers have the right to collectively select safety and health representatives.

3.12.2. Workers' safety delegates, workers' safety and health committees, and joint safety and health committees or, as appropriate, other workers and their representatives should:

- (a) represent workers in all matters bearing on safety and health at the construction site;
- (b) participate in inspections and investigations conducted by the employer and by the competent authority at the workplace and to monitor and investigate OSH matters;
- (c) have recourse to advisers and independent experts;

- (d) consult with the employer in a timely fashion on OSH matters, including policies and procedures;
- (e) consult with the competent authority;
- (f) receive, relevant to the area for which they have been selected, notice of accidents occupational diseases, ill health, and dangerous occurrences;
- (g) be given adequate information on safety and health matters, enabled to examine factors affecting safety and health, and encouraged to propose measures on the subject;
- (h) be consulted when major new safety and health measures are envisaged, and before they are carried out;
- (i) be consulted in planning alterations of work processes, work content or organization of work, which may have safety or health implications for the workers;
- (j) be given protection from dismissal and other measures prejudicial to them while exercising their functions in the field of OSH as workers and their representatives or as members of safety and health committees;
- (k) be able to contribute to the decision-making process at the level of the undertaking regarding matters of safety and health;
- (l) have access to all parts of the workplace and be able to communicate with the workers on safety and health matters during working hours at the workplace;
- (m) be able to contribute to negotiations in the undertaking on OSH matters; and
- (n) have reasonable time during paid working hours to exercise their safety and health functions and to receive training related to these functions.

► 4. Competence, information, instruction and training

4.1. Employers should ensure that workers are competent and that they should be adequately and suitably:

- (a) informed of potential safety and health hazards to which they may be exposed at the workplace or travelling to or from the workplace in accordance with national law and regulation; and
- (b) instructed and trained in the measures available for the prevention and control, and protection against, those risks.

4.2. No person should be employed in any work on a construction project unless that person has received the necessary information, instruction and training so as to be able to do the work competently and safely. The competent authority should, in collaboration with employers, promote training programmes to enable all the workers to understand the information and instructions related to safety and health matters.

4.3. The information, instruction and training should be given in a language understood by the worker and written, oral, visual and participative approaches should be used to ensure that the worker has assimilated the material. Innovative training approaches and tools, including through digital solutions, where practicable, should be considered.

4.4. National laws or regulations should prescribe:

- (a) the nature and length of training or retraining required for various categories of workers employed in construction projects; and
- (b) that the employer has the duty to set up appropriate training schemes or arrange to train or retrain various categories of workers.

4.5. Every worker should receive effective and timely initial practical and theoretical instruction and training regarding the general safety and health measures common to the construction site before the commencement of duties and refresher trainings at appropriate intervals, or further to significant changes in risk levels for workers or in their functions.

4.6. The form and the content of such training should be devised and implemented in consultation with workers and their representatives. In accordance with the needs identified, training programmes on safety and health measures in construction should include, but should not be limited to:

- (a) pertinent aspects of OSH legislation, codes of practice and instructions on the prevention of accidents and diseases and of any collective agreement, such as the obligations, responsibilities, duties and rights of competent authorities, employers, contractors, subcontractors and workers;
- (b) the nature and degree of hazards or risks to safety and health which may occur, including any factors which may influence that risk, such as appropriate risk control measures;
- (c) the correct and effective use of all prevention, control and protection measures, especially engineering and administrative controls and PPE, as well as the worker's own responsibility for using such measures properly and the verification procedures to ensure their correct function;

- (d) correct methods for the handling of substances, for the operation of processes and equipment, and for storage, transport and waste disposal;
- (e) ergonomically correct methods for the handling of materials and tools;
- (f) assessments, reviews and exposure measurements and the rights and duties of workers in this regard;
- (g) the role of health surveillance, the rights and duties of workers in this regard and access to information;
- (h) instructions on PPE, as necessary, including on its significance, correct use and limitations and in particular on factors which may show the inadequacy or malfunction of the equipment, as well as the measures which may be required for the workers to protect themselves;
- (i) hazard site-specific warning signs and symbols for hazardous ambient factors which may occur;
- (j) procedures to be followed in an emergency, emergency measures, rescue, fire response and fire prevention, and first aid;
- (k) appropriate hygiene practices to prevent, for example, the transmission of hazardous substances off site;
- (l) cleaning, maintenance, storage and waste disposal, to the extent that these may cause exposure for the workers concerned; and
- (m) safety and health practices emerging from utilizing digitalization, information and communication technology (ICT) and other new technologies, as well as more sustainable practices in the construction sector.

4.7. Training programmes should:

- (a) be conducted by competent persons;
- (b) include participants' feedback and evaluation of their comprehension and retention of the training with a view to the continuous improvement of such training;
- (c) be reviewed periodically by the safety and health committee, where it exists, or by the employer in consultation with workers and their representatives, and modified as necessary; and
- (d) be documented.

4.8. Copies of the relevant safety and health rules, regulations and procedures should be available to workers upon the commencement of and upon any change of employment.

4.9. Training should be provided to all participants at no cost and should take place during paid working hours. If this is not possible, the timing and other arrangements should be agreed upon between the employer, and workers and their representatives, taking into account the needs of workers with family responsibilities.

4.10. Before commencing work, on-site pre-work briefings should be completed which cover the scope of work, system of work, identification of key hazards and control measures to be used to reduce risks. Such briefings should be given to all workers on site, including contractors, subcontractors and other third parties.

4.11. Specialized instruction and training should be given to:

- (a) managers and supervisors;
- (b) drivers and operators of lifting appliances, transport vehicles, earth-moving and materials handling equipment and plant, and machinery or equipment of a specialized or dangerous nature;
- (c) workers engaged in the erection or dismantling of scaffolds;
- (d) workers engaged in excavations deep enough to cause danger, or shafts, earthworks, underground works or tunnels;
- (e) workers engaged in working at heights;
- (f) workers engaged in confined spaces;
- (g) workers handling explosives or engaged in blasting operations;
- (h) workers engaged in pile-driving;
- (i) workers working in compressed air, cofferdams and caissons;
- (j) workers engaged in the erection of prefabricated parts or steel structural frames and tall chimneys, and in concrete work, formwork and such other work;
- (k) workers handling or disturbing hazardous substances or hazardous dust such as asbestos and silica;
- (l) workers exposed to significant vibration and noise levels;
- (m) workers working as bankpersons/signallers;
- (n) workers engaged in demolition; and
- (o) other specialized categories of workers.

4.12. Wherever required by national laws and regulations, only drivers, operators or attendants holding a certificate of competence or licence should be employed to operate particular vehicles, lifting appliances, boilers or other equipment.

4.13. Contracts for services should contain standard clauses requiring contractors to employ only workers and subcontractors who possess relevant skills and to comply with national laws and regulations establishing OSH requirements. The OSH management systems of contractors and subcontractors and their OSH record should carry a similar weight to other performance factors commensurate with the level of risk when considering the choice of contractors and subcontractors.

► 5. Reporting of accidents and diseases

5.1. In the establishment, review and application of systems for the reporting, recording and notification of occupational injuries, occupational diseases, ill health and dangerous occurrences, the competent authority should take account of the Employment Injury Benefits Convention, 1964 [Schedule I amended in 1980] (No. 121), the Protocol of 2002 to the Occupational Safety and Health Convention, 1981, the List of Occupational Diseases Recommendation, 2002 (No. 194), the ILO List of Occupational Diseases (revised 2010), and the ILO code of practice on recording and notification of occupational accidents and diseases (1996). The competent authority should establish a nationally consistent approach to collecting and reporting statistics on occupational accidents, injuries and occupational diseases. Where possible, the competent authority should promote digital notification systems to reduce the administrative burden.

5.2. Reporting, recording, notification and investigation of occupational accidents, diseases, ill health and dangerous occurrences are essential for preventive as well as reactive monitoring and should be undertaken to:

- (a) provide reliable sex- and age-disaggregated information about occupational accidents, occupational diseases and dangerous occurrences at the construction site, sectoral and national levels;
- (b) identify major safety and health problems for both women and men and young workers arising from construction activities;
- (c) define priorities of action;
- (d) evolve effective and inclusive methods for dealing with occupational accidents and diseases, ill health and dangerous occurrences;
- (e) identify possible gaps in safety and health legislation and regulation;
- (f) monitor the effectiveness of measures taken to secure satisfactory levels of safety and health; and
- (g) monitor improvements over time and reveal new developments and issues.

5.3. Based on national laws and regulations or any other method consistent with national conditions and practice, the competent authority, in consultation with the most representative organizations of employers and workers, should:

- (a) specify which categories or types of occupational injuries and diseases, ill health and dangerous occurrences are subject to requirements for reporting, recording and notification; these should comprise, at a minimum:
 - (i) all fatal accidents;
 - (ii) occupational accidents causing loss of working time, other than insignificant loss;
 - (iii) all occupational diseases;
 - (iv) and, to the extent possible, suspected occupational diseases; and
 - (v) dangerous occurrences such as:
 - explosions and serious fires;

- the collapse of cranes, derricks or other lifting appliances;
 - the collapse of buildings, structures or scaffolds, or parts thereof; and
 - commuting accidents;
- (b) establish and apply uniform requirements and procedures for the site-level reporting and recording of occupational accidents, diseases, ill health and dangerous occurrences and suspected cases of diseases by employers and workers, physicians, health services and other bodies, as appropriate;
- (c) establish and apply uniform requirements and procedures for the notification of prescribed sex- and age-disaggregated data, specifying in particular:
- (i) the respective information to be notified to the competent authority, insurance institutions, labour inspectorates, health services and other authorities and bodies directly concerned, as appropriate;
 - (ii) the timing of the notification; and
 - (iii) the prescribed standardized form of notification to be used;
- (d) make appropriate arrangements for the necessary coordination and cooperation between the various national authorities and bodies and when two or more employers engage in activities simultaneously at one workplace;
- (e) make appropriate arrangements for guidance to be provided to employers and workers to help them comply with the legal obligations; and
- (f) apply these requirements and procedures to all women and men in all construction-related activities, regardless of their employment status or the type of work performed.

5.4. For the purpose of prevention, recording, notification and, if applicable, compensation, a national list of occupational diseases should be established by the competent authority, in consultation with the most representative organizations of employers and workers, by methods appropriate to national conditions and practice and by stages, as necessary. This prescribed list of occupational diseases should:

- (a) take account of the diseases enumerated in Schedule I to Convention No. 121, as amended in 1980; and
- (b) comprise, to the extent possible, other diseases contained in Recommendation No. 194 and the ILO List of Occupational Diseases (revised 2010).

5.5. In accordance with national laws or regulations, the employer should ensure that arrangements are made within the construction site which are capable of satisfying the requirements to record and notify information in connection with:

- (a) the national social insurance and/or compensation schemes in case of occupational injury and occupational disease; and
- (b) the system for the recording and notification of occupational injuries, occupational diseases, ill health and dangerous occurrences.

5.6. Workers and their representatives in the construction site should be given appropriate information by the employer about the arrangements for:

- (a) the recording and notification of information required for the payment of benefits or compensation in the case of occupational work injury and occupational disease; and

- (b) the reporting, recording and notification of occupational injuries and diseases, ill health and dangerous occurrences.

5.7. The employer, after consultation with workers and their representatives in the enterprise, should set up arrangements, in accordance with national laws or regulations, to enable all workers at the site to comply with the requirements to report:

- (a) forthwith to their immediate supervisor, without detriment to themselves, any situation which they believe presents a danger to life or health; and
- (b) any occupational injury, suspected case of occupational injuries and diseases, ill health and dangerous occurrences.

5.8. The employer should ensure that records of occupational injuries and diseases, ill health and dangerous occurrences are available and readily retrievable at all reasonable times. Such records should be maintained in accordance with national laws and regulations, where these exist, and should include contractor and subcontractor workers at the site. In the absence of national laws and regulations on recording at the level of the construction site, guidance should be drawn from this code, as well as from other relevant nationally and internationally recognized instruments. For long latency occupational diseases, records should be retained for such time as to recognize work-related associations.

5.9. In cases in which more than one worker is injured in a single occupational accident, a record should be made for each of the injured workers.

5.10. Workers' compensation insurance reports and accident reports to be submitted for notification should be considered acceptable as records if they contain all the facts required for recording or are supplemented in an appropriate manner.

5.11. For inspection purposes and as information for worker representatives and health services, employers should prepare records disaggregated by sex and age within a period of time to be determined by the competent authority.

5.12. Workers in the course of performing their work should cooperate with the employer in carrying out the arrangements within the construction site for recording and notification of occupational injuries and diseases, ill health and dangerous occurrences.

5.13. The employer should give appropriate information to workers and their representatives concerning:

- (a) the arrangements for recording; and
- (b) the competent person(s) identified by the employer to receive and record information on occupational injuries and diseases, ill health and dangerous occurrences.

5.14. The employer should provide appropriate information to workers and their representatives on all occupational injuries and diseases, ill health and dangerous occurrences at the construction site, as well as commuting accidents, in order to help workers and employers reduce the risk of exposure to similar events.

5.15. All fatalities and serious occupational accidents should be notified to the immediate family and/or designated contact person of the accident victim, who should be informed as soon as possible, in compliance with national laws or regulations, to the competent authority, the labour inspectorate, the appropriate insurance institution or any other body:

- (a) immediately after an occupational accident causing loss of life; and
- (b) within a prescribed time for other occupational accidents.

5.16. Notification should be made within such time as may be specified and in prescribed specific standardized forms or formats, such as:

- (a) an accident/disease report for the labour inspectorate;
- (b) a report for the statistics-producing body; or
- (c) a single form which contains all essential sex- and age-disaggregated data for all bodies.

5.17. National laws or regulations should specify that notifications of occupational accidents and diseases include at least the following information to meet the requirements of labour inspectorates, insurance institutions and the statistics-producing body:

- (a) occupational accident:
 - (i) construction site and employer;
 - (ii) injured person (name, address, gender and age; employment status; occupation);
 - (iii) type, nature and location of injury; and
 - (iv) accident and its sequence (geographical location, date and time, action leading to injury, type of accident); and
- (b) occupational disease:
 - (i) construction site and employer;
 - (ii) person affected by the occupational disease (name, address, gender and age, employment status, occupation at the time when the disease was diagnosed, employment history); and
 - (iii) occupational disease (name, nature, harmful agents, processes or exposure, description of work, length of exposure, date of diagnosis and name of doctor diagnosing).

5.18. National laws or regulations should provide for the specification of the relevant necessary information to be notified for commuting accidents.

► 6. PPE

6.1. General provisions

6.1.1. Where adequate collective protection measures against the risk of accident or ill health, including exposure to adverse conditions, cannot be ensured by other means, such as eliminating the hazard or minimizing the risk, suitable and sufficient PPE, in line with an assessment of the risks associated with the work, and in consultation with workers and their representatives, should be used by the workers and provided and maintained by the employer, without cost to the workers, as may be prescribed by national laws or regulations.

6.1.2. PPE should comply with relevant national standards and criteria approved or recognized by the competent authority, taking into account as far as possible ergonomic principles.

6.1.3. The minimum requirements for mandatory PPE at the construction site should be established and communicated with appropriate signage.

6.1.4. Employers should provide workers with appropriate information, instruction and training to enable them to properly use, maintain and store PPE as well as ensuring its proper use.

6.1.5. A competent person having a full understanding of the nature of the hazard and the type, range and performance of the protection required should:

- (a) select suitable items of PPE, which are ergonomically designed, take into account the individual and ensure a good fit; and
- (b) arrange that they are properly stored, maintained, and replaced before any expiration date is reached, and, if necessary for health reasons, disinfected or sterilized at suitable intervals, in accordance with good practice, guidance set or otherwise recognized by the competent authority.

6.1.6. Workers should be required to:

- (a) make proper use of and to take good care of the PPE provided for their use; and
- (b) examine PPE before each use to ensure that it is in good condition and is replaced or repaired, as necessary, by the employer, at no cost to the user.

6.1.7. PPE should be issued as new to an individual worker and not interchanged unless it has been maintained, examined and properly sanitized.

6.1.8. PPE that may be contaminated by materials hazardous to health should not be laundered, cleaned or kept at workers' homes.

6.1.9. PPE should meet the requirements of Chapters 10–23 of this code with respect to each hazard identified at the construction site, for example heat and cold stress, noise exposure, work at height, hazardous substances and vibration.

6.2. Types

6.2.1. Clothing

6.2.1.1. Workers should wear the appropriate protective clothing provided by the employer.

6.2.1.2. The clothing supplied should meet the following requirements, as applicable:

- (a) waterproof clothing and head coverings when working in adverse weather conditions; and
- (b) distinguishing clothing or reflective devices or otherwise conspicuously visible material when there is exposure to danger from moving vehicles.

6.2.1.3. Work clothes contaminated with chemical substances should be washed (if reusable) or disposed of in a workplace facility. Accommodation for clothing should be provided when protective clothing is required to be used or when there is a risk of the contamination of outdoor clothing by hazardous materials. Changing facilities should be so situated and designed to prevent the spread of contamination from protective clothing to personal clothing and from one facility to another. Employers should ensure that workers do not take contaminated clothing home and should provide for the cleaning of such clothing at no cost to the worker.

6.2.1.4. The employer should ensure that workers remove protective clothing before leaving the containment area or any workplace exposed to a substance that may pose a risk outside the containment area. Contaminated clothing should be disposed of safely.

6.2.2. Head protection

6.2.2.1. Safety helmets or hard hats to protect the head from injury due to falling or flying objects, or due to striking against objects or structures, should be worn by all persons, at all relevant times while at the construction site.

6.2.2.2. In general, the shell of a helmet should be of one-piece construction, with an adjustable cradle/suspension straps inside to support the helmet on the wearer's head and, where appropriate, particularly for persons working overhead, a chinstrap should be fitted to prevent the helmet from falling off. The cradle and chinstrap should be properly adjusted to ensure a snug fit as soon as the helmet is put on.

6.2.2.3. Any helmet that has been submitted to a heavy blow, even if there are no evident signs of damage, should be discarded.

6.2.2.4. If splits or cracks appear, or if a helmet shows signs of ageing or deterioration of the cradle/suspension straps, the helmet should be discarded as per manufacturer's instructions.

6.2.2.5. Where there is a risk of contact with exposed conductive parts, only helmets made of non-conducting material should be used.

6.2.2.6. In addition to safety, consideration should also be given to the physiological aspects and comfort for the wearer. The helmet should be as light as possible, the harness should be flexible and should not irritate or injure the wearer and a sweatband should be incorporated.

6.2.3. Face and eye protection

6.2.3.1. PPE for face and eyes are available in a wide variety of designs. Careful consideration should be given to the characteristics of the respective hazard during selection of the adequate PPE. Clear or coloured safety spectacles, glasses (ventilated or non-ventilated), a screen, a face shield or other suitable device, made of appropriate impact-resistant material, should be worn when there is risk to the eyes or face. The following tasks, amongst others, should be considered: welding, flame cutting, grinding, rock drilling, concrete mixing or other hazardous work that generates flying particles; dangerous substances; airborne dust; or harmful heat, light or other radiation.

6.2.3.2. Ordinary prescription (corrective) glasses, unless manufactured to a safety standard, do not afford protection. Glasses designed to be worn over ordinary prescription glasses should be selected according to the hazards to be protected against.

6.2.3.3. With the use of face and eye protectors, due attention should be paid to comfort and efficiency.

6.2.3.4. Welding and cutting processes emit radiation in the ultraviolet, visible and infrared bands of the spectrum, which are all able to produce harmful effects upon the eyes. In welding operations, workers require adequate PPE, which is mounted on a helmet or hand-held, some of which are auto darkening. Protection is also necessary for the welder's assistant and others who may be exposed to these hazards.

6.2.4. Hand and foot protection

6.2.4.1. Hands should be protected against biological, physical, chemical and other hazards. Protective gloves or gauntlets, appropriate barrier creams and suitable protective clothing to protect hands, as required, should be worn when exposed to heat radiation or while handling hot, hazardous or other substances which might cause injury to the skin.

6.2.4.2. Should a risk assessment determine gloves not to be appropriate when using rotating machinery such as lathes, or machines with nip points, other appropriate protections should be provided.

6.2.4.3. Footwear of an appropriate type with toecaps, midsoles and slip-resistant should be used in workplaces where there is a risk of exposure to adverse conditions likely to cause injury, such as falling objects, moving vehicles, hot or hazardous substances, sharp-edged tools or nails and slippery, wet or ice-covered surfaces. Sandals and similar footwear should not be worn when working.

6.2.4.4. Footwear with suitable insulated soles should be worn by electricians or other workers who may be in contact with live parts.

6.2.4.5. Knee protectors may be necessary, especially where work involves kneeling.

6.2.5. Respiratory protective equipment

6.2.5.1. Respiratory protective equipment, suitably risk assessed for the particular environment, should be used when workers cannot be protected against chemical or biological agents, airborne dust, fumes, vapours or gases by ventilation or other means.

6.2.5.2. Where there is risk to life or serious ill health (for example oxygen deficiency) or the risk cannot be assessed with sufficient accuracy to define the appropriate level of respiratory protection, employers should make available positive-pressure, air-supplied respiratory protective devices until such time that the risk can be assessed more accurately.

6.2.5.3. Each respirator should be used with an understanding of its limitations based on a number of factors, such as protection level, the level and duration of exposure to the contaminant, the characteristics of the contaminant and the service life of a respirator.

6.2.5.4. In accordance with national laws and regulations, workers should be medically evaluated for their ability to wear a respirator safely before they are required to do so.

6.2.5.5. When there is a need for using respiratory protective equipment, there should be a face fit test which should be conducted by a competent person, in line with national law and

regulation or whenever there is a change to the circumstances of the wearer that could alter the fit of the respiratory protective equipment.

6.2.5.6. Periodic breaks from wearing respiratory protective equipment that results in undue stress should be introduced when respiratory protective equipment is required to be worn by workers.

6.2.6. Hearing protection

6.2.6.1. Workers who by the nature of their duties are exposed to high noise levels, in terms of level of intensity or duration of exposure, should be provided with, and should wear, ear protectors. Various types of hearing protectors are available, including ear plugs and ear muffs, each of which may be of different design standards. Protectors should be of a type recommended as suitable for the particular circumstances and climatic conditions. Hearing protectors should be made available at the entrance to the noisy space. Noisy areas should be indicated and warning signs displayed at the location.

6.2.6.2. Hearing protectors should be comfortable and users should be trained to use them properly. Special attention should be paid to possible increased risk of accidents due to the use of hearing protectors. Hearing protection reduces the capacity to locate sound sources and prevents warning signals from being heard. This is especially true for workers with considerable hearing loss.

6.2.6.3. No type of hearing protection is suitable for all persons. Those wearing hearing protectors should be able to choose from alternative products that meet the attenuation criteria. Earplugs should not be the only solution as not all people can wear them.

6.2.6.4. Hearing protectors only work well if they are worn correctly and well maintained. Any other PPE worn with them should be compatible in order to not jeopardize the fit. Good maintenance consists of cleaning, changing replaceable parts such as cushions, and monitoring of the state of the hearing protector.

6.2.6.5. If earplugs are used as hearing protection, special attention should be paid to the proper fitting technique.

6.2.7. Protectors against radioactive contamination

6.2.7.1. Respirators, overalls, head coverings, gloves, closed-toe footwear and aprons appropriate to the risks of radioactive contamination should be worn in areas where unsealed radioactive sources are prepared or used.

6.2.7.2. Any work in the vicinity of radioactive sources should be limited to workers with relevant authorization and training, and they should be provided with the necessary health surveillance.

► 7. Welfare

7.1. General provisions

7.1.1. All workers should be provided reasonable opportunities in paid work time to make use of welfare facilities.

7.1.2. At or within reasonable access to the worker on every construction site, an adequate supply of wholesome drinking water of suitable temperature should be provided.

7.1.3. At or within reasonable access to the worker on every construction site, the following facilities should, depending on the number of workers and the duration of the work, be provided, kept clean and maintained:

- (a) sanitary and washing facilities or showers;
- (b) facilities for changing and for the storage and drying of clothing;
- (c) accommodation for taking meals and for taking shelter during interruption of work due to adverse weather conditions;
- (d) waste disposal; and, where they exist; and
- (e) living accommodation and facilities for workers away from their homes according to national practices.

7.1.4. Men and women workers should be provided with separate and private sanitary, washing and changing facilities and sleeping facilities where appropriate.

7.2. Drinking water

7.2.1. All drinking water should be from a source approved by the competent authority.

7.2.2. Where such water is not available, the competent authority should ensure that the employer takes the necessary steps to make any water to be used for drinking fit for human consumption.

7.2.3. Drinking water for common use should only be stored in closed containers from which the water should be dispensed through taps or cocks.

7.2.4. If drinking water has to be transported to the worksite, the transport arrangements should be approved by the competent authority.

7.2.5. Transport tanks, storage tanks and dispensing container should be designed, used, cleaned and disinfected at suitable intervals in a manner approved by the competent authority.

7.2.6. Water that is unfit to drink should be conspicuously indicated by notices prohibiting workers from drinking it.

7.2.7. A supply of drinking water should never be connected to a supply of water that is unfit to drink.

7.2.8. To reduce the risk of communicable diseases, the communal use of glasses or drinking water receptacles should be prohibited.

7.3. Sanitary and washing facilities

7.3.1. The scale of provision of toilet or sanitary facilities, and the construction and installation of water flush toilets, privies, chemical closets, plumbing or other toilet fixtures should comply with the requirements of the competent authority and should be in relation to the number of workers at the site.

7.3.2. No toilet other than a water flush toilet should be installed in any building containing sleeping, eating or other living accommodation and should be adequately ventilated and lit, and not open directly into occupied rooms.

7.3.3. The number and standard of construction and maintenance of washing facilities should comply with the requirements of the competent authority.

7.3.4. Washing facilities should be conveniently accessible but situated so that they are not themselves exposed to contamination from the workplace and should not be used for any other purpose.

7.3.5. Adequate washing facilities should be provided near toilets and where appropriate at other locations. The facilities should include hot and cold or warm running water, together with soap or other cleaning materials and drying equipment. Employers should provide, without charge, toilet paper, soap and disposable towels as required and facilities for their safe and hygienic disposal.

7.3.6. Separate facilities for men and women with a door that can be locked, preferably in the vicinity of changing rooms, should be provided.

7.3.7. Where workers are exposed to skin contamination by poisonous, infectious or irritating substances, or oil, grease or dust, there should be a sufficient number of appropriate washing facilities or showers supplied with hot and cold water, and appropriate cleaning products.

7.4. Facilities for changing and storing clothing

7.4.1. Facilities for changing and storing clothing should be provided for workers at easily accessible places and not be used for any other purpose.

7.4.2. These facilities should contain areas for drying wet clothes and for hanging clothing, including, where necessary and to avoid contamination, suitable lockers separating working from street clothes.

7.4.3. Suitable arrangements should be made for disinfecting these facilities and lockers, in conformity with the requirements of the competent authority.

7.4.4. Facilities for changing and storing clothing should be so situated and designed as to prevent the spread of contamination from protective clothing to personal clothing and from one facility to another.

7.5. Facilities for food and drink

7.5.1. In appropriate cases, depending on the number of workers, the duration of the work and its location, clean, hygienic and safe facilities for obtaining, serving or preparing food and drink at or near a construction site should be provided, if not otherwise available.

7.5.2. The consumption of food or beverages in areas where hazardous substances are likely to be present should be prohibited.

7.5.3. At sites where food is provided, the food should be nutritious, balanced and hygienic.

7.6. Shelters

7.6.1. Shelters should, as far as practicable, provide facilities for washing, taking meals and for drying and storing clothing, unless such facilities are available in the vicinity. Notwithstanding employers should consider introducing a no-smoking policy, smoking may be permitted in designated areas.

7.7. Childcare facilities

7.7.1. The competent authority should formulate and implement laws, regulation and policies to promote and encourage the provision of affordable day care facilities and other supporting family or social services to enable parents to combine family obligations with work responsibilities.

7.7.2. In cases where childcare is provided by the employer, such facilities should be located away from areas used for storage of hazardous substances, wet and dry processing, loading and unloading, movement of heavy machinery and other dangerous areas.

7.7.3. Childcare facilities should comply with building, fire-safety and other relevant standards established by the competent authority and must include, at a minimum:

- (a) all hot surfaces must be insulated so that children cannot come in contact with them and fireplaces must be guarded;
- (b) electrical outlets within reach of children must be provided with receptacle covers when not in use;
- (c) medicines, vector controls or vermin poisons and other hazardous substances must be stored in a locked cabinet;
- (d) the premises must be clean, well ventilated and well maintained at all times;
- (e) outdoor play areas must be safe and secure and any open water or pits must be fenced or covered;
- (f) potable drinking water must be available;
- (g) toilet facilities must be clean, suitable for children and provided with hand-washing facilities;
- (h) individual clean cribs, cots or mats and clean linens must be provided;
- (i) the ratio of children per adult and the number of children in a group should be low and linked to the children's age;
- (j) the personnel should be qualified and stable, which implies that their terms and conditions of employment should be sufficiently attractive;
- (k) all childcare workers should be trained in first aid and emergency response procedures;
- (l) parent and guardian information should be kept on file;
- (m) children may only be released to an authorized parent, guardian or designated individual;

- (n) health records should be maintained for each child, including details of immunizations, medications, communicable diseases and evidence of neglect or unusual injuries; and
- (o) any instances of neglect or unusual injuries must be reported to the facility manager.

7.8. Living accommodation

7.8.1. Suitable living accommodation should be made available for workers, in accordance with national standards at construction sites which are remote from their homes, where adequate transportation between the site and their homes or other suitable living accommodation is not available. These facilities should ensure adequate security and privacy for all workers.

7.8.2. Where collective housing is provided for workers who are single or are separated from their families, the competent authority should establish housing standards that provide, at a minimum, for:

- (a) a separate bed for each worker;
- (b) separate accommodation for workers of different genders;
- (c) a separate locker for keeping personal belongings;
- (d) an adequate supply of drinking water;
- (e) adequate sanitary and washing facilities;
- (f) adequate ventilation and, where appropriate, heating;
- (g) canteens; and
- (h) rest and recreation facilities.

7.8.3. The competent authority, if appropriate, should identify the agency or agencies responsible for providing such living accommodation and should specify the minimum standards for housing, including for its construction material, fire safety, minimum size and the layout of accommodation, cooking, washing, storage, water supply and sanitary facilities.

7.8.4. In cases where housing is provided by the employer, the accommodation should comply with minimum housing standards established by the competent authority in the light of local conditions.

7.8.5. As far as practicable, sleeping rooms should be arranged so that shifts are separated and no workers working during the day share a room with workers on night shifts.

7.8.6. In cases where housing is provided by the employer, the premises should be inspected at regular intervals to ensure that the accommodation is clean, habitable and maintained in a good state of repair, and that smoke detection and fire alarm systems, emergency lighting, fire-extinguishing equipment and exit doors are operational. There should be at least two exit doors on each floor and on opposite sides of the building, and these should never be locked from the outside.

7.8.7. Further information about workers' housing can be found in ILO Helpdesk Factsheet No. 6: Workers' housing (2009).

► 8. Safety of workplaces

8.1. General provisions

8.1.1. All appropriate precautions should be taken:

- (a) to ensure that all workplaces are safe and without risk of injury to the safety and health of workers; and
- (b) to protect persons present at or in the vicinity of a construction site from all risks which may arise from such site.

8.1.2. All openings and other areas likely to pose danger to workers should be clearly indicated.

8.2. Means of access and egress

8.2.1. Adequate and safe means of access to and egress from all workplaces should be provided and should be:

- (a) indicated where appropriate;
- (b) maintained in a safe condition;
- (c) kept free from obstructions;
- (d) protected against falling objects if they pass under workplaces; and
- (e) as far as practicable, so installed that no loads pass over them. In any event, loads should not be passed over the means of access while workers are on it.

8.2.2. To the extent possible, vehicular traffic should be physically separated from pedestrian or bicycle traffic.

8.3. Housekeeping

8.3.1. A suitable housekeeping programme should be established and continuously implemented on each construction site which should include provisions for:

- (a) the proper storage of materials and equipment; and
- (b) the removal of scrap, waste and debris at appropriate intervals.

8.3.2. Loose materials which are not required for immediate use should not be placed or allowed to accumulate on the site so as to obstruct means of access to and egress from workplaces and passageways.

8.3.3. Workplaces and passageways that are slippery owing to ice, snow, oil or other causes should be cleaned up or strewn with sand, sawdust, ash or the like.

8.3.4. Areas assessed to be unsafe should be closed off and clearly signposted until suitable remedial work has taken place.

8.4. Precautions against the fall of materials and persons, and collapse of structures

8.4.1. Adequate precautions should be taken such as the provision of fencing, look-out persons or barriers to protect any person who might be injured by the fall of materials, or tools or equipment being raised or lowered.

8.4.2. Where necessary to prevent danger, guys, stays or supports should be used or other effective precautions should be taken to prevent the collapse of structures or parts of structures that are being erected, maintained, repaired, dismantled or demolished.

8.4.3. All openings through which workers are liable to fall should be kept effectively covered or fenced and indicated in the most appropriate manner.

8.4.4. As far as practicable, guard rails and toe boards in accordance with national laws and regulations should be provided to protect workers from falling from elevated work places. Wherever the guard rails and toe boards cannot be provided:

- (a) adequate safety nets or safety sheets should be erected and maintained; or
- (b) adequate safety harnesses should be provided and used.

8.4.5. The employer should ensure all the above precautions are inspected/reviewed regularly, to ensure suitable protection is maintained.

8.5. Prevention of unauthorized entry

8.5.1. Construction sites in built-up areas and alongside vehicular and pedestrian traffic routes should be fenced and suitably signed to prevent the entry of unauthorized persons.

8.5.2. No person should be allowed access to construction sites unless authorized to do so and having been made aware of emergency procedures, all risks to which they may be exposed and wearing appropriate PPE. Authorized persons may be accompanied by a responsible and competent person.

8.5.3. Appropriate arrangements concerning access by workers and their representatives should be established in accordance with the provisions of national laws and regulations or collective agreements.

8.6. Fire prevention and fire response

8.6.1. All appropriate measures should be taken by the employer to:

- (a) avoid the risk of fire, including, but not limited to, effective design of the construction site;
- (b) control quickly and efficiently any outbreak of fire; and
- (c) bring about a quick and safe evacuation of persons.

8.6.2. Smoke detection and alarm systems should be installed as early as possible in the construction site. Alarm system and evacuation testing should be carried out at suitable intervals during the construction project. National laws or regulations should establish standards requiring automatic fire sensor and warning device systems to be used to actuate automatic fire suppression systems.

8.6.3. Sufficient and secure storage areas suitably segregated with respect to compatibility should be provided for flammable liquids, solids and gases, such as liquefied petroleum gas (LPG) tanks and acetylene cylinders, paints and other such materials.

8.6.4. Smoking should be prohibited and “No Smoking” notices be prominently displayed in all places containing readily combustible or flammable materials.

8.6.5. Wherever flammable or explosive gases, vapours or dusts can cause danger:

- (a) only suitably protected electrical installations and equipment, including portable lamps, should be used;
- (b) there should be no naked flames or similar means of ignition;
- (c) there should be notices prohibiting smoking;
- (d) oily rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place; and
- (e) persons wearing clothes likely to cause static electricity or shoes likely to cause sparks should be excluded, or should be provided with anti-static PPE. Equipment capable of generating static, for example hoses, should be supplied or fitted with appropriate risk mitigation measures.

8.6.6. Combustible materials such as packing materials, sawdust, greasy/oily waste and scrap wood or plastics should not be allowed to accumulate in workplaces but should be kept in closed containers made of non-combustible material in a safe place and away from sources of ignition.

8.6.7. Regular inspections should be made of places where there are fire risks. These include the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, hot welding and cutting operations.

8.6.8. Welding, flame cutting and other hot work should only be done on the orders of a competent supervisor after appropriate precautions, as required, are taken to reduce the risk of fire and explosion.

8.6.9. In accordance with national laws and regulations and the results of the initial hazard identification and risk assessment and based on the processes identified in the safe work plans, places where the danger of fire has been identified should be provided as far as practicable with:

- (a) suitable and sufficient fire-extinguishing equipment, appropriate to the materials to be extinguished, which should be easily visible and accessible; and
- (b) an adequate water supply at ample pressure.

8.6.10. Fire-extinguishing equipment should be properly maintained in full working order and inspected and tested at suitable intervals by a competent person in accordance with the manufacturers' recommendations. Access to fire-extinguishing equipment, such as hydrants, portable extinguishers and connections for hoses, should be kept clear at all times.

8.6.11. All supervisors and a sufficient number of workers should be trained in the use of fire-extinguishing equipment, so that adequate trained personnel are readily available during all working periods.

8.6.12. Where necessary to guard against danger, workers should be suitably trained in the action to be taken in the event of fire, including the use of means of escape.

8.6.13. Escape routes should be:

- (a) kept clear at all times;
- (b) provided at the site and from the site during all construction activities;
- (c) frequently inspected and modified as necessary at the site according to the progress of the construction work;
- (d) clearly marked; well-lit at all times, where necessary using emergency lighting;
- (e) shown on plans, which should be posted at the access to and inside construction site, as appropriate; and
- (f) provided through two separate routes.

8.6.14. Sufficient, suitable and effective means (sight and sound signals) should be installed to give warning in case of fire. Such warning should be clearly audible or visible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated speedily without panic and accounted for and all plant and processes shut down.

8.6.15. Notices should be posted at conspicuous places, indicating:

- (a) the nearest fire alarm;
- (b) the telephone number and address of the nearest emergency services; and
- (c) the nearest first-aid post.

8.7. Lighting

8.7.1. Where natural lighting is not adequate to ensure safe working conditions, adequate and suitable lighting, including portable lighting where appropriate, should be provided at every workplace and any other place on the construction site where a worker may have to pass.

8.7.2. Artificial lighting should, as far as practicable, not produce glare or disturbing shadows or stroboscopic effects.

8.7.3. Account should be taken of required luminance set by competent authorities for artificial lighting. This includes the ability to recognize and distinguish colours.

8.7.4. Suitable and sufficient emergency lighting should be in place.

8.7.5. Where necessary to prevent danger, lamps should be protected by suitable guards against accidental breakage.

8.7.6 The cables of portable electrical lighting equipment should be of adequate size and characteristics for the power requirements and of adequate mechanical strength to withstand severe conditions in construction operations and should be maintained in a safe condition suitably positioned to accommodate maintenance and replacement needs.

► 9. Health hazards, first aid and occupational health services

9.1. General requirements

9.1.1. For works which by their very nature expose workers to hazards arising from the use or presence of chemical, physical or biological agents psychosocial risks or risks arising from adverse climatic conditions, appropriate preventive measures should be taken to avoid any danger to the safety and health of workers.

9.1.2. The preventative measures referred to in paragraph 9.1.1 should be determined through assessment of risk and should prioritize avoidance of exposure through elimination from the workplace of the hazard to health. If this is not possible, then prevention should be achieved in line with the following hierarchy:

- (a) through substitution with a substance or process that is less hazardous to health;
- (b) designing and using suitable work processes and engineering controls (for example, mechanical handling aids);
- (c) controlling exposure to the hazard at source through, for example, local exhaust ventilation;
- (d) provision of PPE alongside relevant information, instruction and training;
- (e) design of work methods and organization to reduce, as far as practicable, psychosocial risks; and
- (f) measures to identify and address risks posed by biological agents.

9.1.3. The employer should make arrangements for the identification and assessment by competent persons of health hazards presented by the conduct of different operations and use of plant, machinery, equipment, substances and radiations at the construction site and take appropriate preventive measures against the identified health risks in conformity with the national laws and regulations.

9.1.4. The employer should design production processes and reward systems so they do not promote injurious work.

9.2. First aid

9.2.1. The employer should be responsible for ensuring that first aid, including the provision of trained personnel, is available. Arrangements should be made for ensuring the removal for medical attention of workers who have suffered an accident or sudden illness.

9.2.2. The manner in which first-aid facilities and personnel are to be provided should be prescribed by national laws or regulations, and drawn up after consulting the competent health authority and the most representative organizations of employers and workers concerned.

9.2.3. Where the work involves risk of drowning, asphyxiation or electric shock, first-aid personnel should be proficient in the use of resuscitation and other life-saving techniques and in rescue procedures.

9.2.4. Suitable rescue and resuscitation equipment, as required, including stretchers, should be kept readily available at the construction site. All workers should be informed of the location of this equipment.

9.2.5. First-aid kits or boxes, as appropriate, should be provided at the workplaces, including isolated locations such as maintenance gangs, and on motor vehicles, locomotives, boats and floating equipment, and be protected against contamination by dust, moisture, etc.

9.2.6. First-aid kits and boxes should be clearly marked and should not contain anything besides material for first aid in emergencies.

9.2.7. First-aid kits and boxes should contain simple and clear instructions to be followed, be kept under the charge of a responsible person qualified to render first aid and be regularly inspected and kept properly stocked.

9.2.8. Safety data sheets that are used at the construction site should be kept readily available and used in the application of first aid.

9.2.9. If a minimum number of workers as prescribed is employed in any shift, at least one suitably equipped first-aid room or station under the charge of qualified first-aid personnel or a nurse should be provided at a readily accessible place for the treatment of minor injuries or cardiopulmonary resuscitation (CPR), and as a rest place for seriously sick or injured workers.

9.2.10. A first-aid register should be kept at the construction site for recording the names and gender of persons to whom first aid has been rendered and the particulars of injuries and treatment. The information in this register is confidential and should only be accessible to authorized persons. Anonymized information may be made available to a competent authority and the safety and health committee for the purposes of incident and injury analysis.

9.3. Occupational health services

9.3.1. A multiplicity of health hazards are present in construction work and every effort should be made to promote awareness of this fact and of the need to safeguard health.

9.3.2. Consistent with the Occupational Health Services Convention (No. 161) and Recommendation (No. 171), 1985, the competent authority should make provision for the establishment of occupational health services:

- (a) by enacting laws or regulations;
- (b) through collective agreements or as otherwise agreed upon by the employers and workers concerned;
- (c) in any other manner approved by the competent authority after consultation with the representative organizations of employers and workers concerned; or
- (d) a combination of any of the above.

9.3.3. Occupational health services may be organized as a service for a single site or as a service common to a number of sites, as appropriate, and by:

- (a) sites or groups of sites concerned;
- (b) public authorities or official services;
- (c) any institutions authorized by the competent authority; or
- (d) any combination of the above.

9.3.4. The employer, in consultation with workers and their representatives, should provide for the setting up of, or access to, an occupational health service whose basic function, objective and operation in the establishment should be preventive and supportive to the employer, in particular regarding:

- (a) the identification and assessment of the risks from health hazards in the workplace;
- (b) surveillance of the factors in the working environment (see Appendix II to this code) and working practices which may affect workers' health, including sanitary installations, canteens, childcare facilities and housing, where these facilities are provided by the employer;
- (c) advice on the planning and organization of work, including the design of workplaces, working time flexibility, on the choice, maintenance and condition of machinery and other equipment, and on substances used at work;
- (d) participation in the development of programmes for the improvement of working practices, as well as testing and evaluation of health aspects of new equipment;
- (e) advice on occupational health, safety and hygiene and on ergonomics and personal and collective protective equipment that is adapted for both women and men;
- (f) surveillance of workers' health in relation to work (see Appendix I to this code);
- (g) the adaptation of work to the worker;
- (h) the contribution to measures of vocational rehabilitation;
- (i) collaboration in providing information, instruction and training in the fields of OSH, hygiene and ergonomics;
- (j) the organizing of first aid and emergency treatment; and
- (k) participation in the analysis of occupational incidents, accidents and diseases.

9.3.5. The surveillance of workers' health should be appropriate to the occupational risks in the construction site in line with the ILO *Technical and Ethical Guidelines for Workers' Health Surveillance* (1998) and as prescribed by national laws and regulations:

- (a) These guidelines require arrangements, in particular regarding the following activities (see Appendix I to this code):
 - (i) the organization of workers' health surveillance at different levels;
 - (ii) health assessments and the collection, analysis and evaluation of information;
 - (iii) pre-assignment and regular and post-employment medical examinations; and
 - (iv) the use of the results and records of workers' health surveillance.
- (b) Collection, processing, communication and use of workers' personal medical data should:
 - (i) be collected and stored in conformity with medical confidentiality, in accordance with the ILO code of practice on protection of workers' personal data (1997); and
 - (ii) be used to protect the health of workers (physical, mental and social well-being) individually and collectively.
- (c) The results and records of workers' health surveillance should:

- (i) be clearly explained by professional health personnel to the workers concerned or to persons of their choice;
- (ii) not be used for discrimination, for which there should be recourse in national law and practice;
- (iii) be made available, where requested by the competent authority, to any other party agreed by both employers and workers, to prepare appropriate health statistics and epidemiological studies, provided anonymity is maintained, where this may aid in the recognition and control of occupational injuries and diseases; and
- (iv) be kept for the time and under the conditions prescribed by national laws and regulations, with appropriate arrangements to ensure that workers' health surveillance records are securely maintained in the case of establishments that have closed down.

9.3.6. The surveillance of the working environment and planning of safety and health precautions should be performed in line with the requirements in Appendix II to this code and as prescribed by national laws and regulations.

9.4. Hazardous substances

9.4.1. The competent authority should provide information to parties in the construction sector on health risks associated with hazardous substances including exposure limits. The competent authority should keep this information under review using the results of international scientific research as specified by the Chemicals Convention, 1990 (No. 170).

9.4.2. An information system could be set up and be regularly reviewed by the competent authority, using the results of international scientific research, to provide information for clients, architects, contractors, employers' and workers and their representatives on exposure limits and the health risks associated with the hazardous substances used in the construction sector.

9.4.3. National laws and regulations should require that the manufacturers, importers and suppliers of hazardous products used in the construction sector should provide them in clearly labelled containers listing the ingredients and the appropriate hazard warnings and instructions on their use as well as a safety data sheet detailing information on the products, in the appropriate language, on associated health risks and on the precautions to be taken, containing the following core information:

- (a) identification of manufacturer, product and ingredients;
- (b) physical and chemical properties and information on the health effects, physical hazards, environmental impact and relevant exposure limits; and
- (c) recommendations concerning safe work practices; transport, storage and handling; waste disposal; PPE; first aid, fire response and chemical spills. The *Globally Harmonized System of Classification and Labelling of Chemicals* provides guidance on the preparation of labels, safety data sheets and the provision of information to workers.

9.4.4. In the use, storage and transport of materials that contain hazardous substances and in the removal and disposal of waste, the employer should ensure that the health of workers and of the public and the preservation of the environment are safeguarded as prescribed by national laws and regulations.

9.4.5. The employer should ensure that all containers of hazardous substances are clearly labelled through listing the ingredients, the appropriate hazard warnings and instructions on their use. They should be handled under conditions prescribed by national laws and regulations or by the competent authority. The employer should ensure that workers are protected from hazardous substances generated at work.

9.4.6. The employer should ensure that workers are adequately protected from hazardous substances that are generated at work and are therefore not labelled. These include, but are not limited to, exposures to respirable crystalline silica from work with stone, in particular engineered stone, brick and concrete, diesel exhaust fumes and welding and cutting fumes.

9.4.7. The competent authority, in consultation with the most representative organizations of employers and workers, should determine which hazardous substances should be prohibited from use in the construction sector.

9.4.8. Preference should be given to the application and removal of hazardous substances by means that minimize the formation and spread of airborne contaminants, when feasible.

9.4.9. The employer should consider the use of less hazardous substances. Where the use of toxic solvents, certain thinners, certain paints or volatile chemical substances cannot be avoided, employers should take special precautions such as providing general and local exhaust ventilation, and, if this is not practicable or is inadequate, ensuring respiratory PPE is used. Such measures should be applied more rigorously in situations when such chemicals are heated or used in confined spaces, as well as when workers are likely to be exposed to hazardous fumes as by-products (for example welding). Paints and adhesives which present health hazards should be replaced with water-dispersed products. Additional measures should be taken to protect pregnant and breastfeeding women from hazardous exposure.

9.4.10. Skin contact with hazardous chemicals should be avoided, particularly when dealing with chemicals which can penetrate through intact skin (for example certain wood preservatives) or can cause dermatitis (for example wet cement). Personal hygiene and the type of clothing worn should be such as to enable the rapid removal of any chemical from skin contact. Where allergic effects caused by certain materials could be reduced by introducing other additives, necessary steps should be taken to make use of these additives preferably at the manufacturing stage (for example adding iron sulphate to cement and cement products containing hexavalent chromium).

9.4.11. Additional health and safety controls are necessary where work could present a risk of exposure to carcinogens used or generated at work, prioritizing prohibitions or "every effort" to replace cancer-causing substances with safer alternative substances or processes as specified by the Occupational Cancer Convention, 1974 (No. 139). When it is necessary to deal with proven carcinogenic substances, particularly in work involving tar asphalt, asbestos fibres, pitch, some heavy oils, and some aromatic solvents, the employer should take strict measures to avoid inhalation, ingestion and skin contact including by using safety processes. The employer should prepare, if not already available, an inventory of hazardous substances involved in construction, and should require from contractors and subcontractors, and suppliers, an inventory of hazardous substances used in their project. This list should highlight those substances which are mutagens, carcinogen and reproductive toxins. Particular care should be taken with substances where there is reliable evidence of suspected carcinogenic effects. The inventory should be reviewed regularly to keep details of substances and the health effects current. Exposure to carcinogenic substances should be recorded on occupational health records, detailing the time, nature and extent of the exposure.

9.4.12. The understanding of hazards associated with nanomaterials and other novel materials may develop with the adoption of certain construction materials and equipment. In order to assess the risks from exposure to nanomaterials and other novel materials in construction, the material should be characterized, the potential routes of exposure should be assessed and control measures should be provided comparable to other similarly characterized hazardous substance, as set out in the paragraphs above. Where insufficient data on health effects are available, a precautionary approach to the use of these substances should be adopted.

9.5. Asbestos

9.5.1. Priority should be given to the elimination of asbestos risks, which is most effectively achieved through a ban on all use. This approach is supported by the ILO and the World Health Organization (WHO) in their joint *Outline for the Development of National Programmes for Elimination of Asbestos-Related Diseases*.

9.5.2. In accordance with the Convention No. 170, countries should ensure that where hazardous substances “are prohibited for reasons of safety and health at work, this fact and the reasons for it shall be communicated by the exporting member State to any importing country”. Asbestos is recognized by the WHO’s International Agency for Research on Cancer (IARC) as a Group 1 human carcinogen. A warning to this effect should accompany any exports.

9.5.3. Continuing asbestos use in some countries and asbestos in-situ in buildings and infrastructure everywhere requires the strictest approach to identification and management of risks and prevention of asbestos-related disease.

9.5.4. In line with the Asbestos Convention, 1986 (No. 162), national laws or regulations should recognize the serious health risks posed by asbestos exposure at work, and require the “prevention and control” of those risks, through effective regulation, training, information and supervision.

9.5.5. Employers are responsible for compliance with these measures, which will be enforced by competent authorities, with an adequate and appropriate system of inspection, and effective enforcement with appropriate penalties.

9.5.6. Measures to prevent and control asbestos risks at work to be required by competent authorities under national laws or regulations include:

- (a) strict safety rules should be drawn up and applied by the competent authority in respect of workers engaged in the construction, renovation, demolition or dismantling of any building in which there is a risk of exposure to asbestos;
- (b) the client of the premises should carry out a survey for the presence of asbestos before starting any renovation, demolition or dismantling of the building:
 - (i) this survey should be done by a competent person with in-depth knowledge in the field of asbestos; and
 - (ii) the results of this survey must be communicated to all employers operating on site presenting an asbestos risk;
- (c) employers should consult with workers and their representatives any work to be undertaken with asbestos;
- (d) the employer should provide appropriate training to workers to enable them to carry out their work in accordance with the rules established by the competent authority; The training should relate in particular to the removal technique used to minimize the

release of asbestos fibres and to the use of respiratory protection, hand protection and work clothes. It should also focus on how to decontaminate after an intervention exposed to asbestos fibres;

- (e) buildings intended to be renovated, demolished or dismantled should be cleared of asbestos by trained workers before any other intervention by other workers on the premises;
- (f) remedial work with asbestos should be carried out in suitable enclosures to avoid the asbestos contamination of the workplace and the wider environment;
- (g) workers to be declared fit having been medically examined in accordance with criteria set by the competent authority and not have a history of serious respiratory ill health;
- (h) medical follow-up should be provided for all employees exposed to asbestos to detect the diseases they may develop following exposure to asbestos;
- (i) the employer must provide workers with individual respiratory protection with a high protection factor: this equipment should be made available to workers at no cost;
- (j) the employer must ensure that respiratory protection is effectively worn by workers; and
- (k) the disposal of all waste containing asbestos should be done in accordance with the laws and regulations put in place by the competent authority.

9.6. Silica

9.6.1. National authorities should introduce measures to eliminate respirable crystalline silica-related risks, as prioritized in the joint ILO/WHO Global Programme for the Elimination of Silicosis (GPES) and described in the ILO/WHO Outline for a National Programme for the Elimination of Silicosis (NPES).

9.7. Dangerous atmospheres and confined spaces

9.7.1. Where workers are required to enter any area in which a toxic or harmful substance may be present, or may have been present, or in which there may be an oxygen deficiency or a flammable atmosphere, adequate measures should be taken to guard against danger.

9.7.2. The measures regarding dangerous atmospheres to be taken pursuant to paragraph 9.7.1 above should be prescribed by the competent authority and should include prior written authority or permission from a competent person, or in conformity with any other system by which entry into any area in which a dangerous atmosphere may be present can be made, only after completing specified procedures.

9.7.3. No naked light or flame or hot work such as welding, cutting and soldering should be permitted inside a confined space or area with a dangerous atmosphere unless it has been made completely free of the flammable atmosphere, tested and found safe by a competent person. Only explosion-proof tools and lights should be used inside such confined space or area for initial inspection, cleaning or other work required to be done for making the area safe. All equipment should follow a classification system set by competent authorities.

9.7.4. No person should enter a confined space or area with a dangerous atmosphere or deficiency of oxygen unless:

- (a) the atmosphere has been found to be safe after suitable testing by a competent person (which should be repeated at suitable intervals); and

- (b) adequate ventilation is provided.

9.7.5. If the conditions in the preceding paragraph cannot conveniently be fulfilled, persons may enter such spaces for prescribed periods using air lines or self-contained breathing apparatus and safety harnesses with lifelines.

9.7.6. While a worker is in a confined space:

- (a) adequate ventilation, facilities and equipment, including appropriate breathing apparatus or respirators, a first-aid kit, resuscitation apparatus and oxygen, should be readily available for rescue purposes;
- (b) a fully trained attendant(s) should be stationed at the opening and should have no other assignments;
- (c) suitable means of communication at all times should be maintained between the worker and the attendant(s); and
- (d) where practicable, means should be available for the attendant(s) or other rescue personnel to effect rescue from the confined space without the necessity of their themselves entering it.

9.7.7. In confined spaces in which flammable gases, vapours or dust may cause danger, work should not begin before adopting the measures established in paragraph 8.6.5 of this code.

9.7.8. Confined spaces should have signs and barriers to prevent inadvertent entry.

9.8. Radiation hazards

Ionizing radiations

9.8.1. Stringent safety regulations should be drawn up and enforced by the competent authority with respect to construction workers engaged in the construction, maintenance, renovation, demolition or dismantling of any buildings in which there is a risk of exposure to ionizing radiations, in particular in the nuclear power industry, and in work using radioactive sources or inside structures containing natural radioactive materials.

9.8.2. The employer should ensure the appropriate instruction, certification, information and training of workers engaged in radiography to enable them to carry out their work in accordance with the requirements of radiation protection criteria, regulations and other instruments.

9.8.3. Access should be restricted to areas where radiographic testing is taking place and they should be marked with X-ray radiation signs and safety flag lines.

9.8.4. Relevant provisions of the ILO code of practice on radiation protection of workers (ionizing radiations) should be followed. For further information, see *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (FAO, IAEA, ILO, OECD/NEA, PAHO and WHO, 1996).

9.8.5. Workers in these settings should be provided with personal radiation dose meters and trained in their use. Workers exceeding a permissible dose in a designated time period should be temporarily reassigned to other tasks where they are not exposed to further radiation or suspended on full pay.

Non-ionizing radiations

9.8.6. Workers performing operations where they are exposed to non-ionizing radiations should be provided with adequate protection, and particularly in welding, torch cutting and soldering operations, eye and face protection along with protective clothing covering exposed skin should be provided.

9.8.7. For the purpose of detecting precancerous lesions of the skin, workers continually working under non-ionizing radiation exposure, including exposure to the sun, should be under medical surveillance, where appropriate.

9.8.8. It is desirable to limit sun exposure by wearing adequate clothing (including sunglasses), limiting periods of exposure by the provision of shade and the use of protective sunscreen on exposed skin. These measures should be provided by the employer at no cost.

9.9. Heat stress, cold and wet conditions

9.9.1. Whenever heat stress, cold or wet conditions are such that they can lead to impairment of health or extreme discomfort, preventive measures should be taken by the employer, such as:

- (a) proper design of the workload and workstation, with special regard to workers in cabins, and command or driving operations;
- (b) training workers and their representatives and supervisors to enable detection of early signs of disorders and the preventive steps to be taken, including suitable liquid intake and dietary requirements;
- (c) supply of PPE;
- (d) routine medical surveillance;
- (e) acclimatization to a hot/cold environment, including major changes in climatic conditions;
- (f) supervision so that workers can be withdrawn from adverse conditions if symptoms of heat/cold stress occur; and
- (g) limiting work activities during the hottest part of the day.

9.9.2. Workers should, when experiencing symptoms of heat and cold stress brought about by climatic conditions, have the right to remove themselves from work when they have reasonable justification to believe that there is an imminent and serious danger to their safety and health. In doing so, workers should inform their supervisor immediately.

9.9.3. It should be taken into account that the use of rain gear or protective clothing against hazardous substances can increase the risk of heat stress, and also that respiratory protectors can be hazardous in extremely hot working environments.

9.9.4. When working in hot conditions, preventive measures to avoid heat stress should include work-rest cycles in cool areas and the employers should make available an adequate supply of drinking water with the proper electrolytes and shaded areas, where appropriate.

9.9.5. Workers in extremely cold/hot working environments should be able to handle equipment and installations, fire response and emergency preparedness in those conditions.

9.10. Noise and vibration

9.10.1. The competent authority should set standards for the maximum noise dose to prevent hearing impairment in the working environment.

9.10.2. Employers should provide protection for workers from the harmful effects of noise and vibration from machines and work processes, with reasonable accommodation of pregnant and breastfeeding women, by measures including:

- (a) replacing hazardous machines and processes by less hazardous ones;
- (b) ensuring appropriate maintenance of machinery;
- (c) reducing the exposure of workers; and
- (d) providing personal hearing protection.

9.10.3. Employers and manufacturers should consider the following developments and improvements in machines and processes:

- (a) pneumatic drills and jackhammers to be replaced by hydraulic and electro-pneumatic hammers;
- (b) remote operation of jackhammers, drills and other equipment that causes vibration and noise hazards;
- (c) acoustic enclosure and improved design for compressed air discharges, and the cutters, blades and exhausts of internal combustion engines as well as the engines themselves; and
- (d) better means of supporting or holding manually operated tools, such as anti-vibration handles, in order to reduce the effects of vibration or better vibration damping on vehicle controls and seats.

9.10.4. Employers should give priority to the reduction of the duration of workers' exposure to noise and vibration when operating:

- (a) jackhammers, drills and compressors;
- (b) high impact noise tools such as cartridge-operated guns;
- (c) manually operated vibratory tools, especially those operated upwards or in a cold environment; and
- (d) other tools or machinery in processes in which the level and duration of the exposure of workers nears the exposure limits, as established by the competent authority.

9.10.5. Employers should provide PPE where the harmful effects of noise and vibration will be experienced by workers; this should include:

- (a) hearing protection in accordance with national laws and regulations, which can be worn with other PPE; and
- (b) in the case of vibration, anti-vibration gloves, having in mind their limited effectiveness.

9.10.6. Workers who may be, or have been, exposed to significant noise should receive initial and further regular audiometric testing and be informed of the results of their audiometric tests.

9.10.7. Workers who may be, or have been, exposed to significant vibration levels should receive regular and suitable checks by a competent person to identify any signs and symptoms of ill health.

9.11. Biological agents

9.11.1. National laws and regulations should ensure that risks, such as those of infection, allergy or poisoning due to biological agents, are so far as is reasonably practicable, controlled when the appropriate measures of protection are taken.

9.11.2. Employers should ensure that risks generated by exposure to biological agents, such as bacteria, viruses, fungi, other micro-organisms and their associated toxins, allergens, and organic dusts, are eliminated or minimized so far as is reasonably practicable.

9.11.3. Risk assessments should identify measures to minimize exposures to contaminated materials and dusts, for example mould, bird and rat droppings. In areas where biological agents pose a hazard, preventive measures should be taken which take account of the mode of transmission, in particular:

- (a) detection, where possible, for example by testing drinking water;
- (b) the provision of sanitation and sanitary hygiene information to workers;
- (c) action against vectors, including rats and insects, such as physical protections, fumigation and insecticides. The use of alternative measures such as medical prophylaxis and immunization should be considered in consultation with workers and their representatives;
- (d) the provision of first aid, antidotes and other emergency procedures in case of contact with animals, such as spiders, snakes and insects or plants, and suitable preventive and curative medicine; and
- (e) the supply of adequate PPE (see Chapter 6 of this code) and other appropriate precautions.

9.11.4. The competent authority should establish safety standards with regard to occupational exposure to biological agents. Such standards should be based on sound scientific criteria and accepted international practice.

9.11.5. The competent authority should make available information on the prevention of risks from biological agents and provide appropriate support services with regard to public health and occupational health measures.

9.11.6. The employer should undertake action to eliminate the occurrence of biological agents through a combination of disease-eradication measures; provision of safe water supplies; proper disposal of waste; sanitation of buildings, workspaces and housing; cleaning and protection of open wounds; and use of PPE.

9.11.7. Where the results of the assessment reveal a risk to workers' safety and health from a biological agent, such risk of exposure should be prevented or reduced to as low a level as necessary through measures such as: work planning to reduce risk of exposure; design of work processes and engineering control measures to prevent or minimize the release of biological agents; collective and individual protection measures, including hygiene measures; warning signs and testing, as needed.

9.11.8. The employer should provide instructions at the workplace and display notices, which should include the procedure to be followed in the case of a serious outbreak, accident or incident involving the handling of a biological agent.

9.11.9. The employer should immediately inform workers and their representatives when an accident or incident occurs that has resulted in the release of a biological agent and that could cause severe human infection and illness, specifying the causes thereof and the measures taken or to be taken to rectify the situation.

9.11.10. Workers should immediately report any accident or incident involving the handling of a biological agent to the employer or to the safety and health officer(s).

9.11.11. In accordance with national laws and regulations, the employer should notify the competent authority in case of any accident or incident involving biological agents. All cases of diseases or death identified in accordance with national laws and regulations to be the result of occupational exposure to biological agents should be notified to the competent authority and, where appropriate, relevant public health agencies.

9.11.12. Workers and working environments at risk of exposure to a biological agent should be subject to relevant health surveillance in line with the requirements in Appendices I and II to this code and as prescribed by national laws and regulations.

9.11.13. If a worker is found to be suffering from an infection or illness that is suspected to be the result of exposure to a biological agent, health surveillance should be offered to other workers who have been similarly exposed.

9.11.14. Workers should be informed that they have the right to remove themselves from any workplace at the construction site when circumstances arise that appear, with reasonable justification, to pose a serious danger to their safety or health. They should also be informed of their duty to inform management.

9.11.15. All information retention and disclosure should take worker privacy and data protection requirements into account.

9.11.16. There should be no stigmatization and discrimination based on the medical records of the worker.

9.12. Ergonomics

9.12.1. The competent authority, after consulting the representative organizations of employers and workers concerned, should establish safety and health considerations for repetitive work, working postures, work pace, work demand, work volume, physical load and the handling and transport of materials, particularly for manual handling. Such considerations should be based on risk assessment, technical standards and medical opinion, taking into account all the relevant conditions under which the work is performed, in accordance with national law and practice.

9.12.2. To the extent possible, the task should be adapted to the worker, and jobs and tasks with unacceptable ergonomic problems should be eliminated by redesigning work procedures, workstations, tools and machinery. Any new equipment should meet ergonomic design principles, including ease and safety of operation and adjustability to the user.

9.12.3. If complete elimination is not practicable, the time that workers are required to spend in such conditions should be as short as possible in conjunction with sufficient rest periods, job rotations and changes in postures, with reasonable accommodation of pregnant and breastfeeding women.

9.12.4. Employers should provide workers with information about the weight of any object to be handled, lifted or moved by hand. Where practicable, alternatives to manual handling should be used, including lifting aids and devices. Workers and their representatives should be consulted on manual handling risk assessments and procedures.

9.12.5. Workers should receive the information, instruction and training on manual handling and on measures to minimize the need of manual handling.

9.12.6. Information should be provided to workers to inform them about the musculoskeletal disorders related to manual handling, including repetitive movements and heavy lifting, carrying and the moving of heavy loads, including back problems and repetitive strain injuries. Practical information should be provided on manual handling best practices.

9.12.7. National authorities in cooperation with the manufacturers and suppliers should seek to lower the individual weight of manufactured containers, sacks or boxes, to as low a weight as practicable.

9.12.8. When buying new equipment, employers should take into account technical evolution and select equipment which presents less risks for the workers.

9.13. Psychosocial risks and work-related stress

9.13.1. A psychosocial risk assessment should be carried out and written risk control measures drawn up for all operations, in accordance with national laws and regulations.

9.13.2. The psychosocial risk assessment and control measures should be developed in consultation with workers and their representatives and there should be a demonstrated commitment from all parties. It should cover roles and responsibilities of managers, professional staff, contractors and subcontractors.

9.13.3. The psychosocial risk assessment should consider work-related fatigue, resulting from features of the work and the workplace.

9.14. Labour protection

9.14.1. Employment and social security

9.14.1.1. Employers should, as prescribed by national laws and regulations, or in accordance with national conditions and practice, ensure that:

- (a) every worker has an employment contract;
- (b) every worker is registered with the competent authority for social security;
- (c) coverage is provided, such as benefits in case of injury, sickness, temporary and permanent disability through workers' compensation in the event of occupational accidents and diseases, and compensation for survivors in the event of work-related death, for all workers in the construction sector, irrespective of their employment status; and
- (d) contributions to workers' compensation schemes are paid.

9.14.2. Maternity protection

9.14.2.1. In accordance with the provisions of the Maternity Protection Convention (No. 183) and Recommendation (No. 191), 2000, the competent authority should adopt

regulations, policies and measures that provide for the safety and health aspects in relation to maternity protection in the construction sector.

9.14.2.2. Employers should inform themselves about applicable international instruments, national laws and regulations and the recommendations of the competent authority, and should formulate and implement, in consultation with workers and their representatives, a workplace policy on maternity protection.

9.14.2.3. The employer should take measures to ensure that pregnant or breastfeeding women are not obliged to perform work that has been determined to be prejudicial to the health of the mother or the child or where an assessment has established a significant risk to the mother's health or that of her child.

9.14.2.4. The employer should assess workplace risks related to the safety and health of pregnant or breastfeeding women and their children. Where significant risk has been identified, the employer should take measures to provide, on the basis of a medical certificate, as appropriate, an alternative to such work in the form of:

- (a) elimination of risk;
- (b) an adaptation of her conditions of work;
- (c) a transfer to another post, without loss of pay, when such an adaptation is not feasible; or
- (d) paid leave, in accordance with national laws, regulations or practice, when such a transfer is not feasible.

9.14.2.5. When adapting conditions of work, the employer should take particular measures in respect of:

- (a) arduous work involving the manual lifting, carrying, pushing or pulling of loads;
- (b) work involving exposure to biological, chemical or physical agents which represent a reproductive health hazard;
- (c) work requiring special equilibrium; or
- (d) work involving physical strain due to prolonged periods of sitting or standing, to extreme temperatures, or to vibration.

9.14.2.6. The employer should ensure that a pregnant or breastfeeding woman should not be obliged to do night work if a medical certificate declares such work to be incompatible with her pregnancy or breastfeeding.

9.14.2.7. The employer should allow a woman to leave her workplace, if necessary, after notifying her employer, for the purpose of undergoing medical examinations relating to her pregnancy.

9.14.2.8. The employer should provide maternity leave in accordance with national laws, regulations or practice. To the extent possible, measures should be taken to ensure that the woman is entitled to choose freely the time at which she takes any non-compulsory portion of her maternity leave, before or after childbirth.

9.14.2.9. In accordance with national laws and regulations, the employer should ensure that cash and sickness benefits shall be provided to women who are absent from work on leave both in respect of maternity leave and leave in case of miscarriage, complication or illness.

9.14.2.10. The employer should not terminate the employment of a woman during her pregnancy or absence on leave or during a period following her return to work, as prescribed by national laws or regulations. She should be guaranteed the right to return to the same position or an equivalent position paid at the same rate at the end of her maternity leave.

9.14.2.11. The employer should respect the right of breastfeeding mothers to one or more daily breaks or a daily reduction of hours of work.

9.14.2.12. When practicable, the employer should establish the facilities for nursing and for storing expressed milk under adequate hygienic conditions at or near the workplace.

9.14.3. Working hours

9.14.3.1. Any OSH policy or plan should provide for reasonable working hours, which should not exceed the number prescribed by national laws and regulations or approved by labour inspectorates or in collective agreements, where applicable.

9.14.3.2. Working hours should be arranged so as to provide adequate periods of rest, which, as prescribed by national laws and regulations or approved by labour inspectorates or through social dialogue, where applicable, should include:

- (a) short breaks during working hours, especially when the work is strenuous, dangerous, monotonous or requires high concentration, to enable workers to recover their vigilance and physical fitness;
- (b) sufficient breaks for meals;
- (c) daily or nightly rest;
- (d) weekly rest; and
- (e) annual leave.

9.14.3.3. Any changes in work schedules that could affect OSH should be preceded by full consultation with the workers and their representatives.

9.14.4. Night work and lone-working

9.14.4.1. Where night work is required, the employer should take the necessary measures to ensure that risks do not exceed those in daytime operations, in particular managing lighting and avoiding, as far as possible, the isolation of workers.

9.14.4.2. Specific measures required by the nature of night work should be applied progressively. Such measures should comprise:

- (a) health assessments to identify and monitor health problems associated with night work; and
- (b) compensation in the form of reduced working time, premium pay or similar benefits and appropriate social services.

9.14.4.3. Lone-working should be avoided. If it is necessary, the employer should, in consultation with workers and their representatives, take appropriate measures for the protection of workers working alone or in isolation. A risk assessment should be performed for those who work alone or in isolation in consultation with workers and their representatives to ensure that suitable welfare, emergency or emergency contact arrangements are in place.

9.14.5. Fatigue

9.14.5.1. A fatigue risk assessment should be carried out and written fatigue risk control measures drawn up for all operations and in accordance with national laws and regulations. The fatigue risk assessment should consider work-related fatigue, resulting from features of the work and the workplace. The fatigue risk control measures should specify working-time arrangements where workers:

- (a) carry out work between 7 p.m. and 6 a.m.;
- (b) work more than 48 hours in any consecutive five-day period (working on each day) including unplanned work, emergencies, overtime, breakdowns and call-outs;
- (c) are employed on rotating or irregular shift patterns; or
- (d) do not have a minimum of two consecutive days off in any seven-day period.

9.14.5.2. The fatigue risk assessment and the fatigue risk control measures should be developed in consultation with workers and their representatives and there should be a demonstrated commitment from all parties that it will be supported by the whole organization. It should cover the rosters, roles and responsibilities of managers, professional staff, contractors, subcontractors, those who work on planned rosters and unplanned work such as overtime and call-outs. Commuting times as well as suitability of employer-provided accommodation should also be considered.

9.14.6. Alcohol and drug use

9.14.6.1. Alcohol and other drug policies and programmes should promote the prevention, reduction and management of alcohol and drug-related issues in the workplace. Management and workers and their representatives should cooperate in developing such programmes. The same restrictions or prohibitions with respect to alcohol should apply to both management and workers.

9.14.6.2. Testing of bodily samples for alcohol and drugs in the context of employment involves moral, ethical and legal issues of fundamental importance, requiring a determination of when it is fair and appropriate to conduct such testing.

9.14.6.3. Workers who seek treatment and rehabilitation for alcohol- or drug-related issues should not be disciplined or discriminated against by the employer and should enjoy fundamental principles and rights at work in accordance with the 1998 Declaration on Fundamental Principles and Rights at Work. Any information communicated should be treated with confidentiality.

9.14.6.4. It should be recognized that the employer has authority to discipline workers for employment-related misconduct associated with alcohol and drugs. Recognizing that each case is unique and different, however, counselling, treatment and rehabilitation should be preferred.

9.14.6.5. Further information can be found in the ILO code of practice on management of alcohol- and drug-related issues in the workplace (1996); *Alcohol and Drug Problems at Work: The Shift to Prevention* (ILO, 2003), and the *SOLVE Training Package: Integrating Health Promotion into Workplace OSH Policies* (ILO, 2012).

9.14.7. HIV

9.14.7.1. HIV should be treated as any other chronic condition in the workplace.

9.14.7.2. The ILO HIV and AIDS Recommendation, 2010 (No. 200), concerning HIV and AIDS and the world of work, should guide action at the workplace to reduce the transmission of HIV, alleviate and mitigate its impact on workers and their families and provide social protection.

9.14.7.3. The work environment should be healthy and safe in order to prevent transmission of HIV. Employers should take steps to prevent the transmission of HIV and other blood-borne pathogens, particularly with respect to emergency response. Universal precaution should be applied with respect to first aid and other medical procedures and the handling of other potentially infected material.

9.14.7.4. There should be no disciplinary action or discrimination against workers on the basis of ongoing medical care or real or perceived HIV status. Real or perceived HIV status should not be a cause for termination of employment. Temporary absence from work because of illness or caregiving duties related to HIV or AIDS should be treated in the same way as absences for other health reasons.

9.14.7.5. Persons with HIV-related illness should not be denied the possibility of continuing to carry out their work, with reasonable accommodation if necessary, for as long as they are medically fit to do so. Measures to redeploy such persons to work that is reasonably adapted to their abilities, to find other work for them through training or to facilitate their return to work should be encouraged.

9.14.7.6. In workplaces, it is recommended to have an HIV and AIDS policy and programme, the successful implementation of which requires cooperation and trust between employers, workers and their representatives. The active participation of both men and women should be promoted in the HIV response.

9.14.7.7. When there is a possibility of exposure to HIV at work, workers should receive information, instruction and training on modes of transmission and measures to prevent exposure and infection. Awareness-raising measures should emphasize that HIV is not transmitted by casual physical contact and that the presence of a person living with HIV should not be considered a workplace hazard.

9.14.7.8. There should be no discrimination against workers living with HIV in their access to, and receipt of, benefits from social security programmes and occupational health services.

9.14.8. Violence and harassment

9.14.8.1. In accordance with the provisions of the Violence and Harassment Convention (No. 190) and Recommendation (No. 206), 2019, an inclusive, integrated and gender-responsive approach to the prevention and elimination of violence and harassment in the world of work, including gender-based violence and harassment should include the construction sector, and should be adopted by the competent authority. Such an approach should promote practices and measures that help to prevent and eliminate violence and harassment and take into account violence and harassment involving third parties. Cooperation between competent authorities, employers and workers and their representatives is essential in developing and implementing appropriate policies and procedures to minimize the risk of violence and harassment.

9.14.8.2. The competent authority should adopt laws, regulations and policies to:

- (a) ensure the right to equality and non-discrimination in employment and occupation, including for women workers, as well as for workers and other persons belonging to one or more vulnerable groups or groups in situations of vulnerability that are disproportionately affected by violence and harassment in the world of work;

- (b) monitor and enforce laws and regulations regarding violence and harassment in the world of work;
- (c) ensure easy access to appropriate and effective remedies and safe, fair and effective reporting and dispute resolution mechanisms and procedures in cases of violence and harassment in the world of work, such as protection against victimization of or retaliation against complainants, victims, witnesses and whistle-blowers and legal, social, medical and administrative support measures for complainants and victims;
- (d) ensure that workers have the right to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to life, health or safety due to violence and harassment, without suffering retaliation or other undue consequences, and the duty to inform management;
- (e) recognize the effects of domestic violence and, so far as is reasonably practicable, mitigate its impact in the world of work;
- (f) ensure that labour inspectorates and other relevant authorities, as appropriate, are empowered to deal with violence and harassment in the world of work, including by issuing orders requiring measures with immediate executory force, and orders to stop work in cases of an imminent danger to life, health or safety, subject to any right of appeal to a judicial or administrative authority which may be provided by law; and
- (g) hold perpetrators of violence and harassment in the world of work accountable and providing counselling or other measures, where appropriate, with a view to preventing the reoccurrence of violence and harassment, and facilitating their reintegration into work, where appropriate.

9.14.8.3. Employers should inform themselves about applicable international instruments, national laws and regulations and the recommendations of the competent authority, and take appropriate steps commensurate with their degree of control, so far as is reasonably practicable to take into account violence and harassment and associated psychosocial risks in the management of OSH. They should formulate and implement, in consultation with workers and their representatives, a workplace policy on violence and harassment. Such a policy should:

- (a) state that violence and harassment will not be tolerated;
- (b) establish violence and harassment prevention programmes with, if appropriate, measurable objectives;
- (c) specify the rights and responsibilities of the workers and the employer;
- (d) contain information on complaint and investigation procedures;
- (e) provide that all internal and external communications related to acts of violence and harassment will be duly considered, and acted upon as appropriate;
- (f) specify the right to privacy of individuals and confidentiality while balancing the right of workers to be made aware of all hazards; and
- (g) include measures to protect complainants, victims, witnesses and whistle-blowers against victimization or retaliation.

9.14.8.4. The employer should take appropriate steps commensurate with their degree of control, so far as is reasonably practicable to identify hazards and assess the risks of violence and harassment with the participation of workers and their representatives and take measures to prevent and control them. The risk assessment should take into account factors that increase the likelihood of violence and harassment, including psychosocial hazards and risks. Particular

attention should be paid to the hazards and risks that arise from working conditions and arrangements, work organization and human resource management as appropriate, as well as from discrimination, the abuse of power relations and the gender, cultural and social norms that support violence and harassment.

9.14.8.5. Employers should take appropriate steps commensurate with their degree of control so far is reasonably practicable and provide to workers and other persons concerned information and training, in accessible formats as appropriate, on the identified hazards and risks of violence and harassment and the associated prevention and protection measures, including on the rights and responsibilities of workers and other persons concerned in relation to the workplace policy referred to in paragraph 9.14.8.3.

► Part II. Technical guidance related to the construction sector

► 10. Scaffolds, ladders, lifting appliances and mobile elevated working platforms ¹

10.1. General provisions

10.1.1. Where work cannot safely be done on or from the ground or from part of a building or other permanent structure, a safe and suitable scaffold should be provided and maintained or other equally safe and suitable provision should be made.

10.1.2. Scaffolds should be provided with safe means of access, such as stairs, ladders or ramps. Ladders should extend at least 1 m above the landing point to provide a secure handhold, be secured against inadvertent movement, and at ladder access points, a self-closing gate is recommended.

10.1.3. The competent authority should establish and enforce laws and regulations and other nationally recognized instruments covering detailed technical provisions for the design, construction, erection, use, maintenance, dismantling and inspection of the different kinds of scaffolds, ladders, working platforms and mobile elevated working platforms in use.

10.1.4. Every scaffold and part thereof should be:

- (a) designed, constructed, erected, maintained and dismantled so as to reduce risks for workers, for example falls from height, and prevent collapse or accidental displacement when properly used;
- (b) designed so that guard rails and other protective devices, platforms, putlogs, rakers, transoms, ladders, stairs or ramps, can be easily put together; and
- (c) of suitable and sound material and of adequate size and strength for the purpose for which it is to be used and maintained in a proper condition.

10.1.5. Further to the requirements in subparagraph 4.11(c), a scaffold should not be erected, substantially altered or dismantled except by or under the supervision of a competent person.

10.2. Materials

10.2.1. Sufficient suitable and sound material should be provided and used in the construction of scaffolds, in overall conformity with quality standards in relevant national laws and regulations.

10.2.2. Timber, including bamboo, used in the construction of scaffolds should be straight-grained, sound, and free from large knots, dry rot, worm holes and other defects likely to affect its strength.

10.2.3. No rope which is defective whether through contact with acids or other corrosive substances or otherwise should be used on scaffolds.

¹ The ILO code of practice on safety and health in the use of machinery (2013) defines safety and health requirements and precautions and provides detailed guidance applicable to governments, workers and employers, and also to designers, manufacturers, and suppliers of machinery.

10.2.4. Where necessary, boards and planks used for scaffolds should be protected against splitting by using end bands or a similar device.

10.2.5. Ladders, boards and planks used in scaffolds should not be painted so that any defects and manufacturer's specifications or capacity levels are visible.

10.2.6. Materials used in the construction of scaffolds should be stored under good conditions and apart from any material unsuitable for scaffolds.

10.2.7. Fastenings on wooden and bamboo scaffolds should conform with the national laws and regulations or be approved by the competent authority.

10.2.8. All tubes, couplers and fittings used in metal tubular scaffolding should be of a standard and type approved by the competent authority. All couplers and fittings should be free from damage and distortion, and should be maintained in an efficient state, in efficient working order and in good repair.

10.2.9. Couplers should not cause deformation in tubes. Couplers should be made of drop forged steel or equivalent material.

10.2.10. Tubes should be free from cracks, splits and excessive corrosion and be straight to the eye, and tube ends cut cleanly square with the tube axis.

10.2.11. Material used to construct scaffolding should be selected according to the applicable standards or comply with the relevant national laws and regulations and not be intermixed on the same scaffold unless authorized by the manufacturer.

10.3. Design and construction

10.3.1. Scaffolds should be designed for their maximum load and with a safety factor of 4, or as prescribed by the competent authority.

10.3.2. Scaffolds should be adequately braced and anchored to ensure stability.

10.3.3. Scaffolds which are not designed to be independent should be rigidly connected to the building at suitable vertical and horizontal distances.

10.3.4. A scaffold should never extend above the highest anchorage to an extent which might endanger its stability and strength.

10.3.5. Sufficient putlogs and transoms should remain in position and securely fastened to the ledgers and uprights/standards to ensure the stability of the scaffold until it is finally dismantled.

10.3.6. All scaffolds and appliances used as supports for working platforms should be of sound construction, have a firm footing, and be adequately strutted and braced to maintain their stability.

10.3.7. Loose bricks, drainpipes, chimney-pots or other unsuitable material should not be used for the construction or support of any part of a scaffold.

10.3.8. When necessary to prevent danger from falling objects, working platforms, gangways and stairways of scaffolds and adjacent areas should be provided with appropriate overhead protection of adequate strength and dimensions.

10.3.9. Nails should be driven full length, and not driven part way and then bent over, and should not be subject to direct pull.

10.3.10. Scaffolding materials should not be thrown from scaffolds or from heights. Other materials should only be thrown from scaffolds or heights where the landing area has been designated, protected, appropriate notices displayed, and is under the supervision of a person on the landing level. The use of waste chutes allows material to be safely removed from height.

10.3.11. Metal scaffolds should not be erected close to overhead electricity transmission lines equipment except in accordance with safety distances laid down by the competent authority or after the electrical transmission line or equipment has been rendered electrically dead.

10.3.12. As far as practicable, every part of a working platform, gangway or stairway of a scaffold from which a person is liable to fall a distance likely to cause personal injury, or as prescribed in the national laws or regulations, should be provided with upper and intermediate guard rails and toe boards complying with the relevant national standards.

10.3.13. Working platforms should be of sufficient strength and width to provide for the safe storage of materials and safe passage of personnel. The recommended width of the working platform should be no less than 600 mm and the recommended width of a scaffold when storing materials should be no less than 800 mm.

10.3.14. Where the ends of boards meet, transoms must be doubled and so spaced that no board overhangs by more than four times its thickness and less than 50 mm.

10.3.15. When practicable during assembly, workers should put in place guard rails from the protected lower floor; where this is not practicable, a PFAS should be worn and securely attached.

10.4. Inspection and maintenance

10.4.1. Scaffolds should be inspected as prescribed by national laws or regulations, and the results recorded by a competent person:

- (a) before being taken into use;
- (b) at periodic intervals thereafter, as prescribed for different types of scaffolds; and
- (c) after any alteration, interruption in use, exposure to weather or seismic conditions or any other occurrence likely to have affected their strength or stability.

10.4.2. Inspection by the competent person should more particularly ascertain that:

- (a) the scaffold is of suitable type and adequate for the job;
- (b) materials used in its construction are sound and of sufficient strength;
- (c) it is of sound construction and stable; and
- (d) that the required safeguards are in position.

10.4.3. No scaffold should be partly dismantled and left so that it is capable of being used, unless it continues to be safe for use.

10.4.4. When parts of a scaffold are not ready for use, for example during erection, dismantling or alteration, they should be marked with appropriate warning signs.

10.5. Lifting appliances on scaffolds

10.5.1. When a lifting appliance is to be used on a scaffold:

- (a) the parts of the scaffold should be suitably designed and carefully inspected by a competent person to determine the additional strengthening and other safety measures required;
- (b) any movement of the putlogs should be prevented; and
- (c) if practicable, the uprights should be rigidly connected to a solid part of the building at the place where the lifting appliance is erected.

10.6. Prefabricated scaffolds

10.6.1. In the case of prefabricated scaffold systems the instructions provided by the manufacturers or suppliers should be strictly adhered to. Prefabricated scaffolds should have adequate arrangements for fixing bracing.

10.6.2. Frames of different types should not be intermingled in a single scaffold unless authorized by the manufacturers.

10.7. Use of scaffolds

10.7.1. The employer should provide competent supervision to ensure that all scaffolds are used appropriately and only for the purpose for which they are designed or erected.

10.7.2. In transferring heavy loads on or to a scaffold a sudden shock should not be transmitted to the scaffold.

10.7.3. When necessary to prevent danger, loads being hoisted on or to scaffolds should be controlled, for example by a hand rope (tag line), so that they cannot strike against the scaffold.

10.7.4. The load on the scaffold should be evenly distributed, as far as practicable, and in any case should be so distributed as to avoid disturbance of the stability of the scaffold.

10.7.5. During the use of a scaffold care should constantly be taken that it is not overloaded or otherwise misused.

10.7.6. Scaffolds should not be used for the storage of material except that required for immediate use.

10.7.7. Workers should not be employed on external scaffolds in weather conditions that threaten their safety.

10.8. Suspended scaffolds

10.8.1. In addition to the requirements for scaffolds in general as regards soundness, stability and protection against the risk of falls, suspended scaffolds should meet the following specific requirements in so far as such requirements are applicable:

- (a) platforms should be designed and built with dimensions that are compatible with the stability of the structure as a whole, especially the length;
- (b) the number of anchorages should be compatible with the dimensions of the platform;
- (c) the safety of workers should be safeguarded by employers providing and workers using PFASs having a point of attachment independent of the anchorage arrangements for the scaffold;
- (d) the anchorages and other elements of support of the scaffold should be designed and built in such a way as to ensure sufficient strength;

- (e) the ropes, electric motors, winches, pulleys or pulley blocks should be designed, assembled, used and maintained according to the requirements established for lifting gear adapted to the lifting of persons according to national laws and regulations; and
- (f) before and during use, the whole structure should be examined to ensure safety by a competent person in accordance with Chapter 11 of this code.

10.9. Platforms attached to lifting appliances and mobile elevated working platforms

10.9.1. When a working platform is attached to a lifting appliance, the lifting appliance should:

- (a) be provided with a means of positively locking the supports to prevent inadvertent movement of the platform;
- (b) be fitted with over-hoisting limit switches;
- (c) be installed and fixed so that its position cannot be changed by either the load or by any other influence; and
- (d) while the platform is in use, should not be moved on any surface.

10.9.2. If necessary to prevent danger, the lifting appliance operator should remain at the controls while the platform is in use.

10.9.3. If the platform is suspended, adequate precautions should be taken against swinging and spinning.

10.9.4. Lifting bridles of working platforms suspended from cranes should:

- (a) have four legs such that the stability of the platform is ensured; and
- (b) be attached to the crane rope by safety hooks, shackles or other means that effectively prevent them from disengaging from the crane rope.

10.9.5. If the platform is rigidly attached to the lifting appliance, adequate precautions should be taken to prevent it from tilting during raising and lowering.

10.9.6. Mobile elevated working platforms should:

- (a) have an emergency stop that can be operated from the base;
- (b) only be operated on level and firm ground and any service drains should be able to support the passage of the equipment;
- (c) not be operated in winds greater than the maximum allowable wind speed identified by the supplier; and
- (d) only carry workers wearing a safety harness with a short work/fall restraint lanyard attached to a suitable anchor point.

10.10. Mobile scaffolding

10.10.1. Scaffolding supported on wheels should be adequately stabilized in accordance with the manufacturer's instructions to prevent dangerous distortion in use and, if necessary for stability, should be adequately weighted at the base.

10.10.2. Mobile scaffolding should be used only on a firm, level surface.

10.10.3. The height of mobile scaffolding should not exceed four times the lesser base dimension.

10.10.4. A safe way to get to and from the work platform must be provided, such as an appropriately designed internal ladder, as this assists in ensuring the stability of the scaffold.

10.10.5. When mobile scaffolding is in use, the castors or wheels should be adequately chocked.

10.10.6. No person, material or tool should be on scaffolding that is being moved and the manufacturer's instructions should be followed with regard to the maximum height of the scaffold allowed when moving.

10.10.7. When mobile scaffolding is being moved, a risk assessment should be made to:

- (a) mitigate movement of uneven surfaces; and
- (b) avoid any contact with overhead electric cables.

10.11. Ladders

10.11.1. Ladders are not designed to replace working platforms. Where the ladder is integrated into the working platform, this should be used for access/egress only.

10.11.2. Leaning ladders should be used only as a temporary way to access points of work. The angle should be approximately 75 degrees or a 1:4 ratio.

10.11.3. Workers should inspect ladders prior to use. If the ladder is damaged, it must be removed from service and tagged until repaired or discarded.

10.11.4. Rungs, cleats and steps of ladders must not be spaced less than 25 cm apart or more than 36 cm apart, along the ladder's side rails.

10.11.5. Labels and markings on the ladder should be read and followed. Ladders and appropriate accessories (for example, ladder levellers, jacks or hooks) should be used only for their designed purpose. Ladders must not be used beyond their manufacturer's rated load capacity.

10.11.6. Ladders should be maintained free of oil, grease and other slipping hazards. Rungs of metal ladders should be corrugated or treated to prevent slipping.

10.11.7. Ladders should be fitted with slip-resistant feet and used only on stable and level surfaces and, where practicable, should be secured.

10.11.8. When placed in areas such as passageways, doorways or driveways or where they can be displaced by workplace activities, ladders should be secured to prevent accidental movement or a barricade should be used to keep traffic or activity away from the ladder.

10.11.9. Areas around the top and bottom of ladders should be kept clear.

10.11.10. Before using the ladder, workers should check overhead and must not use it near power lines or exposed energized electrical equipment. Metal ladders should not be used in proximity to electrical equipment.

10.11.11. Workers using or working off ladders for low-risk and short duration tasks should:

- (a) maintain three points of contact when climbing (one hand and two feet, or two hands and one foot);

- (b) face the ladder;
- (c) avoid wearing slippery boots or shoes; and
- (d) avoid carrying heavy or bulky loads that could cause loss of balance and falling.

10.11.12. Ladders should not be moved while a person or equipment is on the ladder.

10.11.13. If objects have to be carried on ladders, belts or other suitable means should be provided and used for the purpose.

10.11.14. Improvised hand ladders should not be used.

► 11. Lifting appliances and gear

11.1. General provisions

11.1.1. Employers should have a well-planned safety programme to ensure that all the lifting appliances and lifting gear are selected, installed, examined, tested, maintained, operated and dismantled:

- (a) with a view to preventing the occurrence of any accident or dangerous occurrence;
- (b) in accordance with the requirements laid down in national laws, regulations and standards; and
- (c) in accordance with manufacturer's instructions.

11.1.2. Every lifting appliance including its constituent elements, attachments, anchorages and supports, should be of good design and construction, sound material and adequate strength for the purpose for which it is used.

11.1.3. Every lifting appliance and every item of lifting gear should be accompanied at the time of purchase with instructions for use and with a test certificate from a competent person or a guarantee of conformity with national laws and regulations and manufacturers' specifications concerning:

- (a) the maximum safe working load;
- (b) safe working loads at different radii if the lifting appliance has a variable radius; and
- (c) the conditions of use under which the maximum or variable safe working loads can be lifted or lowered; and
- (d) accessible to the operator, the date of the technical revision and by whom it was performed, where appropriate.

11.1.4. Lifting appliances having a safe working load that varies with the radius of operation should display a chart showing the radius and the corresponding safe working load, in accordance with national laws and regulations. The chart should also state the maximum and minimum operating radius for the appliance and the point from which the radius is measured. Such appliances should also be fitted with a radius indicator that can be clearly seen by the operator at the controls and, where practicable, a safe working load indicator.

11.1.5. Every lifting appliance and every item of lifting gear having a single safe working load should be clearly marked at a conspicuous place with the maximum safe working load in accordance with national laws and regulations.

11.1.6. Every lifting appliance having a variable safe working load should be fitted with a load indicator or other effective means to indicate clearly to the operator each maximum safe working load and the conditions under which it is applicable.

11.1.7. All lifting appliances should be adequately and securely supported; the weight-bearing characteristics of the ground or surface on which the lifting appliance is to operate should be surveyed in advance of use.

Installation

11.1.8. Lifting appliances should be installed by competent persons so that:

- (a) they cannot be displaced by the load, vibration or other influences;
- (b) the operator is not exposed to danger from loads, ropes or drums; and
- (c) the operator can either see over the zone of operations or communicate with all loading and unloading points by telephone, signals or other adequate means.

11.1.9. A clearance of at least 60 cm or more, as prescribed by national laws and regulations, should be provided between moving parts or loads of lifting appliances and fixed objects in the surrounding environment such as walls and posts. The clearance from electrical conductors should be more for all voltages in accordance with the requirements of national laws and regulations.

11.1.10. The operation, strength and stability of lifting appliances should take into account the effect of any wind forces and other adverse weather conditions to which they may be exposed.

11.1.11. The manufacturers' instructions on the methods and sequence of erection and dismantling of lifting appliances should be followed. No structural alterations or repairs should be made to any part of a lifting appliance which may affect the safety of the appliance without the permission and supervision of the competent person.

Examinations and tests

11.1.12. Lifting appliances and items of lifting gear, as prescribed by national laws and regulations, should be examined and tested by a competent person:

- (a) before being taken into use for the first time;
- (b) after erection on a site;
- (c) subsequently at intervals prescribed by national laws and regulations;
- (d) after any substantial alteration or repair; and
- (e) after every exceptional circumstance liable to affect the safety of the equipment.

11.1.13. The manner in which the examinations and tests are to be carried out by the competent person and the test loads to be applied for different types of lifting appliances and lifting gear should be in accordance with national laws and regulations.

11.1.14. The results of the examinations and tests on lifting appliances and lifting gear should be recorded in prescribed forms and, in conformity with national laws and regulations, made available to the competent authority and to employers and workers or their representatives if the lifting appliances or lifting gear was found to be defective.

Controls, control devices and cabins

11.1.15. Controls of lifting appliances should be:

- (a) designed and constructed as far as possible in accordance with ergonomic principles;
- (b) conveniently situated with ample room for operation and an unrestricted view for the operator;
- (c) provided, where necessary, with a suitable locking device to prevent accidental movement or displacement, along with any other safety devices, as prescribed by national laws and regulations;
- (d) in a position free from danger from the passage of the load; and

- (e) clearly marked to show their purpose and method of operation.

11.1.16. Lifting appliances should be equipped with devices that would prevent the load from over-running and prevent the load from moving if power fails.

11.1.17. The operator of lifting appliances designed to be used outdoors except those used for short periods should be provided with:

- (a) a safe cabin with full protection from weather and adverse climatic conditions, and designed and constructed in accordance with ergonomic principles, where applicable;
- (b) a clear and unrestricted view of the area of operation or otherwise should be provided with a competent banks person/signaller; and
- (c) safe access to and egress from the cabin, including situations where the operator is taken ill.

Operation

11.1.18. Lifting appliances should be operated by a worker who:

- (a) is 18 years of age or older;
- (b) is medically fit; and
- (c) has received appropriate training in accordance with national laws and regulations and is competent.

11.1.19. A lifting appliance or item of lifting gear should not be loaded beyond its safe working load or loads, except for testing purposes as specified by, and under the direction of, a competent person.

11.1.20. Persons should stay clear of suspended loads, should never be under a suspended load and loads should not be lifted over people. Guarded exclusion zones should be established around lifting operations.

11.1.21. Where necessary to guard against danger, no lifting appliance should be used without the provision of suitable signalling arrangements or devices.

11.1.22. No person should be raised, lowered or carried by a lifting appliance unless it is constructed, installed, examined and used for that purpose in accordance with national laws and regulations, except in an emergency situation:

- (a) in which serious personal injury or fatality may occur; and
- (b) for which the lifting appliance can safely be used.

11.1.23. Every part of a load in the course of being hoisted or lowered should be adequately suspended or supported, prepared by a competent person, so as to prevent danger.

11.1.24. Every platform or receptacle used for hoisting bricks, tiles, slates or other loose material should be slung by a competent person.

11.1.25. Loaded wheelbarrows placed directly on a platform for raising or lowering should be secured so that they cannot move and the platform should be enclosed as necessary to prevent the fall of the contents.

11.1.26. In hoisting a wheelbarrow, the wheel should not be used as a means of lifting unless efficient steps are taken to prevent the axle from slipping out of the bearings.

11.1.27. If necessary to avoid danger, long objects such as girders should be guided with a tag line while being raised or lowered.

11.1.28. Landings should be so designed and arranged that workers are not obliged to lean out into empty space for loading and unloading.

11.1.29. The hoisting of loads at points where there is a regular flow of traffic should be carried out over a traffic-restricted area, or if this is impracticable (for example in the case of bulky objects), measures should be taken to hold up or divert the traffic for the time necessary.

11.1.30. When working at heights during lifting operations, Chapter 14 in this code should be consulted.

11.1.31. For further information, see Chapter 8 of the ILO code of practice on safety and health in the use of machinery (2013) for the safe use of lifting machinery (such as cranes and hoists) and machinery for the lifting of persons, and its Appendix II for detailed technical information.

11.2. Hoists

11.2.1. Hoist towers should be designed and examined according to national laws and regulations.

11.2.2. To ensure workers cannot be struck by moving components, hoist shafts should be enclosed with rigid panels or other adequate fencing:

- (a) at ground level on all sides;
- (b) at all other levels at all points at which access is provided; and
- (c) at all points at which persons are liable to be struck by any moving part.

11.2.3. The enclosure of hoist shafts, except at access points/entrances, should extend, where practicable, at least 2 m above the floor, platform or other place to which access is provided, except where a lesser height is sufficient to prevent any person falling down the hoistway and there is no risk of any person coming into contact with any moving part of the hoist, but in no case should the enclosure be less than 1 m high.

11.2.4. Access points/entrances to hoists should be provided with substantial gates or the like which:

- (a) should be gridded for visibility;
- (b) should, where practicable, be at least 2 m high; and
- (c) when closed prevent access to the hoist platform and any moving part of the hoist.

11.2.5. The guides of hoist platforms should offer sufficient resistance to bending and, in the case of jamming by a safety catch, to buckling.

11.2.6. Where necessary to prevent danger, adequate covering should be provided above the top of hoist shafts to prevent material falling down them.

11.2.7. Outdoor hoist towers should be erected on adequately firm foundations, and securely braced, guyed and anchored.

11.2.8. A suitable ladderway should extend from the bottom to the top of outdoor hoist towers, if no other ladderway exists within easy reach.

11.2.9. Hoisting engines should be of ample capacity to control the heaviest load that they will have to move.

11.2.10. Hoists should be provided with devices that stop the hoisting engine as soon as the platform reaches its highest stopping place.

11.2.11. Winches should be so constructed that the brake is applied when the control handle is not held in the operating position.

11.2.12. It should not be possible to set in motion from the platform a hoist which is not designed for the conveyance of persons. Goods hoists should be operated from one working position only and the operator should be able to see all the landing levels from this position.

11.2.13. Winches should not be fitted with pawl and ratchet gears on which the pawl must be disengaged before the platform is lowered.

11.2.14. Hoist platforms should be capable of supporting the maximum load that they will have to carry with a safety factor as laid down in national laws and regulations.

11.2.15. Hoist platforms should be equipped with safety gear that will hold the platform with the maximum load if the hoisting rope breaks.

11.2.16. On sides not used for loading and unloading, hoist platforms should be provided with toe boards and enclosures of wire mesh or other suitable material to prevent the fall of parts of loads.

11.2.17. Where necessary to prevent danger from falling objects, hoist platforms should be provided with adequate covering.

11.2.18. Counterweights consisting of an assemblage of several parts should be made of specially constructed parts rigidly connected together.

11.2.19. Counterweights should run in guides.

11.2.20. Suitable platforms should be provided at all landings used by workers and the distance between the hoist and the landing position must be kept to a minimum.

11.2.21. The following notices should be posted up conspicuously and in very legible characters:

- (a) on all hoists:
 - (i) on the platform: the carrying capacity in kilograms or other appropriate standard unit of weight; and
 - (ii) on the hoisting engine: the lifting capacity in kilograms or other appropriate standard unit of weight;
- (b) on hoists authorized or certified for the conveyance of persons: on the platform or cage: the maximum number of persons to be carried at one time and the carrying capacity in kilograms or other appropriate standard unit of weight; and
- (c) on hoists for goods only: on every approach to the hoist and on the platform: prohibition of use by persons.

11.2.22. Hoists intended for the carriage of persons should be provided with a cage so constructed as to prevent any person from falling out or being trapped between the cage and any fixed part of the structure when the cage gate is shut, or from being struck by the counterbalance weight or by articles or materials falling down the hoistway.

11.2.23. On each side in which access is provided the cage should be fitted with a gate fitted with devices which ensure that the gate cannot be opened except when the cage is at a landing and that the gate must be closed before the cage can move away from the landing.

11.2.24. Every gate in the enclosure of the hoist shaft which gives access from a landing place to the cage should be fitted with devices to ensure that the gate cannot be opened except when the cage is at that landing place, and that the cage cannot be moved away from that landing place until the gate is closed.

11.2.25. Hoists intended for the carriage of persons should be provided with an emergency stop switch in the cage.

11.3. Derricks

11.3.1. Derricks should be erected on a firm base capable of taking the combined weight of the crane structure and maximum rated load.

11.3.2. Suitable devices should be used to prevent masts from lifting out of their seatings.

11.3.3. Electrically operated derricks should be effectively earthed from the soleplate or framework.

11.3.4. Counterweights should be so arranged that they do not subject the backstays, sleepers or pivots to excessive strain.

11.3.5. When derricks are mounted on wheels:

- (a) a rigid member should be used to maintain the correct distance between the wheels; and
- (b) they should be equipped with struts to prevent them from dropping if a wheel breaks or the derrick is derailed.

11.3.6. The length of a derrick jib should not be altered without consulting the manufacturer and without the permission and supervision of the competent person.

11.3.7. The jib of a scotch derrick crane should not be erected within the backstays of the crane.

11.3.8. Derricks should be fitted with the following limiters:

- (a) derricking-in limiter ensuring that the crane jib cannot be derricked back beyond the minimum radius position; and
- (b) derricking-out limiter ensuring that the jib cannot be derricked out beyond the maximum radius position.

Guy derricks

11.3.9. The restraint of the guy ropes should be ensured by fitting stirrups or anchor plates in concrete foundations.

11.3.10. The mast of guy derricks should be supported by six top guys spaced approximately equally.

11.3.11. The spread of the guys of a guy derrick crane from the mast should be not more than 45 degrees from the horizontal.

11.3.12. Guy ropes of derricks should be equipped with a stretching screw or turnbuckle or other device to regulate the tension.

11.3.13. Gudgeon pins, sheave pins and foot bearings should be lubricated frequently.

11.3.14. When a derrick is not in use, the boom should be laid down or anchored to prevent it from swinging.

11.4. Gin poles

11.4.1. Gin poles should:

- (a) be straight;
- (b) consist of steel or other suitable metal or straight-grained timber free from knots;
- (c) be adequately guyed and anchored;
- (d) be vertical or raked slightly towards the load; and
- (e) be of adequate strength for the loads that they will be required to move.

11.4.2. Gin poles should not be spliced and if a gin pole is composed of different elements, they should be assembled in conformity with their intrinsic material strength.

11.4.3. Gin poles should be adequately fastened at their feet to prevent displacement in operation.

11.4.4. When platforms or skips are hoisted by gin poles, adequate precautions should be taken to prevent them from spinning and to provide for proper landing.

11.5. Tower cranes, including remote, self-erecting or pedestrian-operated tower cranes

11.5.1. Where tower cranes have cabs at high level, persons should only be employed as crane operators who are capable and trained to work at heights.

11.5.2. The characteristics of the various machines available should be considered against the operating requirements and the surroundings in which the crane will operate before a particular type of crane is selected.

11.5.3. Any crane to be used in an exposed position such that the effect of wind may be detrimental to its safety should be designed to have the stability and structural strength required to stand up to the additional stresses involved in:

- (a) operating normally up to a predetermined wind velocity; and
- (b) withstanding the foreseeable wind velocity, including gusting, when not in operation.

11.5.4. The ground on which the tower crane stands should have adequate bearing capacity. Account should be taken of seasonal variations in ground conditions.

11.5.5. Bases for tower cranes and tracks for rail-mounted tower cranes should be firm and level. Tower cranes should only operate on gradients within limits specified by the manufacturer. Tower cranes should only be erected at a safe distance from excavations and ditches.

11.5.6. Tower cranes should be sited where there is clear space available for erection, operation and dismantling. As far as possible, cranes should be sited so that loads do not have to be handled over occupied premises, over public thoroughfares, other construction works and railways or near power cables.

11.5.7. Where two or more tower cranes are in the same location, they should be sited in positions so that when in operation their jibs cannot touch any part of the other crane or structures. Any transported loads should also not be able to touch the other crane. When this is not practicable, preventive measures to avoid collision should be adopted, such as direct means of communication between them and a distinct warning system operated from the cab so that one driver may alert the other to impending danger.

11.5.8. The climbing operation of climbing tower cranes should be carried out in accordance with manufacturers' instructions and national laws and regulations. The free-standing height of the tower crane should not extend beyond what is safe and is permissible in the manufacturers' instructions.

11.5.9. When the tower crane is left unattended or out of service, the manufacturers' instructions should be followed to ensure safety. For longer periods or at times when adverse weather conditions are expected, the main jib should be slewed around to stow to the side of the tower away from the wind, put into free slew and the crane immobilized.

11.5.10. A wind speed measuring device should be provided at an elevated position on the tower crane with the indicator fitted in the drivers' cab.

11.5.11. Load moment limiting devices should be provided to prevent loads being moved to a point where the corresponding safe working load of the crane would be exceeded.

11.5.12. Name boards or other items liable to catch the wind should not be mounted on a tower crane other than in accordance with the manufacturers' instructions.

11.5.13. Tower cranes should not be used for magnet, or demolition ball service, piling operations or other duties which could impose excessive loadings on the crane structure.

11.6. Lifting gear

11.6.1. Lifting gear should be installed, maintained, examined and tested in accordance with manufacturers' instructions and national laws or regulations.

11.6.2. Where multiple independent ropes are used, for the purpose of stability, to lift a work platform, each rope should be capable of carrying the load independently.

11.6.3. Operators must conduct daily visual examinations of all lifting gear (lifting hooks, clamps, wires, lines, shackles, lugs, leverpullers and chain-blocks) before use.

11.6.4. All lifting gear should:

- (a) have permanently affixed and legible identification markings, as prescribed by the manufacturer, indicating the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is/they are based, and the number of legs if more than one;
- (b) not be loaded in excess of its recommended safe working load as prescribed in the identification markings by the manufacturer; and
- (c) not be used without the affixed and legible identification markings, as required.

Chains

11.6.5. A load should not be lifted with a chain that has a kink or knot in it. A chain must not be shortened by bolting, wiring or knotting.

11.6.6. All repairs to chains should be made under qualified supervision. Links or portions of the chain found to be defective must be replaced by links having proper dimensions and made of material similar to that of the chain. Before repaired chains are returned to service, they should be examined and certified as fit for service by a competent person.

Hooks

11.6.7. Loads should be applied to the throat of the hook, since loading the point may overstress and bend or spring the hook.

11.6.8. When the hook of a multi-legged sling is attached to an eye fitting on a pallet, tray or load, it should be inserted into the eye from the inside of the load, so that in the event of a leg of the sling becoming momentarily slack, the hook will remain engaged in the eye.

11.6.9. Every hook should be provided with an efficient safety device to prevent the displacement of the load from the hook.

Wire ropes

11.6.10. The guaranteed minimum breaking load should not be less than the product of the safe working load and a factor of safety.

11.6.11. Hoisting ropes should be in one length without any joins and repairs. If the lengthening of a cable is unavoidable, it should be done by an approved method, such as fitting a thimble and shackle. In such cases, the safe working load should be reduced by an appropriate amount as determined by a competent person. It may also be necessary to fit larger sheaves if the connection needs to pass over them.

11.6.12. Wire rope slings may be endless, that is, formed by jointing the two ends of the rope, or have a variety of terminations and splices.

11.6.13. Wire ropes should be inspected for:

- (a) severe corrosion;
- (b) local wear or shiny spots on the outer surface;
- (c) reduction of diameter; a one third reduction of diameter is not safe;
- (d) distortion or other damage of end fittings;
- (e) distortion of wire rope structure;
- (f) an excessive number of broken wires; and
- (g) if any of the above matters are identified, then the wire rope should be examined and tested by a competent person to verify whether it can remain in service.

Synthetic fibre ropes/slings

11.6.14. Synthetic fibre ropes and slings can deteriorate upon contact with acids and caustics. Slings and ropes should not be used with such substances unless the manufacturer recommends them for that use.

11.6.15. The surface of lifting slings should be examined for cuts, gouges or worn surface areas; dry, brittle, scorched or discoloured fibres; or melted fibres. Where defects are observed, the sling must be discarded. Fibre rope slings cannot be repaired. The interior of fibre ropes should be examined to ensure it is clean and there is no excessive internal wear.

Shackles

11.6.16. The safe working load of a shackle in a sling should always be equal to the sling, the increased stress due to an angle in the arrangement being duly taken into account.

11.6.17. “Dee” shackles should be used for straight pull applications and “bow” shackles where a number of slings pull at different angles. Where shackles are permanently rigged, the pins should be locked by mousing a screw collar pin or by a split cotter pin on a nut and bolt pin.

11.6.18. A shackle should not be used on a sling unless it is fitted with a proper shackle pin; an ordinary bolt or piece of steel bar should not be used.

11.6.19. When used in normal slinging applications, the screw pins of shackles should only be done up hand-tight and monitored on a continuous basis. However, the pins should be secured to keep them from coming undone.

► 12. Transport, earth-moving and materials-handling equipment

12.1. General provisions

12.1.1. The employer should ensure that all vehicles and earth-moving or materials-handling equipment should be:

- (a) of good design and construction taking into account as far as possible ergonomic principles particularly with reference to the seat;
- (b) maintained in good working order;
- (c) properly used with due regard to safety and health; and
- (d) operated by workers who have received appropriate training in accordance with national laws and regulations.

12.1.2. The drivers and operators of vehicles and earth-moving or materials-handling equipment should:

- (a) be medically fit;
- (b) have received appropriate information, instruction and training and, where required, have obtained the necessary licences in accordance with national laws and regulations; and
- (c) be of a prescribed minimum age as required by national laws and regulations.

12.1.3. On all construction sites on which vehicles, earth-moving or materials-handling equipment are used:

- (a) safe and suitable access ways should be provided for them; and
- (b) traffic should be so organized, controlled and segregated from workers on foot/pedestrians as to secure their safe operation.

12.1.4. Adequate signalling or other control arrangements or devices should be provided to guard against danger from the movement of vehicles and earth-moving or materials-handling equipment. Special safety precautions should be taken for vehicles and equipment when manoeuvring backwards.

12.1.5. The assistance of a trained and authorized signaller should be available when the view of the driver or operator is restricted. The signalling code should be understood by all involved.

12.1.6. Earth-moving or materials-handling equipment should not be operated in dangerous proximity to live electrical conductors. When practicable, adequate precautions should be taken, such as isolating the electrical supply or erecting ground-level and overhead barriers warning of the presence of live electrical conductors.

12.1.7. Preventive measures should be taken to avoid the fall of vehicles and earth-moving or materials-handling equipment into excavations, water, or tipping or dumping locations.

12.1.8. Vehicles and earth-moving or materials-handling equipment should not travel on bridges, viaducts, embankments, etc., unless it has been established that it is safe to do so.

12.1.9. Based on a risk assessment of the mobile equipment's characteristics and intended use and in accordance with national laws, regulations and applicable standards, it should be equipped with appropriate falling object protective structures (FOPS) and roll over protective structures and devices (for example lap belt/restraint) to protect an operator from falling objects and being crushed should the equipment roll over.

12.1.10. All vehicles and earth-moving or materials-handling equipment should be provided with a plate or the like indicating:

- (a) the nominal power, expressed in kW;
- (b) the weight of the machinery in its most usual configuration, expressed in kg; and
- (c) where appropriate:
 - (i) the maximum drawbar pull provided for at the coupling hook, in newtons (N); and
 - (ii) the maximum vertical load provided for on the coupling hook, in newtons (N).

12.1.11. In addition to the provisions contained in paragraph 12.1.9, without prejudice to the provisions of road traffic regulations, machinery with a ride-on driver, including all vehicles and earth-moving or materials-handling equipment, should be equipped, where practicable, with:

- (a) an electrically operated acoustic signalling device;
- (b) searchlights for forward and backward movement;
- (c) parking and service brakes and systems for safe steering, including in the event of power failure;
- (d) tail lights;
- (e) silencers;
- (f) a reversing alarm and where necessary reversing cameras;
- (g) direction indicators and a rear-view mirror on both sides;
- (h) fire extinguishers of an appropriate type and capacity; and
- (i) where needed, an effective and fit-for-purpose proximity detection system.

12.1.12. In addition to the provisions contained in paragraph 12.1.9, consideration should be given to protecting operators from other hazardous situations that may be present when driving vehicles and earth-moving or materials-handling equipment by providing a vehicle or equipment with a cab which:

- (a) is designed and constructed in accordance with ergonomic principles and provides full protection from adverse weather conditions;
- (b) is fully enclosed where dusty conditions are likely to be encountered; and
- (c) provides the driver with a clear and unrestricted view of the machinery and area of operation.

12.1.13. The cab of vehicles and earth-moving or materials-handling equipment should be kept at least 1 m from a face being excavated and should be equipped with appropriate FOPS.

12.1.14. When power shovels/excavators are being moved out of service, the boom should be in the direction of travel and the scoop or bucket should be raised and without load. When

travelling downhill, the driven axle for tracked excavators should always be positioned at the downhill end.

12.1.15. On transport, earth-moving and materials-handling equipment, motors, brakes, steering gear, chassis, blades, blade-holders, tracks, wire ropes, sheaves, hydraulic mechanisms, transmissions, bolts and other parts on which safety depends should be inspected daily.

12.1.16. Transport, earth-moving or materials-handling equipment should not be left unattended on a slope with the engine running.

12.1.17. Deck plates and steps of vehicles and equipment should be kept free from oil, grease, mud or other slippery substances.

12.1.18. Dredge-type excavators should not be used on earth walls more than 1 m higher than the reach of the excavator if they are installed at the bottom of the wall.

12.1.19. Bucket excavators should be used at the top or bottom of earth walls with a slope of repose based on adequate assessment of soil type and ground conditions.

12.1.20. Where the regular transport of persons is required, buses or other specially fitted vehicles should be used, equipped with seating, seatbelts and safe means of entry and exit.

12.1.21. All vehicle drivers should ensure all plant moving downhill is always, while in motion, kept in gear.

12.2. Power shovels, excavators

12.2.1. If necessary to prevent danger during inspection or repair, the jib of power shovels should be equipped with a ladder protected by a guard rail and toe board.

12.2.2. Brake pedals for all motions on power shovels should have two independent locking devices.

12.2.3. Power shovels should be equipped with an emergency quick-acting stop device independent of the controls.

12.2.4. Excavators that are equipped with a unit for deep digging should either be so designed that the bucket teeth cannot come nearer the boom than 40 cm or be provided with a reliable stop that prevents this from happening.

12.2.5. Excavators that are designed to be used for lifting with lifting gear should be provided with a plate in the cabin and on the boom bearing a clearly legible and durable text giving the maximum safe working load of the lifting gear fitted.

12.2.6. Excavators that are equipped for use as mobile cranes should be:

- (a) examined and tested in accordance with national laws and regulations for mobile cranes; and
- (b) fitted with an automatic safe working load indicator, when practicable.

Electric shovels

12.2.7 The connection or disconnection of the electric cable supplying power from the transmission line to or from the electric shovel should only be done by competent persons duly authorized.

12.2.8. Electrical connectors and relays on the shovel should be inspected daily if in operation.

12.2.9. Electrically powered equipment should be disconnected before mechanical work is done on such equipment. Power switches should be locked out or other measures taken to prevent the equipment being connected again without the knowledge of the persons working on it. Such locks or protective devices should not be removed except by the person who installed them.

12.2.10. In case of an unforeseen interruption of the electric power supply, the operator should immediately return all starters and control levers to the “stop” or “zero” positions.

Operation of power shovels

12.2.11. The boom should be prevented from accidentally swinging during operation or transport.

12.2.12. The bucket or grab of a power shovel should be prevented from accidentally dipping, tipping or swinging in operation.

12.2.13. Before leaving the shovel, the operator should:

- (a) disengage the master clutch; and
- (b) lower the bucket or grab to the ground.

12.2.14. Buckets and grabs of power shovels should be propped to restrict movement while they are being repaired or teeth are being changed.

12.2.15. When an excavator is at work near a wall or similar construction, persons should be prevented from entering the zone in which they may be struck or crushed when the machine rotates.

12.2.16. Trucks should not be loaded in any place where there may be danger from materials such as rocks falling from buckets passing overhead; where this cannot be avoided, no person should remain in the cab during loading.

12.2.17. Trucks should be stationed at such a distance from the excavator that there is a clearance of at least 60 cm between the truck and the superstructure of the excavator even when it turns.

12.2.18. While work is being done on hydraulically operated buckets, where possible the piston should be fully drawn back in the hydraulic cylinder and where necessary props provided.

12.3. Bulldozers

12.3.1. When operating a tractor-type bulldozer, it should be prohibited to:

- (a) stand on the blade frame or on the blade;
- (b) operate a machine that is not fitted with an interlocking device to prevent the engine from starting when it is in gear; or
- (c) operate a machine that is not fitted with a device which requires the engine to be started from within the cab.

12.3.2. Before leaving a bulldozer the operator should:

- (a) apply the brakes;
- (b) lower the blade and ripper; and
- (c) put the shift lever in neutral.

- 12.3.3. At the close of work bulldozers should be left on level ground.
- 12.3.4. When a bulldozer is moving uphill the blade should be kept low.
- 12.3.5. Bulldozer blades should not be used as brakes except in an emergency.

12.4. Scrapers

- 12.4.1. The tractor and scrapers should be joined by a safety line when in operation.
- 12.4.2. Scraper bowls and apron should be blocked before performing any work on the cutting edges.

12.5. Mobile asphalt layers and finishers

- 12.5.1. Wooden floors in front of the sprayers should be covered with corrugated sheet metal.
- 12.5.2. The mixer elevator should be within a wooden or sheet-metal enclosure which should have a window for observation, lubrication and maintenance.
- 12.5.3. Bitumen scoops should have adequate covers.
- 12.5.4. The sprayer should be provided with a fire-resisting shield with an observation window.
- 12.5.5. To avoid fire risks due to foaming:
 - (a) boilers should have a device that prevents foam from reaching the burners; or
 - (b) only non-foaming products should be used.
- 12.5.6. When asphalt plants are working on public roads, an adequate traffic control system should be established. Control systems include but are not limited to barriers, road signs, delineators, safety cones, pylons, pavement markings, flashing lights and flagmen and reflective clothing provided for the workers.
- 12.5.7. A sufficient number of fire extinguishers appropriate to the materials to be extinguished should be kept in readiness on the worksite, including at least two on the spreader.
- 12.5.8. Material should only be loaded on to the elevator after the drying drum has warmed up.
- 12.5.9. No naked flame should be used for ascertaining the level of asphalt in the tank.
- 12.5.10. Thinners (cut-backs) should not be heated over an open flame.
- 12.5.11. If a burner flame is extinguished:
 - (a) the fuel supply should be cut off; and
 - (b) the heating tube should be thoroughly blown out by the fan so as to prevent a backfire.
- 12.5.12. Inspection openings should not be opened while there is any pressure in the boiler.

12.6. Pavers

- 12.6.1. Pavers should be equipped with guards that prevent workers from walking under the skip.

12.6.2. Workers should not step in front of the paver or between the haul truck and the paver unless operations are halted, brakes are engaged and a banksperson/signaller is assigned to watch out for the safety of the workers.

12.7. Road rollers

12.7.1. Before a road roller is used the ground should be examined for bearing capacity and general safety, especially at the edges of slopes such as embankments.

12.7.2. When a roller is not in use:

- (a) the brakes should be applied;
- (b) the engine should be put into bottom gear if the roller is facing uphill;
- (c) the engine should be put into reverse if the roller is facing downhill;
- (d) the contact should be switched off; and
- (e) the wheels should be blocked.

► 13. Plant, machinery, equipment and hand tools

13.1. General provisions

13.1.1. Plant, machinery and equipment, including hand tools, both manual and power-driven, should be:

- (a) of good design and construction, taking into account, as far as possible, health and safety and ergonomic principles;
- (b) maintained and stored in an efficient state, in good working order and in good repair;
- (c) used only for work for which they have been designed and in line with the manufacturer's instructions, unless a use outside the initial design purpose has been assessed by a competent person who has concluded that such use is safe;
- (d) operated only by workers who have been authorized and given appropriate training;
- (e) provided with protective guards, shields, or other devices as required by national laws or regulations; and
- (f) inspected before each use.

13.1.2. Adequate instructions for safe use and maintenance should be provided where appropriate by the manufacturer and the employer, in a form understood by the user.

13.1.3. As far as practicable, safe operating procedures should be established and used for all plant, machinery and equipment.

13.1.4. Operators of plant, machinery and equipment should not be distracted while work is in progress.

13.1.5. Plant, machinery and equipment should be switched off when not in use and isolated before any adjustment, cleaning or maintenance is done. As part of the formal risk management system, specific procedures for isolation from all energy sources should be identified and implemented, including through preparation for shutdown, lockout and tag-out and verification of isolation, as well as, when required, a permit to work.

13.1.6. In order to reduce risks where trailing cables, air lines or hose pipes are used, they should be kept as short as practicable and should be covered or aerially routed.

13.1.7. All dangerous moving parts of machinery and equipment should be enclosed or adequately guarded in accordance with national laws and regulations. Employers and workers must ensure guards are operative at all times.

13.1.8. Every power-driven machine and equipment should be provided with an emergency stop, immediately accessible and readily identifiable to the operator. It should stop the machine quickly and prevent it from being started again inadvertently.

13.1.9. The machines or equipment should be so designed or fitted with a device that the maximum safe speed, which should be indicated on it, is not exceeded. If the speed of the machine is variable, it should only be possible to start it at the lowest speed appropriate.

13.1.10. When risks remain after the control measures described in Chapter 3 of this code have been applied, operators of plant, machinery, equipment and tools should be provided with PPE to reduce the residual risk.

13.2. Hand tools

13.2.1. Hand tools and implements should be tempered, dressed and repaired by competent persons. Heads of hammers and other shock tools should be dressed or ground to a suitable radius on the edge as soon as they begin to mushroom or crack. The cutting edges of cutting tools should be kept sharp.

13.2.2. When not in use, and while being carried or transported, sharp tools should be kept in sheaths, shields, chests or other suitable containers.

13.2.3. Only insulated or non-conducting tools should be used on or near live electrical installations if there is any risk of electrical shock.

13.2.4. Only non-sparking tools should be used near or in the presence of flammable or explosive dusts or vapours.

13.3. Pneumatic tools

13.3.1. Operating triggers on portable pneumatic tools should be:

- (a) so placed as to minimize the risk of accidental starting of the machine; and
- (b) so arranged as to close the air inlet valve automatically when the pressure of the operator's hand is removed.

13.3.2. Hose and hose connections for compressed-air supply to portable pneumatic tools should be:

- (a) designed for the pressure and service for which they are intended and so that they cannot be released while under pressure; and
- (b) fastened securely to the pipe outlet and equipped with a safety chain to reduce risks if unintended decoupling occurs.

13.3.3. Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel. When removal is required, such as when equipment is not in use, this should be done by hand.

13.3.4. Pneumatic tools should be disconnected from power and the pressure in hose lines released before any adjustments or repairs are made.

13.3.5. Portable pneumatic tools should not be hoisted or lowered by the air line.

13.3.6. Compressed air should not be used for cleaning clothing or parts of the body or be directed at the body.

13.3.7. Reservoirs used to feed pneumatic tools should be checked according to applicable laws, regulations and the manufacturer's maintenance schedule.

13.3.8. A safety valve should be installed in accordance with established national standards.

13.4. Hydraulic tools

13.4.1. Hydraulic tools should be stored in dry conditions and the hoses should be kept in hanging position.

13.4.2. The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed.

13.4.3. The safe operating pressure recommended by the manufacturer for hoses, valves, pipes, filters and other fittings must not be exceeded.

13.4.4. Hydraulic tools should be inspected and maintained on a regular basis by a competent person and complete records kept. The status of inspection should be marked on the tool for the information of users.

13.4.5. The maintenance of hydraulic tools should be based on the work cycles of the equipment, in accordance with the instructions of the manufacturer.

13.5. Cartridge-operated tools

13.5.1. Whenever practicable, a low-velocity tool should be used.

13.5.2. When using cartridge-operated tools, a warning sign should be displayed in the working area.

13.5.3. Cartridge-operated tools should have:

- (a) a guard or protective shield that cannot be removed without rendering the tool inoperative;
- (b) a device that prevents the tool from firing inadvertently, for example if it is dropped or while it is being loaded;
- (c) a device that prevents the tool from firing if it is not approximately perpendicular to the working surface; and
- (d) a device that prevents the tool from firing if the muzzle is not pressed against the working surface.

13.5.4. The recoil of a cartridge-operated tool should not be capable of injuring the user.

13.5.5. The noise of the detonation should not be such as to damage hearing.

13.5.6. A cartridge-operated tool, before each occasion of use, should be inspected to ensure that it is safe to use, and in particular, that:

- (a) the safety devices are in proper working order;
- (b) the tool is clean;
- (c) all moving parts work easily; and
- (d) the barrel is unobstructed.

13.5.7. At intervals recommended by the manufacturer, the tool should be completely dismantled and inspected for wear on the safety devices by a competent person.

13.5.8. Cartridge-operated tools should only be repaired by the manufacturer or by competent persons.

13.5.9. Cartridges should not be stored nor cartridge tools operated:

- (a) in a place or environment where these could explode accidentally; or
- (b) in an explosive atmosphere.

13.5.10. When not required for use, inspection or other purpose, cartridge-operated tools should be stored unloaded in a suitable container that:

- (a) is made of suitable material;
- (b) is clearly marked to indicate its contents;
- (c) is kept locked when not in use; and
- (d) contains nothing except the tools and cartridges. The employer should keep a registry of the cartridges.

13.5.11. No cartridge-operated tool should be transported loaded, or left loaded when not in use.

13.6. Power tools

13.6.1. Risk assessments should determine whether battery-operated tools should be used in preference to cord-operated tools. Battery-operated tools reduce the risk of electric shock and also remove the need for trailing cables and this further reduces tripping hazards.

13.6.2. Risk of electric shock from portable electrical equipment should be reduced by either using cordless (battery-powered) tools or operate from a centre taped to earth (CTE) supply so that the maximum voltage does not exceed 55V. All corded tools should be earthed/grounded as per the manufacturer's specifications, unless they are "all insulated" or "double insulated" tools which do not require an earth. Earthing should be incorporated in metallic cases, and as a safeguard where wires enter the tool.

13.7. Woodworking machines

13.7.1. Shavings, sawdust, etc., should not be removed by hand from woodworking machines or in their vicinity while the machines are working.

13.7.2. Where necessary to guard against risks to health, chip and sawdust extraction systems should be provided and maintained in efficient working order.

13.7.3. Machinery should, wherever possible, be equipped with mechanical feeding devices, which should be appropriately guarded and used whenever practicable. Push sticks are an additional device used to keep hands away from the blade.

13.7.4. All cutters and saw blades should be enclosed as far as practicable and where possible, machines should be equipped with a braking device that stops the tool in a sufficiently short time to reduce the risk of contacting the cutters during rundown.

13.7.5. Circular saws should be provided with strong, rigid and easily adjustable hood guards for the saw blades and with riving knives of suitable design matched to the saw blade in use. The width of the opening in the table for the saw blade should be as small as practicable. Machines should be fully enclosed beneath the table.

13.7.6. Portable circular saws should be equipped with guards above and below the base plate or shoe, dimensioned in accordance with national laws or regulations and so designed that when the blade is running idle it is automatically covered.

13.7.7. On band saws all the blade, except the operating portion, should be enclosed. Band wheels should be enclosed with stout guards.

13.7.8. Band saws should be provided with automatic tension regulators.

13.7.9. Planing machines should be provided with bridge guards covering the full length and breadth of the cutting block and easily adjustable in both horizontal and vertical directions.

13.7.10. Thicknessing machines should be provided with sectional feed rollers or a kickback preventer which should be kept as free as possible.

13.7.11. Vertical spindle moulding machines, cutters and the spindle, when in operation, should be guarded as far as is reasonable practicable, and the gap between spindle and table should be kept to a minimum. Backcutting or climbcutting should be discouraged, wherever possible.

13.7.12. Woodworking machines should be properly spaced to avoid accidental injury when handling large boards or long planks.

13.8. Engines

13.8.1. Engines should:

- (a) be constructed and installed so that they can be started safely and the maximum safe speed cannot be exceeded; and
- (b) have remote controls for limiting speed when necessary.

13.8.2. Internal combustion engines should not be operated in confined spaces unless adequate exhaust ventilation is provided.

13.8.3. When internal combustion engines are being fuelled:

- (a) the engine ignition should be shut off and the engine and components allowed to cool;
- (b) care should be taken to avoid spilling fuel;
- (c) all ignition sources should be banned from the area (for example smoking, mobile phones, etc.); and
- (d) a fire extinguisher should be kept readily available.

13.8.4. Secondary fuel reservoirs should be placed outside the engine room. Fuel should be stored in approved containers and protected against impact by moving vehicles or other equipment and measures taken to contain and attend to spillages and leaks. Fire extinguishers should be located near fuel-storage areas and appropriate spill-response equipment should be available at the construction site.

13.9. Silos

13.9.1. Silos should:

- (a) be erected on adequate foundations; and
- (b) withstand the stresses to which they are subjected without any deformation of walls, floors and other load-bearing parts.

13.9.2. All places in silos to which workers have to go should be provided with safe means of access such as stairs, fixed ladders or hoists and the provisions in Chapter 6 of this code should be followed, when applicable.

13.9.3. Facilities should be provided to assess the quantity of material in the silo without entering the silo.

13.9.4. On silos, notices should be conspicuously displayed:

- (a) containing details of the requirements for entry; and
- (b) calling attention to any danger, such as the risk of sinking in fine materials or presence of explosive mixtures of gases or dusts.

13.9.5. If the material in the silo is liable to cause a blockage, agitators, compressed air or other mechanical devices should be preferably provided. To clear blockages, equipment such as poles, long-handled tools, rammers or scraper chains should also be available for emergency use.

13.9.6. Silos for material liable to spontaneous combustion should be provided with fire-extinguishing equipment.

13.9.7. In silos in which explosive mixtures of gases or dusts are liable to form:

- (a) all electrical equipment including hand lamps should be constructed to a suitable explosion-protected equipment standard;
- (b) only non-sparking tools should be used; and
- (c) explosion vents should be provided in the walls.

13.9.8. Entrances of silos should be kept closed and locked.

13.9.9. Workers should not enter a silo unless:

- (a) the discharge opening is closed and secured against opening and filling is stopped;
- (b) they are duly authorized to do so;
- (c) they wear safety harnesses with lifelines securely attached to a fixed object;
- (d) another authorized person provides constant surveillance and is in attendance with suitable rescue equipment; and
- (e) the other provisions contained in section 9.7 of this code are followed.

13.10. Concrete work equipment

13.10.1. Concrete mixers should be protected by side railings to prevent workers from passing under the skip while it is raised.

13.10.2. Hoppers into which a person could fall, and revolving blades of trough or batch-type mixers, should be adequately guarded by grating and/or guard rails, as required.

13.10.3. In addition to the operating brake, skips of concrete mixers should be provided with a device or devices by which they can be securely blocked when raised. Concrete buckets should be equipped with devices that prevent premature or accidental dumping.

13.10.4. While the drum of a concrete mixer is being cleaned, adequate precautions should be taken to protect the workers inside by locking switches open, removing fuses or otherwise cutting off the power. If applicable, the precautions contained in section 9.7 of this code should be followed.

13.10.5. Concrete buckets for use with cranes and aerial cableways should be suspended by safety hooks and free as far as practicable from projections from which accumulations of concrete could fall.

13.10.6. Loaded concrete buckets should be guided into position by tag lines or other appropriate means.

13.10.7. When concrete is being tipped from buckets, workers should keep out of range of any kickback due to concrete sticking to the bucket.

13.10.8. Concrete bucket towers and masts with pouring gutters or conveyor belts should:

- (a) be erected by competent persons; and
- (b) be inspected daily.

13.10.9. The winch for hoisting the bucket should be so placed that the operator can see the filling, hoisting, emptying and lowering of the bucket. Where this is not practicable, a banksman/signaller should direct the operator.

13.10.10. Guides for the bucket should be correctly aligned and so maintained as to prevent the bucket from jamming in the tower.

13.10.11. Scaffolding carrying a pipe for pumped concrete should be designed to accommodate the increased loading, thereby supporting the pipe when filled and all the workers who may be on the scaffold at the same time, and encompassing an appropriate safety factor.

13.10.12. Pipes for carrying pumped concrete should be:

- (a) securely anchored at the ends and at curves and at suitable intervals;
- (b) provided near the top with air release valves; and
- (c) securely attached to the pump nozzle by a bolted collar or equivalent means.

13.11. Pressure plant

13.11.1. Pressure plant and equipment should be examined, tested and issued with a certificate of conformity by a competent person in cases and at times prescribed by national laws or regulations.

13.11.2. National laws or regulations should be laid down and enforced as regards the materials, design, construction, installation, inspection, testing, maintenance and operation of steam boilers and other pressure systems as necessary.

13.11.3. Only competent persons should operate boilers. They should be trained, tested and certified.

13.11.4. Compressors should be equipped with:

- (a) automatic devices that will prevent the maximum safe discharge pressure from being exceeded;
- (b) a quick-release valve; and
- (c) suitable arrangements for preventing contamination where persons are working in confined spaces.

13.11.5. Compressors in which explosive mixtures of gas may form should be protected against ignition sources.

13.11.6. Where compressor cylinders are equipped with water-cooling jackets it should be possible to observe the water flow.

13.11.7. Intercoolers and aftercoolers should be able to withstand safely the maximum pressure in the air-discharge piping and if they are cooled by air, should be located so that the air flow over their surfaces is not obstructed.

13.11.8. Where necessary to prevent danger, air-discharge piping of compressors should be provided with:

- (a) a fusible plug; and
- (b) insulating covers to protect workers against burns, and to prevent fire risks.

13.11.9. Where necessary to prevent danger, an oil separator should be provided between the compressor and the air receiver.

13.11.10. Where stop valves are installed in air-discharge piping:

- (a) they should be easily accessible for inspection and cleaning; and
- (b) one or more safety valves should be installed between the compressor or air receiver, and the stop valve.

13.11.11. Air receivers should be equipped with:

- (a) at least one safety valve;
- (b) a pressure gauge; and
- (c) a drain cock.

13.11.12. Air receivers should be easily accessible and provided with suitable openings for inspection and cleaning.

13.11.13. Air receivers should be examined and tested at appropriate intervals by a competent person.

13.11.14. The safe working pressure should be clearly marked on the pressure gauge.

13.11.15. Where necessary to prevent danger, a pressure-reducing valve and a stop valve should be inserted in the piping between the air receiver and the compressor.

13.11.16. Between the receiver and each consuming appliance there should be a stop valve.

13.11.17. Cylinders for compressed, dissolved or liquefied gases should be properly constructed with sound material, fitted with appropriate safety devices in accordance with national laws or regulations, inspected and tested by a competent person as prescribed and stored, transported, handled and used in conformity with the prescribed safety measures.

13.12. Conveyors

13.12.1. Conveyors should be so constructed, installed and operated to ensure that all dangerous parts where there is a risk to workers are securely guarded.

13.12.2. When conveyors that are not entirely enclosed at cross over places where workers are employed or pass beneath, sheet or screen guards should be provided to catch any falling material. Adequate fencing should be provided at transfer points.

13.12.3. Power-driven conveyors should be provided at loading and unloading stations, at drive and take-up ends, and at other convenient places, if necessary to prevent danger, with emergency-stopping devices that are easily accessible for workers and equipped with an audible warning signal to be sounded immediately before starting up the conveyor.

13.12.4. Where two or more conveyors are operated together, the controlling devices should be so arranged that no conveyor can feed on to a stopped conveyor.

13.12.5. Screw conveyors, when operating, should be enclosed at all times. Any covers should not be removed until the conveyor has been isolated from the power source.

13.12.6. When a conveyor is discharging into a bunker or hopper, the feeding conveyor should be equipped with an overload switch.

13.13. Crusher plants

13.13.1. Crusher plants should be located at a safe distance from the construction work area and should have appropriate risk control measures in place to reduce the risk of injury to workers and ill health to workers and the public resulting from exposure to dust, sand, gravel, noise and vibrations.

13.13.2. Crusher plants should be provided with an overriding power isolation switch next to the crusher unit and visible from it and the provisions contained in paragraph 13.1.5 of this code should be followed, to prevent starting the plant inadvertently during repair or maintenance.

13.13.3. Electrical motors, switches, connections and all instrumentation should be dust and moisture proof.

13.13.4. Equipment, plant and machinery should be cleared daily of dust and sand.

13.13.5. To reduce the possible redistribution of dust, access roads to the crusher hopper and screens should be cleaned by water spraying or other effective means.

13.13.6. Power cables should be laid out either underground, or at safe elevation, properly covered or otherwise protected, and marked with bright colour indicators to avoid damage resulting from poor visibility.

13.13.7. Earth-moving equipment working at a crusher plant should be cleaned and maintained after each work shift.

13.13.8. Operators of crushing machines should be provided with a ventilated booth that provides fresh, climate-controlled air or a remote-control station to reduce the risk of exposure to dust.

13.14. Power generators

13.14.1. Power generators should comply with national laws and regulations to ensure safe and reliable operation.

13.14.2. Power generators should be rated to meet the maximum anticipated load.

13.14.3. Power generators should be located in properly ventilated areas and where necessary covered areas.

13.14.4. Power generators should be provided with an overriding power switch and the provisions contained in paragraph 13.1.5 of this code should be followed to avoid accidental remote starting during maintenance.

13.14.5. Power generators should be provided with adequate silencers to reduce noise and exhaust piping to safely disperse exhaust gases.

13.14.6. When located near workers' accommodation or other occupied spaces, power generators should be housed in a concrete room or properly insulated area in accordance with national laws and regulations to minimize noise disturbance.

► 14. Work at heights including roof work

14.1. General provisions

14.1.1. The competent authority should establish regulations, specifying requirements for fall prevention or work at height. This should include:

- (a) the requirements for preventing falls from height;
- (b) the certification, inspection, testing and use of fall-prevention and fall-protection equipment; and
- (c) the required controls to prevent falling objects striking a person.

14.1.2. The employer should perform a risk assessment to identify and assess tasks that involve a risk of a person falling from height. Based on the risk assessment, a site-specific fall-prevention programme should be developed. The programme should at a minimum include:

- (a) written procedures for working at heights;
- (b) information, instruction and training for working safely at height;
- (c) a process for preparing, testing and implementing emergency rescue procedures for fall scenarios; and
- (d) the certification, provision, use, training, care, inspection, testing and maintenance of fall-prevention and fall-protection equipment.

14.1.3. The employer should also perform a risk assessment to identify and assess the situations, tasks or equipment where there could be an unplanned release from height of any object, equipment, component or material, among other things. Particular attention should be paid to work, either routine or non-routine, where persons are working above other persons. Based on the assessment, the employer should develop control strategies for the prevention of falling objects or protecting persons from the risk of falling objects.

14.1.4. During the planning of any work at height, the employer should determine whether the task could be done more safely in a different way. If this is not the case, there should be processes in place to assess the work and minimize the need for working at any height, including bringing components to ground level to perform maintenance, among other things.

14.1.5. In any case, where there is a risk of falling, greater than the height specified by national regulations, either fall-prevention or fall-protection equipment or systems should be used.

14.1.6. Where necessary to guard against danger, or where the height of a structure or its slope exceeds that prescribed by national laws or regulations, preventive measures should be taken against the fall of workers and tools or other objects or materials. The provisions under section 8.4 of this code should be considered.

14.1.7. Elevated workplaces, where the height exceeds that prescribed by national laws or regulations, including roofs from which a person is liable to fall, should be protected on all open sides by upper and intermediate guard rails and toe boards complying with the relevant national laws and regulations.

14.1.8. Where elimination of the fall risk through barricades or protective covers is not possible, there should be a process to reduce the risk of falling by using fall-prevention measures that include:

- (a) fixed and temporary work platforms, access ways, barriers, and so forth, including scaffolding, among other things; and
- (b) fall restraint, which should only be used when elimination of the fall risk, the use of work platforms or hard barricading cannot be used. Fall restraint should prevent a person reaching a position at which there is a risk of a fall and should consist of a harness, connected by a lanyard to an anchorage point or static line.

14.1.9. Fall-prevention measures should be designed, installed, stored, maintained and certified in accordance with national laws and by competent, authorized persons. There should be processes and procedures for the inspection, maintenance, testing and certification of these.

14.1.10. Wherever practical, a safe working area should be provided by means of work platforms or scaffolds that have complete floors, guard rails, toe boards, and safe access and egress.

14.1.11. Where mobile work platforms are used for fall prevention, there should be a process for ensuring these are compliant with national laws and regulations or nationally and internationally recognized instruments and that they are inspected to manufacturers' preoperational check requirements prior to use. When operating a mobile work platform:

- (a) a competent and authorized person should be designated to control the mobile work platform and that person should be inside the basket; and
- (b) every person in the mobile work platform basket should be attached to an approved anchorage point which is fixed to the basket at all times, according to the manufacturer's instructions.

14.1.12. Where the above fall-prevention strategies cannot be used, fall-protection or fall-arrest systems such as safety nets should be used. Individual fall-arrest systems should only be used where a person:

- (a) can reach a position where a fall is possible;
- (b) has a lanyard, adjustable in length, so the unprotected edge can be reached; and
- (c) is working on a surface that may not hold their weight.

14.1.13. The fall-arrest system should be selected in accordance with the worker's height and weight and consist of:

- (a) an approved body harness;
- (b) a shock-absorbing lanyard, where the potential to fall is greater than 2 m taking into consideration the swing fall hazard;
- (c) double or triple-action snap hooks (or karabiner type rings); and
- (d) secure anchorage points or static lines.

14.1.14. There should be a process for ensuring that arrest equipment, including harnesses, shock-absorbing lanyards, hooks or rings are tested and certified for use; inspected by the user before use; and destroyed after a fall (except for self-retracting equipment) or where inspection shows evidence of excessive wear or mechanical malfunction.

14.1.15. Life vests and life preservers should be worn where there is a danger of falling into water. Workers should be provided with and trained in the use of appropriate fall-protection equipment (see Chapter 19).

14.1.16. Appropriate and timely rescue should be provided when using fall-arrest equipment to prevent suspension trauma.

14.1.17. Permanent anchorage points should be designed and rated to take the required load in the event of a fall and be periodically inspected by a competent person. Temporary anchorage points must be assessed by a competent person prior to use to ensure they can support the required load.

14.1.18. Where overhead work is being conducted, barricading should be erected around the work area to prevent people accessing the drop zone and there should be controls in place to prevent tools, equipment or other objects from falling.

14.1.19. Waste materials or objects should not be thrown down from heights. If material and objects cannot be safely lowered from heights, adequate precautions should be taken, such as the provision of fencing or barriers.

14.1.20. Physical safeguards such as toe boards and brickguards should be installed to prevent materials from falling. Loose articles should not be left lying about in places where they could fall on persons underneath. Materials should never be stacked near edges, particularly unprotected edges.

14.1.21. Workers employed at elevated workplaces should be provided with tool belts and containers for screws, bolts, nuts and the like.

14.1.22. There should be training and competency assessment in accordance with national laws and regulations or other nationally and internationally recognized instruments so that relevant persons are trained and deemed competent to:

- (a) work at heights;
- (b) issue working at heights permits;
- (c) design, erect, dismantle, maintain and inspect work platforms and scaffolds;
- (d) design, install, inspect and maintain anchorage points and static lines;
- (e) operate and maintain mobile work platforms;
- (f) inspect and maintain scaffolding and working at heights equipment; and
- (g) use appropriate fall-protection equipment, such as harnesses and lifelines.

14.2. Roof work

14.2.1. All roof-work operations should be pre-planned and properly supervised.

14.2.2. Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.

14.2.3. Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.

14.2.4. Roofing brackets should fit the slope of the roof and be securely supported.

14.2.5. In accordance with national laws and regulations, all work on sloping roofs requires edge protection including top and intermediate guard rails and a toe board or a system providing equivalent or greater protection. If these requirements are not possible to fulfil, a PFAS should be worn, used and properly tied.

14.2.6. On a large flat roof where work does not have to be carried out at or near the edge, a barrier consisting of crossed scaffold tubes supporting a tubing guard rail may be provided where appropriate. Such barriers should be positioned at least 2 m from the edge.

14.2.7. All covers for openings in roofs should be of substantial construction and be secured in position.

14.2.8. Roofs with a pitch of more than 10 degrees should be treated as sloping or as in accordance with national laws and regulations.

14.2.9. When work is being carried out on sloping roofs, sufficient and suitable crawling boards or roof ladders or other measures should be provided.

14.2.10. During extensive work on the roof, suitable edge-protection systems should be provided to stop a person from falling off the roof.

14.2.11. Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, they should be provided with sufficient suitable roof ladders or crawling boards strong enough, when spanning across the supports for the roof covering, to support those workers.

14.2.12. A minimum of two crawling boards should be provided so that it is not necessary for a person to stand on a fragile roof to move a board or a ladder, or for any other reason. The crawling boards should span at least three purlins to be sufficiently close together to prevent danger.

14.2.13. Where a valley or parapet gutter of a fragile roof is used for access, protection against falling through the fragile material should be provided by covering the adjacent fragile material to a minimum distance of 1 m up the roof.

14.2.14. Buildings with fragile roofs should have a warning notice prominently displayed at the approaches to the roof.

14.3. Work on tall chimneys

14.3.1. For the erection and repair of tall chimneys, appropriate scaffolding should be provided. An adequate debris net/catch platform should be maintained at a suitable distance below the scaffold.

14.3.2. The scaffold floor should always be at least 95 cm below the top of the chimney or an appropriate height as prescribed by national laws and regulations.

14.3.3. Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.

14.3.4. The distance between the inside edge of the scaffold and the wall of the chimney should not exceed 20 cm at any point.

14.3.5. Catch platforms should be erected over:

- (a) the entrance to the chimney; and
- (b) passageways and working places where workers could be endangered by falling objects.

14.3.6. For climbing tall chimneys, access should be provided by:

- (a) stairs or ladders;

- (b) a column of iron rungs securely embedded in the chimney wall; and
- (c) other appropriate means.

14.3.7. When workers use the outside rungs to climb the chimney, they should wear a PFAS.

14.3.8. While work is being done on independent chimneys the area surrounding the chimney should be enclosed by fencing at a safe distance to prevent people accessing the drop zone and there should be controls in place to prevent tools, equipment or other objects from falling.

14.3.9. Workers employed on the construction, alteration, maintenance or repair of tall chimneys should not:

- (a) work on the outside without a PFAS attached by a lifeline to secure anchorage;
- (b) put tools between the PFAS and the body or in pockets not intended for the purpose;
- (c) haul heavy materials or equipment up and down by hand to or from the workplace on the chimney;
- (d) fasten pulleys or scaffolding to reinforcing rings without first verifying their stability;
- (e) work alone;
- (f) climb a chimney that is not provided with securely anchored ladders or rungs; and
- (g) work on chimneys in use unless the necessary precautions to avoid danger from smoke, gases and other hazardous substances have been taken.

► 15. Excavations, shafts, earthworks, underground works and tunnels

15.1. General provisions

15.1.1. Adequate precautions should be taken in any excavation, shaft, earthworks, underground works or tunnel:

- (a) by suitable shoring, sloping, portable shields or other effective means, to guard against danger to workers from a fall or dislodgement of earth, rock or other material;
- (b) to guard against dangers arising from the fall of persons, materials or objects or the inrush of water into the excavation, shaft, earthworks, underground works or tunnel;
- (c) to secure adequate ventilation at every workplace so as to maintain an atmosphere fit for respiration and to limit any fumes, gases, vapours, dust or other impurities to levels which are not dangerous or injurious to health and are within limits laid down by national laws or regulations;
- (d) to enable the workers to reach safety in the event of fire, or an inrush of water or material;
- (e) to avoid risk to workers arising from possible underground dangers such as the circulation of fluids, oxygen deficiency or the presence of pockets of gas, by undertaking appropriate investigations to locate them;
- (f) to ensure safe means of access and egress by providing stairways, ladders, ramps, hoists or other appropriate methods; and
- (g) to ensure reliable and clear means of communication from, to and within the works even in the event of power failure.

15.1.2. Shoring or other support for any part of an excavation, shaft, earthworks, underground works or tunnel should not be erected, altered or dismantled except under the supervision of a competent person.

15.1.3. Every part of an excavation, shaft, earthworks, underground works and tunnel where persons are employed should be inspected by a competent person at times and in cases prescribed by national laws or regulations, and the results recorded.

15.1.4. Work should not commence therein until the inspection by the competent person as prescribed by national laws or regulations has been carried out and the part of the excavation, shaft, earthworks, underground works or tunnel has been found safe for work.

15.1.5. The employer shall maintain a check-in/check-out procedure that will ensure that above-ground personnel can determine an accurate count of the number of persons underground in the event of an emergency.

15.2. Excavations

15.2.1. Before digging begins on site, the employer should ensure that:

- (a) all excavation work is planned and the method of excavation and the type of support work required decided;
- (b) the stability of the ground is verified by a competent person;

- (c) a competent person checks that the excavation will not affect adjoining buildings, structures or roadways;
- (d) the position of all the public utilities such as underground sewers, gas pipes, water pipes and electrical conductors that may cause danger during work is verified;
- (e) if necessary to prevent danger, the gas, water, electrical and other public utilities are shut off or disconnected;
- (f) if underground pipes, cable conductors, etc., cannot be removed or disconnected, they are fenced, hung up and adequately marked or otherwise protected;
- (g) the position of bridges, temporary roads and spoil heaps is determined;
- (h) if necessary to prevent danger, land is cleared of trees, boulders and other obstructions;
- (i) the land to be excavated is not contaminated by hazardous chemicals or gases, or by any hazardous waste material such as asbestos; and
- (j) the land to be excavated does not contain unexploded ordnance.

15.2.2. Sides of excavations should be thoroughly inspected by a competent person:

- (a) daily, prior to each shift and after interruption in work of more than one day to ensure, for example, that props, wedges, etc., are tight and that no undue deflection or distortion in the support work is taking place;
- (b) after every blasting operation;
- (c) after an unexpected fall of ground;
- (d) after substantial damage to supports;
- (e) after a heavy rain, frost or snow; and
- (f) when boulder formations are encountered.

15.2.3. No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endanger any person unless precautions such as the provision of shoring or piling are taken to prevent the sides from collapsing.

15.2.4. Adequately anchored stop blocks and barriers should be provided to prevent vehicles being driven into the excavation. Heavy vehicles should not be allowed near the excavation unless the support work has been specially designed to permit it.

15.2.5. If an excavation is likely to affect the security of a structure on which persons are working, precautions should be taken to protect the structure from collapse.

15.3. Underground works

15.3.1. General provisions

15.3.1.1. Underground works should be carried on in accordance with plans approved by the competent authority when required by national laws and regulations. The plans should define excavation methods, rescue and evacuation methods in case of fire, flood and fall or dislodgement of earth or rock.

15.3.1.2. All occupied workplaces underground should be inspected at least once in every shift.

15.3.1.3. Places occupied by lone workers should be inspected at least twice in every shift.

15.3.1.4. All workers should be withdrawn from underground works if:

- (a) the ventilation fails; or
- (b) other imminent danger threatens.

15.3.1.5. In tunnels and other underground works where an explosive mixture such as methane and air may form, operations should be carried on in accordance with national laws and regulations applicable to gassy mines or coal mines.

15.3.1.6. Air should be tested to ascertain if it is hazardous and no one allowed entry until it is fit for breathing.

15.3.1.7. Escape routes should be properly indicated with signs visible in dim light.

15.3.2. Shaft sinking

15.3.2.1. Every shaft not sunk through solid rock should be cased, lined or otherwise made safe against collapse.

15.3.2.2. Shuttering or formwork for masonry or concrete lining of shafts should only be removed gradually as the masonry or concrete work progresses.

15.3.2.3. Workers employed on sinking shafts should be provided with staging, scaffolds or cradles/suspended scaffolds from which they can work safely following the provisions in Chapter 10 of this code.

15.3.2.4. A thorough inspection of the shaft should be made:

- (a) before a shift descends; and
- (b) after blasting.

15.3.2.5. All shafts over 30 m in depth should have an adequate head frame with the safe working load indicated, be strong enough to withstand safely the maximum load that it will have to carry and preferably be of open steelwork or concrete construction.

15.3.2.6. If head frames are of timber, they should be treated to make them fire-resistant.

15.3.2.7. Head frames should be earthed or otherwise adequately protected against lightning.

15.3.2.8. All landings in shafts should be provided with gates that effectively close the opening to a height of at least 2 m and as prescribed by national laws and regulations.

15.3.2.9. Shafts should be equipped with a signalling system that:

- (a) warns the hoisting engineer when a conveyance approaches the safe limit of travel;
- (b) is arranged so that the hoisting engineer can easily distinguish between signals received from different sources;
- (c) prevents unauthorized persons from giving signals; and
- (d) in shafts where the hoisting engineer has no direct visual contact with the signaller in the shaft bottom, has an automatic device in operation to prevent the conveyance being moved until the hoisting engineer has received a reply or replies to their signal.

15.3.2.10. Before tunnelling operations are begun from a shaft, two separate signalling or communications systems of different types should be installed.

15.3.2.11. The signal code should be posted in the hoisting machine room and at each landing.

15.3.2.12. Hoisting machines should be equipped:

- (a) with an adequate brake that will automatically stop and hold the conveyance if the hoisting power fails;
- (b) with a reliable depth indicator; and
- (c) other appliances as prescribed by national laws and regulations and as provided in section 11.2 of this code.

15.3.2.13. All hoisting machines should be inspected at least once a day by the hoisting engineer, and examined and tested as prescribed in paragraphs 11.1.12–11.1.14 of this code.

15.3.2.14. Shafts exceeding 30 m in depth should have an installation for conveying persons.

15.3.2.15. Cages or cars for conveying persons should be equipped with safety gear that automatically holds the cage or car when fully loaded if the suspension rope breaks or becomes slack.

15.3.2.16. There should be adequate means of blocking the cage or car at every landing.

15.3.2.17. Notices should be posted at conspicuous places at the hoisting installation stating:

- (a) the maximum speed for transporting persons in the shaft; and
- (b) the maximum number of persons and the safe working load that may be carried in each conveyance.

15.3.3. Ventilation

15.3.3.1. All underground workings should be traversed by a regular air current to keep them in a fit state for working and, in particular:

- (a) to avoid excessive rises in temperature;
- (b) to dilute harmful dusts, gases, vapours and fumes to safe concentrations; and
- (c) to prevent the oxygen content of the atmosphere from falling below 19.5 per cent or a level prescribed in national laws and regulations.

15.3.3.2. In all underground workings, it should be possible to reverse the air flow.

15.3.3.3. In tunnels where blasting is done:

- (a) an adequate supply of air should be taken to the face by mechanical ventilation;
- (b) after every blast the face should be cleared of harmful gases and dust as far as practicable by exhaust ventilation and tested; where necessary, the dust should be controlled with water sprays or fog guns; and
- (c) if necessary to remove the fumes, auxiliary ventilation should be provided.

15.3.3.4. Where adequate ventilation is not possible, workers should be provided with suitable breathing apparatus and training in its use.

15.3.4. Fire protection

15.3.4.1. No combustible structure, unless treated to be made fire-resistant, should be built or any flammable material stored within 30 m of a shaft, tunnel mouth, hoisting-engine house or ventilation-fan house.

15.3.4.2. As far as practicable, combustible materials and flammable liquids should not be stored underground.

15.3.4.3. Lubricating oils, grease and rope dressings underground should:

- (a) be kept in closed metal containers; and
- (b) be stored in a safe place away from shafts, hoists, explosives and timber.

15.3.4.4. Naked lights, smoking and other unprotected ignition sources should not be allowed underground.

15.3.4.5. Petrol engines should not be used underground except under conditions approved by the competent authority.

15.3.4.6. If welding or flame cutting is done underground:

- (a) timber supports and other combustible structures or materials should be protected by a fireproof screen;
- (b) suitable fire extinguishers should be kept readily available;
- (c) a constant watch should be kept for outbreaks of fire during work and for 30 minutes after work or for a period as determined by national laws and regulations; and
- (d) welding fumes should be removed by exhaust ventilation.

15.3.5. Electricity

15.3.5.1. Electrical installations in shafts and tunnels should comply with the relevant national laws or regulations.

15.3.5.2. Main switchgear for cutting off the supply of electricity from all underground installations should be:

- (a) installed on the surface;
- (b) accessible only to authorized persons; and
- (c) attended by a competent person authorized to operate it.

15.3.5.3. Where necessary suitable lightning arresters should be installed on the surface to protect the installation below ground from abnormal voltage due to atmospheric electricity.

15.3.5.4. The main cables supplying current to electric motors installed in the vicinity of shafts (such as those for underground fans or drainage pumps) should be duplicated if the stopping of these motors would cause danger.

15.3.5.5. Fixed lamps underground should be provided with a strong protective cover of glass or other transparent material or with a guard.

15.3.5.6. Whenever required by local conditions, all electrical equipment should be protected against exposure to dust, gases, water or other adverse environmental factors.

15.3.5.7. The voltage of hand lamps (portable lamps) used underground should not exceed extra-low safety voltage.

15.3.6. Underground lighting

15.3.6.1. All places where workers have to work or pass should be adequately lit.

15.3.6.2. In addition to the main lighting, there should be emergency lighting that functions long enough to enable the workers to reach the surface safely.

15.4. Drilling

15.4.1. When drilling is done in rock, loose rock should be scaled down to protect drillers against falls of ground; where this is not practicable, a protective canopy or overhead screen should be provided.

15.5. Transport, storage and handling of explosives

15.5.1. The transport, storage and handling of explosives should comply with the requirements of national laws and regulations and with the provisions contained in Chapter 22 of this code.

15.5.2. Explosives should not be conveyed in a shaft cage or bucket together with other materials.

15.5.3. Explosives and detonators should not be conveyed together in a shaft unless they are in a suitable powder car.

15.6. Blasting

15.6.1. The modes of blasting should be in accordance with national laws or regulations and with the provisions contained in Chapter 22 of this code.

15.6.2. No other electrical circuit or other conductors such as water lines should be installed on the same side of the tunnel as the blasting circuit.

15.6.3. Before any shot is fired, all electrical circuits other than the blasting circuit should be de-energized within an adequate distance from the firing point. Electric detonators should only be used where stray currents can be excluded.

15.6.4. Only suitable battery lamps should be used during loading shotholes.

15.6.5. After every blast, the sides, workface and roof should be inspected by a competent person before being cleared of loose rock.

15.7. Haulage

15.7.1. The haulage system should comply with the national laws and regulations.

15.7.2. Pedestrians should only be allowed to walk on one side of the tunnel, adequately separated from vehicles. In tunnels where there are rail tracks, unless there is adequate clearance between the rolling stock and the sides, recesses should be provided at suitable intervals which should be large enough to accommodate two persons and should be at least 60 cm deep.

15.7.3. Mechanical haulage operations should be controlled by suitable signals to warn employees to stay clear.

15.7.4. Trains and single cars should have headlights and tail lights and these should be turned on whenever the equipment is operating.

15.7.5. Rerailing should only be done under the control and supervision of a competent person.

15.7.6. Workers should not be transported on locomotives or in cars other than those specially provided for that purpose.

15.8. Dust control

15.8.1. Adequate measures should be taken to prevent the formation of, or to suppress as close to the source as practicable, all dust (inhalable and respirable) in tunnelling operations and in particular siliceous dusts.

15.8.2. If drilling in rock is done dry, the dust produced should be effectively exhausted and collected.

15.8.3. If drilling in rock is done wet, the drill should be so constructed that it cannot be operated unless the water feed is operating.

15.8.4. During blasting, before any shots are fired and for 15 minutes afterwards, the floor, roof and sides in the vicinity should be thoroughly wetted, if practicable.

15.8.5. Loose rock should be adequately wetted during loading, transport and unloading underground.

15.8.6. Excavated material should not be exposed to high-velocity air currents during transport.

15.8.7. If any stone-crushing equipment is used underground, the provisions contained in section 13.13 of this code should be followed.

► 16. Cofferdams and caissons and work in compressed air

16.1. General provisions

16.1.1. Every cofferdam and caisson should be:

- (a) of good construction and suitable and sound material and of adequate strength;
- (b) provided with adequate means for workers to reach safety in the event of an inrush of water or material; and
- (c) provided with safe means of access to every place where workers are employed.

16.1.2. The construction, positioning, modification or dismantling of a cofferdam or caisson should take place only under the immediate supervision of a competent person.

16.1.3. Every cofferdam and caisson should be inspected by a competent person at intervals prescribed by national laws and regulations.

16.1.4. A person should only be allowed to work in a cofferdam or caisson if it has been inspected and found safe by a competent person within such preceding period as is prescribed by national laws and regulations and the results thereof recorded in a prescribed form or register.

16.1.5. National laws and regulations should lay down the conditions in which the work in compressed air is to be carried out and the plant and equipment to be used, as well as provide for the health surveillance of workers and the duration of work in compressed air.

16.1.6. Work in compressed air should be carried out only by workers who are 18 years old or more and who have been medically examined and found fit for such employment.

16.1.7. Work in compressed air should be carried out only when a competent person is present to constantly supervise the conduct of operations.

16.1.8. All workers employed to work in any cofferdam or caisson should be informed, instructed and trained on the hazards faced and the associated risk control measures in place and to be followed to reduce the risks so far as is reasonably practicable. This should include specific risk control measures for when working in compressed air.

16.1.9. No person should be subjected to a pressure exceeding 2.5 bar or as determined by national laws and regulations, except in emergencies.

16.1.10. For every shift, a record should be kept showing the time every worker spends in the working chamber and the time taken for decompression.

16.1.11. If the air pressure exceeds 1 bar, the medical examination of the worker should have been carried out as prescribed by national laws and regulations preceding their employment. The medical re-examination should be repeated every four weeks.

16.1.12. Workers who have been employed continuously in compressed air at a pressure less than 1 bar should be medically re-examined as prescribed by national laws and regulations.

16.1.13. Workers who have been absent from work in compressed air for any period due to illness or for ten days or more for reasons other than illness should be medically re-examined. Such workers should be reintroduced into compressed-air work in a graduated manner.

16.1.14. For every project where workers are employed in compressed air, a competent medical adviser familiar with compressed-air work should be available at all times.

16.1.15. When persons are employed in compressed air at a pressure exceeding 1 bar the employer should inform a neighbouring hospital of the position of the worksite and of the name and address of the physician exercising medical supervision.

16.1.16. Every person employed in compressed air at a pressure exceeding 0.7 bar should be provided with an identification badge to be worn on the body for 24 hours after leaving work in compressed air, indicating that they have been employed in compressed air and giving the address of the medical lock at their place of employment. The identification badge should clearly state that the wearer has been exposed to work in compressed air and give details of the medical lock to which the worker should be referred to.

16.1.17. Adequate and suitable welfare facilities for remaining on the site after decompression, including shelters with seats should be provided for workers working in compressed air.

16.1.18. Any person not previously employed in compressed air should not be subject to compressed air unless accompanied in the manlock by a person competent to advise them as to the appropriate conduct of persons during compression.

16.1.19. During compression, the pressure should be raised gradually to no more than about 0.25 bar in the first minute. This pressure should be maintained until the lock attendant has ascertained that no person is complaining of discomfort, and thereafter it should be raised at a rate not exceeding about 0.5 bar per minute.

16.1.20. If during compression any person is suffering from discomfort, compression should stop and if the discomfort does not quickly cease, the pressure should gradually be reduced. If the discomfort does not cease during decompression, the person concerned should be released from the lock when atmospheric pressure is reached and referred to the medical adviser.

16.2. Work in cofferdams and caissons

16.2.1. When necessary to prevent danger, caissons and shafts should be:

- (a) adequately braced; and
- (b) firmly secured in position.

16.2.2. Before being taken into use, shafts should undergo an appropriate hydrostatic test.

16.2.3. Every caisson and shaft containing flammable material should be provided with a water line, sufficient hose connections and sufficient hose or appropriate extinguishers.

16.2.4. Every caisson, shaft, working chamber, medical lock and manlock should have a minimum internal height of 1.8 m.

Working chambers

16.2.5. Every working chamber should be provided with a wet bulb thermometer.

16.2.6. Working in the chamber when the wet bulb temperature exceeds 27°C should be restricted unless it is absolutely necessary.

16.2.7. While any person is in a working chamber, the door between the chamber and a manlock leading to a lower pressure should as far as practicable be kept open if the lock is not in use.

Medical locks

16.2.8. Where the pressure in a working chamber ordinarily exceeds 0.7 bar, a suitable medical lock conveniently situated should be provided solely for the treatment of workers employed in compressed air.

16.2.9. The medical lock should have two compartments so that it can be entered under pressure.

16.2.10. While any person is employed in compressed air, the medical lock should be kept ready for immediate use and for 24 hours thereafter and be in the charge of a competent person.

Manlocks

16.2.11. Every manlock should be of adequate internal dimensions and equipped with:

- (a) pressure gauges that indicate to the manlock attendant the pressure in the lock and in each working chamber to which it affords direct or indirect access and indicate to the persons in the lock the pressure in it;
- (b) a clock or clocks so placed that the lock attendant and the persons in the lock can readily ascertain the time;
- (c) efficient means of verbal communication between the lock attendant, the lock and the working chamber or chambers;
- (d) means of enabling the persons in the lock to convey visible or other non-verbal signals to the lock attendant; and
- (e) efficient means enabling the lock attendant, from outside the lock, to reduce or cut off the supply of compressed air to the lock.

16.2.12. Persons in the lock should not be able to reduce the air pressure except:

- (a) under the control of the lock attendant; and
- (b) in an emergency, by special means that should normally be kept sealed or locked.

16.2.13. In every manlock, a copy of the decompression tables should be available and there should be a suitable notice indicating the precautions to be taken by persons during compression and decompression, and after decompression.

16.2.14. Every manlock should, while any person is in it or in any working chamber to which it affords direct or indirect access, be in the charge of an attendant who should:

- (a) control compression, decompression and ventilation in the lock;
- (b) if the pressure exceeds 1 bar, keep a register for each worker showing:
 - (i) the exposure period, that is the times at which compression and decompression start;
 - (ii) the maximum exposure pressure during the shift; and
 - (iii) the decompression table used.

Air supply

16.2.15. Compressed-air installations should be provided with an air-supply plant capable of supplying any working chamber with sufficient fresh air at the pressure in the chamber, and not less than 1.0 m³ per minute per person in the chamber.

16.2.16. Pollution of the air supplied from a compressor or any other source should be prevented.

16.2.17. All air lines should be in duplicate, protected against impact and equipped with non-return valves.

16.2.18. There should be a sufficient reserve of air in compressor installations to allow a safe margin for breakdowns or repairs.

16.2.19. There should be one or more stand-by or reserve compressor(s) for emergencies in line with national laws and regulations.

16.2.20. Two power units supplied from independent sources should be provided for each compressor.

16.2.21. The air in the working chamber should be analysed in accordance with national laws and regulations and the test results should be within the threshold limit values prescribed by national laws and regulations.

Signalling

16.2.22. Reliable means of communication such as bells, whistles or telephones should be maintained at all times between the working chamber and surface installations.

16.2.23. The code of signals should be conspicuously displayed in convenient positions at workplaces.

Lighting

16.2.24. All locks and working chambers should be provided with adequate electric lighting.

16.2.25. There should be two separate lighting installations supplied from independent sources of current.

16.3. Work in tunnels in compressed air

16.3.1. The bulkhead separating the working chamber from areas of lower pressure should be tested and of sufficient strength to withstand safely the maximum pressure to which it will be subjected.

16.3.2. When necessary to prevent danger in the event of rapid flooding, the bulkhead should be sufficiently close to the face or shield to allow the workers to escape in an emergency.

16.3.3. Safety bulkheads should be provided within 60 m of the working face in all tunnels having a danger of inrush of water or material.

16.3.4. If the compressor is driven by electricity from the grid, stand-by compressor plant should be provided capable of maintaining at least 50 per cent of the air supply if the electrical power fails.

16.3.5. If the compressors are not driven by electricity, not more than half of them should be driven from the same source.

16.3.6. Each air line should be equipped with an adequate air receiver, a stop valve, a pressure-reducing valve, and a non-return valve close to the manlocks.

16.3.7. The air supply should be provided by duplicate air lines between the air receiver and the working chamber.

16.3.8. An adjustable safety valve should be fitted on the outside of the bulkhead to a separate pipe leading from the working chamber through the bulkhead to the outside air.

16.3.9. Where practicable, in addition to a suitable manlock and a material lock, tunnels should have an emergency lock capable of holding an entire heading shift.

16.3.10. In all tunnels 5 m or over in diameter or height, a well-guarded overhead gangway should be provided from the working surface to the nearest airlock with an overhead clearance of at least 1.80 m.

16.3.11. Every tunnel should be provided with a water line extending into the working chamber to within 30 m of the working face, sufficient hose connections at suitable places, and sufficient hose.

16.3.12. When blasting work is being done in compressed air in tunnels:

- (a) it should follow the provisions laid down in national laws, regulations and Chapter 22 of this code;
- (b) no worker other than the blaster and their assistants should be in the working chamber or manlock while explosives are transported or boreholes are being loaded;
- (c) detonators and explosives should be taken separately into the working chambers; and
- (d) no worker should re-enter a working chamber after a blast until the fumes have cleared.

► 17. Structural frames, formwork and concrete work

17.1. General provisions

17.1.1. The examination, erection or dismantling of buildings, structures, civil engineering works, formwork, shuttering, falsework and shoring should be carried out by trained workers only under the supervision of an appointed competent person to coordinate the work and check that the procedures are being followed.

17.1.2. Adequate precautions should be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.

17.1.3. Formwork, falsework and shoring should be so designed, constructed and maintained that it will safely support all loads that may be imposed on it.

17.1.4. Formwork should be so designed and erected that working platforms, means of access, bracing and means of handling and stabilizing are easily fixed to the formwork structure.

17.1.5. All lifting operations, appliances and every item of lifting gear should comply with the provisions in Chapter 11 of this code.

17.2. Erection and dismantling of steel and prefabricated structures

17.2.1. As far as practicable, the safety of workers employed on the erection and dismantling of steel and prefabricated structures should be ensured by appropriate means, such as provision and use of:

- (a) ladders, gangways or fixed platforms;
- (b) platforms, buckets, boatswain's chairs or other appropriate means suspended from lifting appliances;
- (c) PFASs, catch nets or catch platforms; and
- (d) power-operated mobile working platforms.

17.2.2. Steel and prefabricated structures should be so designed and made that they can be safely transported and erected, and if required by national laws and regulations, each unit should be clearly marked with its own weight.

17.2.3. In addition to the need for the stability of the part when erected, when necessary to prevent danger the design should explicitly take into account:

- (a) the conditions and methods of attachment in the operations of transport, storing and temporary support during erection or dismantling as applicable; and
- (b) methods for the provision of safeguards such as guard rails and working platforms, and, when necessary, for mounting them easily on the structural steel or prefabricated parts before being lifted into position.

17.2.4. The hooks and other devices built in or provided on the structural steel or prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:

- (a) to withstand with a sufficient margin the stresses to which they are subjected;
- (b) not to set up stresses in the part that could cause failures, or stresses in the structure itself not provided for in the plans, and be designed to permit easy release from the lifting appliance. Lifting points for floor and staircase units should be located (recessed if necessary) so that they do not protrude above the surface; and
- (c) to avoid imbalance or distortion of the lifted load.

17.2.5. Prefabricated parts made of concrete should not be stripped or erected before the concrete has set and hardened sufficiently to the extent provided for in the plans, and before use should be examined for any sign of damage which may indicate weakness.

17.2.6. Storeplaces should be so constructed that:

- (a) there is no risk of structural steel or prefabricated parts falling or overturning;
- (b) storage conditions generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions; and
- (c) racks are set on firm ground and designed so that units cannot move accidentally.

17.2.7. While they are being stored, raised or set down, structural steel or prefabricated parts should not be subjected to stresses prejudicial to their stability.

17.2.8. Tongs, clamps and other appliances for lifting structural steel and prefabricated parts should be of such shape and dimensions as to ensure a secure grip without damaging the part, and to prevent any accidental spinning.

17.2.9. When necessary to prevent danger, before they are raised from the ground, structural steel or prefabricated parts should already be fitted with safety devices such as guard rails, working platforms and other means of protection to prevent persons from falling.

17.2.10. While structural steel or prefabricated parts are being erected the workers should be provided with and use appliances for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the operations.

17.2.11. Before it is released from the lifting appliance, a raised structural steel or prefabricated part should be so secured and wall units so propped that their stability cannot be imperilled, even by external agencies such as wind and passing loads, in accordance with national laws and regulations.

17.2.12. At workplaces, adequate instruction should be given to the workers on the methods, arrangements and means required for the storage, transport, lifting and erection of structural steel or prefabricated parts, and before erection starts a meeting of all those responsible should be held to discuss and confirm the requirements for safe erection.

17.2.13. During transport, attachments such as slings and stirrups mounted on structural steel or prefabricated parts should be securely fastened to the parts. Before releasing attachments when unloading, workers should verify that the load will remain secure on the transporter. If this is not so, then a competent person should establish how the unloading will take place.

17.2.14. Structural steel or prefabricated parts should be so transported that the conditions do not affect the stability of the parts or the means of transport result in jolting, vibration or stresses due to blows, or loads of material or persons.

17.2.15. When the method of erection does not permit the provision of other means of protection against falls of persons, the workplaces should be protected by upper and intermediate guard rails and toe boards.

17.2.16. When adverse weather conditions, such as violent storms, heavy rain, snow, ice, high winds or reduced visibility, increase the risks of accidents, the work should be stopped until the risk of accidents due to the weather conditions has reduced.

17.2.17. The risks of falling, to which workers moving on high or sloping girders are exposed, should be limited by all means of adequate collective protection or, where this is impossible, by the use of a PFAS that is well secured to a sufficiently strong support.

17.2.18. Structural steel parts that are to be erected should as far as practicable be assembled at ground level before being lifted into place.

17.2.19. To protect against falling objects when structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the working zone should be barricaded or guarded.

17.2.20. Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.

17.2.21. No load-bearing structural member should be dangerously weakened by cutting, holing or other means.

17.2.22. Structural members should not be forced into place by the hoisting machine while any worker is in such a position where there is a risk of being injured by the operation.

17.2.23. Open-web steel joists that are hoisted singly should be directly placed in position and secured against dislodgement before being released.

17.3. Cast-in-situ concrete structures

17.3.1. The construction of cast-in-situ, large span and multi-storey concrete structures should be based on plans that:

- (a) include specifications of the steel, concrete and other material to be used, including technical methods for safe placing and handling;
- (b) indicate clearly the position and arrangement of reinforcements in structural elements; and
- (c) provide, if appropriate, calculations of the load-bearing capacity of the structure.

17.3.2. During the construction of cast-in-situ, large span and multi-storey concrete structures, a daily record should be kept of the progress of the work, including indications of all data which could affect the curing of the concrete.

17.3.3. Precise procedures for all stages of erection should be prepared.

17.3.4. Immediately prior to, during and immediately after pouring, shuttering and its supports should be continuously watched for defects.

17.3.5. Loads should not be dumped or placed on setting concrete unless a competent person has determined that the structure is capable of supporting the loads.

17.3.6. If necessary to protect workers against the hazard of impalement, exposed and projecting reinforced steel rods or similar should have protective covers.

17.4. Provision of temporary floors

17.4.1. All tiers of open joists and girders on which workers are working should be securely covered with close planking or any other effective covering until the permanent floor is installed.

17.4.2. Parts of the protection should only be removed to the extent required for the continuation of the work and if other precautions are in place to prevent falls.

17.4.3. In halls and similar buildings without intermediate walls, columns or chimneys, close planking may be replaced by working platforms with suitable risk control measures to protect against falls.

17.4.4. In buildings or structures of skeleton steel construction, permanent floor filling should as far as practicable be installed as the erection progresses.

17.5. Formwork

17.5.1. All formwork should be properly designed by a competent person.

17.5.2. Clear and concise procedures to cover all stages of work should be prepared.

17.5.3. No changes should be made without consulting the competent person.

17.5.4. All materials and scaffolding should be carefully examined and checked with the drawings before being taken into use.

17.5.5. The foundations should be checked to see that the excavated ground conditions are as the original geo-technical report suggested.

17.5.6. The necessary information for the erection of shuttering, including particulars of the spacing of stringers and props to stringers, should be provided for the workers in the form of sketches or scale drawings.

17.5.7. Lumber and supports for shuttering (forms) should be adequate, having regard to the loads to be borne, spans, setting temperature and rate of pour. Where necessary to prevent danger, adequate shoring should be provided to support slabs and beams as a protection against superimposed loads.

17.5.8. All adjustable shoring should be locked in position once adjusted.

17.5.9. Shoring should be so arranged that when it is being removed, sufficient props can be left in place to afford the support necessary to prevent danger.

17.5.10. Shoring should be adequately protected from damage from moving vehicles, swinging loads, etc.

17.5.11. Shoring should be left in place until the concrete has acquired sufficient strength to support safely not only its own weight but also any imposed loads. It should not be removed until authorization has been given by a competent person.

17.5.12. Shoring should be adequately braced or tied together to prevent deformation or displacement.

17.5.13. To prevent danger from falling parts when shuttering is being taken down, the shuttering should as far as practicable be taken down whole, or else remaining parts should be supported.

17.5.14. Mechanical, hydraulic or pneumatic lifting appliances for handling forms should be provided with automatic holding devices to prevent danger if the power of the lifting mechanism fails.

17.5.15. Vacuum-lifting appliances should only be applied to smooth, clean surfaces.

17.5.16. Vacuum-lifting devices should be provided with an automatic cut-off to prevent loss of suction in the event of a power or equipment failure.

► 18. Pile-driving

18.1. General provisions

18.1.1. All pile-driving equipment should be of good design and construction taking into account as far as possible ergonomic principles, and be properly maintained.

18.1.2. Pile-driving should be carried out only under the supervision of a competent person.

18.1.3. Prior to piling, all underground services in the area should be located and rendered safe.

18.1.4. Pile-drivers should be firmly supported on heavy timber sills, concrete beds or other secure foundation.

18.1.5. If necessary to maintain stability and prevent danger (such as overturning), pile-drivers should be secured by guys, outriggers or counterbalances.

18.1.6. Pile-drivers should not operate in dangerous proximity to live electrical conductors. A competent person should determine adequate safety distances or ensure they are first made dead.

18.1.7. If two pile-drivers are erected at one place, they should be separated by a distance at least equal to the longest leg.

18.1.8. When leads have to be inclined:

- (a) they should be adequately counterbalanced; and
- (b) the tilting device should be secured against slipping.

18.1.9. The hoses of steam and air hammers should be securely tethered with chain, wire rope whip checks, whip socks or other appropriate means determined by the competent person to the hammer so as to prevent them from whipping if a connection breaks.

18.1.10. Adequate precautions should be taken, by providing stirrups or by other effective means, to prevent the wire rope from coming out of the top pulley or wheel.

18.1.11. Adequate precautions should be taken to prevent the hammer from missing the pile.

18.1.12. If necessary to prevent danger, long piles and heavy sheet piling should be secured against falling.

18.2. Inspection and maintenance of pile-driving equipment

18.2.1. Pile-driving equipment should not be taken into use until it has been inspected by a competent person and found to be safe in accordance with national laws and regulations.

18.2.2. Pile-driving equipment, pile lines and pulley blocks in use should be inspected by a competent person before the beginning of each shift.

18.3. Operation of pile-driving equipment

18.3.1. Only competent persons should operate pile-drivers. They should be trained, tested and certified.

18.3.2. Pile-driving operations should be governed by suitable signals.

18.3.3. Workers employed in pile-driving operations should wear hearing protection, safety footwear, safety helmets or hard hats and other PPE as required.

18.3.4. During pile-driving operations:

- (a) no worker should stand under the outrigger/spotter;
- (b) no worker should be positioned directly under the hammer or pile;
- (c) essential workers should stand at the sides or the rear of the leads during installation of the pile; and
- (d) non-essential workers should not be within a distance of one and a half times the suspended load.

18.3.5. As far as practicable, piles should be prepared at a distance at least equal to twice the length of the longest pile from the pile-driver.

18.3.6. When piles are driven at an inclination to the vertical, if necessary to prevent danger, they should rest in a guide.

18.3.7. When a pile-driver is not in use, the hammer should be blocked at the bottom of the leads.

18.4. Floating pile-drivers

18.4.1. When pile-drivers are working over water, all relevant precautions for work over water should be taken in accordance with Chapter 19 of this code and in particular a suitable boat should be kept readily available at all times.

18.4.2. All members of floating pile-driver crews should be trained to handle boats.

18.4.3. Floating pile-drivers should be provided with a whistle, siren, horn or other effective signalling equipment.

18.4.4. Floating pile-drivers should be provided with adequate fire-response equipment and suitable life-saving equipment.

18.4.5. The weight of machinery on a floating pile-driver should be evenly distributed so that the deck of the installation is horizontal.

18.4.6. Steel pile-driver hulls should be divided into watertight compartments.

18.4.7. Watertight compartments should be provided with siphons for the removal of water seepage.

18.4.8. Deck hatches should have firmly fastened covers that fit flush with the deck.

18.4.9. Sufficient sheaves should be provided on deck to enable the pile-driver to be safely manoeuvred in any direction and safely secured in position.

18.4.10. Regular head counts should be taken of the pile-driving crew members.

18.5. Sheet piling

18.5.1. If necessary to prevent danger from wind or other sources, tag lines should be used to control the load.

18.5.2. Where support systems are required, the use of walkway walings and trestles should be considered. All walkways should be fitted with guard rails and toe boards and suitable ladder access.

18.5.3. Remote release shackles should be used where possible. The length of the operating rope should be less than the length of the pile and the rope should be secured around the pile to prevent snagging, or being caught in the wind and becoming inaccessible.

18.5.4. If piles are too heavy for a remote release shackle and work cannot be carried out safely from a ladder, a mobile elevated working platform should be provided to gain access for unscrewing the shackle.

18.5.5. Long sheet piles should be pitched with a pile threader. When this is not possible, a mobile elevated working platform should be used. The operatives should be provided with a safety harness to be attached to the platform.

18.5.6. Workers handling sheets should wear gloves.

18.5.7. While it is being weighted with stones, etc., sheet piling should be securely moored.

18.5.8. Adequate pumping facilities should be available at cofferdams to keep them clear of water.

► 19. Work over water

19.1. General provisions

19.1.1. Where work is done over or in close proximity to water provision should be made for:

- (a) preventing workers from falling into water;
- (b) the rescue of workers in danger of drowning; and
- (c) safe and sufficient transport.

19.1.2. National laws and regulations should lay down provisions for the safe performance of work over or in close proximity to water which should include, where appropriate, the provision and use of suitable and adequate:

- (a) fencing, safety nets and safety harnesses;
- (b) lifebuoys, personal flotation devices and manned boats (motor-driven if necessary);
- (c) protection against such hazards as reptiles and other animals; and
- (d) communication systems.

19.1.3. Gangways, pontoons, bridges, footbridges and other walkways or workplaces over water should:

- (a) possess adequate strength and stability;
- (b) be sufficiently wide to allow safe movement of workers;
- (c) have level surfaces free from protruding knots, bark, nails, bolts, tackle, tools and other tripping hazards or obstructions;
- (d) if necessary to prevent danger, be boarded over;
- (e) if necessary to prevent danger, be adequately lit when natural lighting is insufficient;
- (f) be provided at appropriate points with sufficient lifebuoys, lifelines and other life-saving equipment;
- (g) where practicable and necessary to prevent danger, be provided with toe boards, upper and intermediate guard rails, hand ropes or the like;
- (h) as far as practicable, be kept free of any snow, ice, grease or other substance, be strewn with sand, ashes or the like when slippery;
- (i) be secured to prevent dislodgement by rising water or high winds, especially in the case of decking boards on gangways and platforms erected above tidal waters;
- (j) if necessary, be equipped with ladders which should be sound, of sufficient strength and length and be securely lashed to prevent slipping. Where vertical permanent ladders are provided in plant over water, they should be fitted with safety hoops; and
- (k) where appropriate, possess adequate buoyancy.

19.1.4. Floating structures should, if necessary to ensure protection, be provided with shelters.

19.1.5. Floating operational equipment should be provided with sufficient and suitable rescue equipment such as lifelines, boathooks/poles and lifebuoys.

19.1.6. Rafts for work on water should:

- (a) be sufficiently stable, strong and adapted for their purpose;
- (b) have their capacity and buoyancy displayed;
- (c) be securely moored or anchored;
- (d) have suitable life-saving equipment; and
- (e) not be overloaded.

19.1.7. Iron decks should be studded or have some other type of non-slip surface.

19.1.8. As far as practicable, all deck openings should be suitably fenced where there is danger of workers falling through them.

19.1.9. A safe walkway should be provided on all floating pipelines.

19.1.10. No person should enter a hydraulic dredge gear room without first informing the leverman and without being accompanied by a second person.

19.1.11. Hoist lines, drag lines, buckets, cutter heads and bridles should be tested in accordance with national laws and regulations and inspected daily.

19.1.12. Workers should be embarked and disembarked only at suitable and safe landing places. Pontoons and landing places should be provided with sufficiently strong and well-secured bollards or cleats to which boats can be made fast. They should be provided with sufficient suitable life-saving appliances.

19.1.13. Regular head counts should be taken of workers involved in operations over water.

19.1.14. Persons who work over water should be provided with some form of buoyancy aid. Personal flotation devices should provide sufficient freedom of movement, have sufficient buoyancy to bring persons to the surface and keep them afloat face upwards, be easily secured to the body, be readily visible, not be prone to snagging under water and have, when necessary, clip-on self-igniting lights.

19.1.15. Operatives should not work alone on or above water.

19.1.16. Each worker should be trained in the procedure to be followed in the event of an emergency and rescue. All workers should be trained in the use of personal flotation devices and buoyancy aids.

19.2. Boats

19.2.1. Boats used to transport workers by water should comply with requirements which should be laid down by the competent authority.

19.2.2. Boats used to transport workers should have a valid certificate issued by the competent authority, and be manned by adequate and competent crew in line with national laws and regulations.

19.2.3. The maximum number of persons transported in a boat should not be greater than safety allows and this number should be displayed in a conspicuous place.

19.2.4. Boats should be equipped with communications and first-aid equipment and suitable fire extinguishers and where necessary navigation equipment. All equipment should be maintained and should conform to national requirements.

19.2.5. Tow-boats should have a device by which the tow-rope can be quickly released.

19.2.6. Rowboats should carry a spare set of oars.

19.2.7. Rescue boats should be properly constructed and of sufficient length and beam to afford reasonable stability. For work in tidal waters or fast flowing rivers a power-driven craft should be provided, with a fixed self-starting device on the motor. Engines on powered craft when not patrolling should be run daily to ensure full efficiency.

► 20. Demolition

20.1. General provisions

20.1.1. When the demolition of any building or structure might present danger to workers or other persons in the vicinity:

- (a) appropriate precautions, methods and procedures should be adopted, including those for the disposal of waste or residues, in accordance with national laws or regulations;
- (b) the work should be planned and undertaken only under the supervision of a competent person; and
- (c) the work should only be carried out by competent workers.

20.1.2. Before demolition operations begin:

- (a) structural details and builders' drawings should be obtained wherever possible;
- (b) wherever possible, details of the previous use should be obtained to identify any possible contamination and hazards from chemicals, flammables, etc.;
- (c) an initial survey should be carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health, and should include an assessment survey for asbestos-containing materials, where applicable. The survey should note the type of ground on which the structure is erected, the condition of the roof trusses, the type of framing used in framed structures and the load-bearing walls;
- (d) precautions should be taken in the vicinity of premises such as hospitals and industrial premises containing equipment sensitive to vibration and dust and all premises sensitive to noise to ensure that such premises are not adversely affected;
- (e) a method of demolition and a demolition sequence should be formulated after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions;
- (f) a building should be checked and it should be verified that it is vacant; and
- (g) the potential for safe reuse, recycling and other material recovery should be considered.

20.1.3. All electric, gas, water, steam and urban heating channelling, telecommunication service lines above- or underground should be shut off and, as necessary, capped or otherwise controlled at or outside the construction site before work commences.

20.1.4. If it is necessary to maintain any electric power, water or other services during demolition operations, they should be adequately protected against damage and marked.

20.1.5. As far as practicable any danger zone round the building should be adequately fenced off and signposted. To protect the public a fence 2 m high should be erected enclosing the demolition operations and the access gates should be secured outside working hours.

20.1.6. The fabric of buildings contaminated with substances hazardous to health should be decontaminated. For the safe decontamination, removal and disposal of hazardous materials,

where necessary, suitable, appropriate protective clothing and respiratory protective equipment should be provided and worn.

20.1.7. Where the plant has contained flammable materials, special precautions should be taken to avoid fire and explosion.

20.1.8. The plant to be demolished should be isolated from all other plant that may contain flammable materials. Any residual flammable material in the plant should be rendered safe by, for example, cleaning, purging or the application of an inert atmosphere as appropriate.

20.1.9. Care should be taken not to demolish any parts which would destroy the stability of other parts.

20.1.10. Demolition activities should not be continued under climatic conditions such as high winds, which could cause the collapse of already weakened structures.

20.1.11. When necessary to prevent danger, parts of structures should be adequately shored, braced or otherwise supported.

20.1.12. Structures should not be left in a condition in which they could be brought down by wind pressure or vibration.

20.1.13. Where necessary to keep down dust, buildings being demolished should be sprayed with water constantly or at suitable intervals.

20.1.14. Foundation walls serving as retaining walls to support earth or adjoining structures should not be demolished until the adjoining structure has been underpinned or braced, and the earth removed or supported by sheet piling or sheathing.

20.1.15. Where a deliberate controlled collapse technique is to be used, expert engineering advice should be obtained, and:

- (a) it should only be used where the whole structure is to come down because it relies on the removal of key structural members to effect a total collapse; and
- (b) it should only be used on sites that are fairly level and where there is enough surrounding space for all operatives and equipment to be withdrawn to a safe distance.

20.1.16. Buildings and structures which are not carrying their design loads may be pre-weakened prior to a deliberate collapse, but in such cases:

- (a) the pre-weakening should be carefully planned so that, despite the removal of redundant members and the partial cutting of load-bearing members, the structure should have sufficient strength to resist wind loads or impact loads until such time as a deliberate collapse is achieved; and
- (b) the dead load should be reduced systematically by the removal of surplus material, machinery, cladding, walls and parts of floors before work begins on the structural frame.

20.1.17. Where explosives are used to demolish key members, the blast protection and safe distances should be agreed in advance. The work should only be undertaken by competent persons in the controlled application of explosives in accordance with national laws and regulations. See Chapter 22 of this code for additional information.

20.1.18. The shotfirers should establish the area at risk to enable the area to be appropriately cleared or evacuated, if necessary. Blast protection should be of a high standard

but should not be considered as an alternative to defining the area likely to be affected. See Chapter 22 of this code for additional information.

20.1.19. When mechanical equipment, such as power shovels and bulldozers, is used for demolition, due consideration should be given to the nature of the building or structure, its dimensions, as well as to the power of the equipment being used. All powered mobile plants used for demolition work must be fitted with a suitable combination of operator protection devices.

20.1.20. If a swinging weight is used for demolition, a safety zone having a width of at least one and a half times the height of the building or structure should be maintained around the points of impact.

20.1.21. Swinging weights should be so controlled that they cannot swing against any structure other than the one being demolished.

20.1.22. If a clamshell bucket is used for demolition, a safety zone extending 8 m from the line of travel of the bucket should be maintained.

20.1.23. Where necessary during the demolition of buildings or other structures, appropriate catch platforms capable of withstanding safely a live load of 6.0 kN/m² and at least 1.5 m wide or as specified by national legislation, should be provided along the outside of exterior walls so as to prevent danger from falling objects.

20.2. Demolition of walls

20.2.1. Walls should be demolished storey by storey beginning at the roof and working downwards.

20.2.2. Where necessary, unsupported walls should be prevented from falling by means such as shoring and ties.

20.2.3. Manual demolition of walls should be performed from safe working platforms.

20.3. Demolition of floors

20.3.1. When necessary to prevent danger, workers demolishing floors should be provided with substantial and secure planking or walkways on which to stand or move, as well as appropriate fall protection equipment.

20.3.2. Openings, when chutes are not used, through which material is dropped should be adequately fenced or barricaded to prevent danger; the area underneath should be completely enclosed with barricades; and signs warning of the hazard of falling materials should be posted.

20.3.3. All work above each tier of floor beams should be completed before the safety of the tier supports is impaired.

20.4. Demolition of structural steelwork

20.4.1. All practicable precautions should be taken to prevent danger from any sudden twist, spring or collapse of steelwork, ironwork or reinforced concrete when it is cut or released.

20.4.2. Steel construction should be demolished tier by tier.

20.4.3. Structural steel parts should be lowered and not dropped from a height.

20.5. Demolition of tall chimneys

20.5.1. Tall chimneys should not be demolished by blasting or overturning unless a protected area of adequate dimensions can be established in which the chimney can fall safely.

20.5.2. Workers should not stand on top of the chimney wall.

20.5.3. Material thrown down should only be removed during breaks in the work or under controlled conditions.

20.6. Removal of asbestos and materials and articles containing asbestos

20.6.1. Removal of asbestos-containing materials and articles such as asbestos cement sheets or asbestos insulation present particular health hazards/risks as they often involve dismantling or breaking large quantities of friable materials. The work should be performed in accordance with the Asbestos Convention (No. 162) and Recommendation (No. 172), 1986, as well as relevant provisions of the ILO code of practice on safety in the use of asbestos (1984), in particular the provisions contained in section 18.2, "Demolition and alteration work".

► 21. Electricity

21.1. General provisions

21.1.1. All electrical distribution panels, breakers, switches and junction boxes should be in accordance with the required ingress protection rating to avoid exposure to wet conditions and dust.

21.1.2. All electrical equipment and installations should be constructed, installed and maintained on construction sites by a competent person and in compliance with national laws and regulations and so used as to guard against danger, such as electric shock, fire and explosion.

21.1.3. Before construction is commenced and during the progress thereof, adequate steps should be taken to ascertain the presence of and to guard against danger to workers from any live electrical cable or apparatus which is under, over or on the site.

21.1.4. All parts of electrical installations should be of adequate size and characteristics for the power requirements and work they may be called upon to do and in particular they should:

- (a) be of adequate mechanical strength to withstand working conditions in construction operations; and
- (b) not be liable to damage by water, dust or electrical, thermal or chemical action to which they may be subjected in construction operations.

21.1.5. The electrical distribution at each site should be via an isolator which cuts off current from all conductors, is readily accessible and can be locked in the "off" position but not locked in the "on" position.

21.1.6. The power supply to all electrical equipment should be provided, automatically where possible (trip switches), with means of cutting off current from all conductors in an emergency.

21.1.7. All electrical circuits should be fitted with a ground-fault circuit interrupter (GFCI).

21.1.8. All electrical appliances and outlets should be clearly marked to indicate their purpose and voltage.

21.1.9. When the layout of an installation cannot be clearly recognized, the circuits and appliances should be identified by labels or other effective means.

21.1.10. Circuits and appliances carrying different voltages in the same installation should be clearly distinguished by conspicuous means such as coloured markings.

21.1.11. Adequate precautions should be taken to prevent installations from receiving current at a higher voltage from other installations.

21.1.12. Where necessary to prevent danger, installations should be protected against lightning.

21.1.13. Lines for signalling and telecommunication systems should be protected by isolation or suitable insulation, or both, from contacting energized power conductors or any other power source.

21.1.14. Only explosion-proof equipment and conductors should be installed in explosive atmospheres or in storeplaces for explosives or flammable liquids.

21.1.15. A notice or notices should be kept exhibited at suitable places:

- (a) prohibiting unauthorized persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus;
- (b) containing directions as to procedures in case of fire, rescue of persons in contact with live conductors and the treatment of persons suffering from an electric shock; and
- (c) specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with that person.

21.1.16. Suitable warnings should be displayed at all places where contact with or proximity to electrical equipment can cause danger.

21.1.17. Persons having to operate electrical equipment should be fully instructed as to any possible dangers of the equipment concerned.

21.1.18. A worker that has received an electric shock should seek medical attention immediately, even if there are no signs of injury.

21.2. Inspection and maintenance

21.2.1. All electrical equipment should be inspected before it is taken into use to ensure that it is suitable for its proposed use.

21.2.2. At the beginning of every shift, the person using the electrical equipment should make a careful external examination of the equipment and conductors, especially the flexible cables/plugs, etc.

21.2.3. Where possible, all work likely to lead to contact with the overhead line should be done in an area well clear of the line itself. Where this is not feasible, either the power line must be made dead or suitable precautions must be taken to prevent any danger and provide temporary insulation. For some jobs, it may be necessary for the electricity supplier to isolate or reroute overhead lines to enable work to proceed.

21.2.4. Before any work is begun on conductors or equipment that do not have to remain live:

- (a) the current should be switched off by a competent person;
- (b) the power switches should be locked out and warning signs posted or other adequate precautions should be taken to prevent the current from being switched on again;
- (c) the conductors or the equipment should be tested to ascertain by a competent person that they are dead; and
- (d) neighbouring live parts should be adequately protected against accidental contact.

21.2.5. After work has been done on conductors and equipment, the current should only be switched on again on the orders of a competent person after the earthing and short-circuiting have been removed and the workplace reported safe.

21.2.6. Electricians should be supplied with sufficient insulated tools and PPE such as rubber gloves, mats and blankets applicable to the voltage.

21.2.7. All conductors and equipment should be considered to be live unless there is certain proof, determined by a competent person, of the contrary.

21.2.8. Before work is done in dangerous proximity to live electrical parts, a competent person should ensure that the equipment is dead. If for operational reasons this is not possible, the live parts should be fenced off or enclosed by qualified staff from the power station concerned.

21.3. Testing

21.3.1. Electrical installations should be inspected and tested by a competent person and the results recorded in accordance with national laws or regulations.

21.3.2. Periodic testing of the efficiency of the earth leakage and residual current protective devices should be carried out.

21.3.3. Particular attention should be paid to the earthing of apparatus, the continuity of protective conductors, polarity and insulation resistance, protection against mechanical damage and condition of connections at points of entry.

► 22. Explosives

22.1. General provisions

22.1.1. Explosives should not be stored, transported, handled or used except:

- (a) under conditions prescribed by national laws or regulations;
- (b) by a competent person, who should take all necessary steps to ensure that workers and other persons are not exposed to risk of injury; and
- (c) in conformity with the manufacturers' instructions.

22.1.2. Only explosives and detonators approved by the competent authority and provided by, or with the knowledge of, the employer at the construction site should be used. National laws and regulations should define the term "explosives" and specify the conditions governing their manufacture, storage, transport and use.

22.1.3. Before explosives are used for blasting on a site, employers and workers should prepare, agree and put on record a system of work (local shotfiring rules) determining the responsibilities of persons that will be applied, in line with national laws and regulations.

22.1.4. Dynamite should not be removed from its original wrapper until it is being loaded into boreholes.

22.1.5. As far as practicable, blasting should be done off shift or during breaks in the work.

22.1.6. As far as practicable, blasting above ground should be done in daylight.

22.1.7. Visibility, including during the hours of darkness, should be adequate for the blast and other associated work to be carried out safely.

22.1.8. If blasting can endanger workers in another enterprise:

- (a) blasting times should be agreed between the two enterprises; and
- (b) shots should not be fired until a warning has been given to the other enterprise and acknowledged by it.

22.1.9. In line with shotfiring rules, loaded boreholes should be continuously monitored.

22.1.10. Before a borehole is loaded all workers not employed in the blasting operation should withdraw to a safe place.

22.1.11. At an appropriate time before the final blasting warning, checks should be made to ensure that no one is within the danger zone. All workers must be accounted for and remain in a designated safe place.

22.1.12. In line with shotfiring rules, an unmistakable, audible, final warning should be sounded one minute prior to the detonation of explosives; after detonation, when the person in charge has established that safe conditions prevail, an "all clear" should be sounded.

22.1.13. To prevent persons entering any danger zone during blasting operations:

- (a) look-outs should be posted around the area of operations;
- (b) warning flags should be flown; and
- (c) conspicuous notices should be posted at points around the area of operations.

22.1.14. Ignition sources, such as smoking and open flames, should not be allowed in the loading area.

22.2. Transport, storage and handling

22.2.1. All explosives supplied to and issued from a magazine should be accounted for and recorded, and unused explosives should be returned to the same magazine on the completion of the operation for which they were drawn. The employer should ensure that a durable record is kept, which should show the quantities of explosives on hand and the quantities of explosives received or issued, as well as the dates and times at which they were received or issued and to whom.

22.2.2. Detonators and detonating accessories should not be stored in the same magazine as other explosives unless kept in a separate approved compartment.

22.2.3. Workers should not smoke or permit other ignition sources, for example an open flame, to be within a specified distance (for example 6 m) of any place where explosives are stored, transported or used. Every magazine should be kept clean, dry and adequately ventilated and the roof and walls maintained in good and safe condition.

22.2.4. The employer should ensure that road and rail vehicles used to transport explosives comply with the following requirements:

- (a) have substantially constructed bodies, no sparking metal exposed in the cargo space and should be equipped with suitable sides and tailgates;
- (b) be equipped with suitable fire extinguishers, wheel chocks and, when powered by an internal combustion engine, a battery-isolating switch;
- (c) when transporting explosives or detonators, be posted with proper warning signs;
- (d) if they are parked while containing explosives or detonators, the brakes should be set, the ignition switched off, the vehicle blocked securely against movement and never left unattended;
- (e) when required to be taken to a garage or repair shop for any purpose, be emptied and cleaned out; and
- (f) their trailers, if used, be fitted with efficient brakes and coupled to the towing vehicle by a properly designed rigid tow bar and safety chain couplers.

22.2.5. Explosives should be transported in separate vehicles from detonators, unless both materials are housed in separate and properly constructed and locked containers. National laws should state the maximum quantities of explosives and detonators which may be transported.

22.2.6. Different types of explosives should not be transported in the same container.

22.2.7. Containers should be marked to show the type of explosive kept in them.

22.2.8. Explosives should be permanently stored only in magazines which should:

- (a) be constructed in accordance with the requirements of, and should be licensed by, the competent authority;
- (b) be at a safe distance from occupied buildings or areas;
- (c) be substantially constructed, bulletproof and fire-resistant;
- (d) be clean, dry, well ventilated, cool, and protected against frost;

- (e) be kept securely locked; and
- (f) have electrical systems suitable for potentially explosive atmospheres.

22.2.9. With the exception of explosives, articles likely to cause a fire or explosion should not be taken into or permitted to remain in explosives magazines.

22.2.10. In explosives magazines or in a restricted and clearly marked zone around them:

- (a) ignition sources, such as smoking, matches, open lights or open flames should not be permitted;
- (b) firearms should not be discharged; and
- (c) combustible debris such as grass, leaves or brushwood should not be allowed to accumulate.

22.2.11. Explosives magazines should not be opened during or on the approach of an electrical storm. As soon as the approach of an electrical storm is detected, all workers should be removed from the area where explosives are stored or are in use.

22.2.12. If quantities of explosives and detonators have to be provisionally stored outside the main magazine, separate special accommodation should be provided, such as a special room, a portable magazine or a suitable container.

22.2.13. Overshoes to prevent static discharge should be kept at each storage area and worn by people who have to enter in them.

22.2.14. Only persons authorized to handle explosives should have the keys of magazines, storerooms or cases for explosives.

22.2.15. Explosives should be protected from impact.

22.2.16. Separate containers for explosives, detonators, blasting agents, fuses and detonating accessories should be provided and used where these are carried manually. Explosives should not be carried in pockets or elsewhere on the person.

22.2.17. No explosives should be left without supervision by a competent person.

22.3. Misfires

22.3.1. The employer, in consultation with workers where shotfiring is practised, should draw up a scheme specifying the procedure to be followed in the event of a misfire. When a misfire is known or suspected to have occurred, no work should be done at the site until the shotfirer or another competent person has inspected the site at which the misfire occurred and taken such action as may be necessary to ensure that further work may be safely continued. No person should approach a misfired hole:

- (a) when a safety fuse has been used, until at least 30 minutes have elapsed since the time of lighting the fuse; and
- (b) when electrical firing has been used, until the shotfiring lines have been disconnected from the source of electric power and been short-circuited, and then at least 15 minutes after that have elapsed.

22.3.2. After the appropriate time interval, the shotfirer should inspect, or where they cannot do so instruct another competent person to inspect, the bench or face and take such action as may be necessary to ensure that further work may be safely continued (for example, miss hole refiring or washing the miss hole out).

22.3.3. A record of the inspection and the action taken should be made, in a book kept at the construction site for the purpose, at the end of the shift by the person making the inspection.

22.3.4. It is also common practice for the competent authorities to require the reporting of instances of misfires.

22.4. Disposal of explosives

22.4.1. Where surplus or deteriorated explosives have to be disposed of, the advice of the manufacturer should be sought and the destruction carried out in accordance with an agreed and developed procedure laid down by the employer.

22.4.2. Material used in the wrapping or packing of explosives should not be used again for any purpose but should be destroyed by burning. These materials should not be burned in a stove, fireplace or other confined space. Rather, they should be burned at an isolated outdoor location, at a safe distance from thoroughfares, magazines and other structures. It is important to check that the containers are entirely empty before burning. During burning, no person should remain within 30 m of the fire.

22.4.3. In the disposal of explosives and related material, the health of workers and of the public as well as the preservation of the environment should be safeguarded as prescribed by national laws and regulations.

► 23. OSH, natural disasters, emergencies, extreme weather events and waste management

23.1. General provisions

23.1.1. Natural disasters have become an increasing threat to the health and safety of construction workers. Work during and remedial work in the wake of these natural disasters inevitably places construction workers in hostile work environments with a heightened risk of accidents. Work with equipment in unusually challenging conditions may present an increased risk from water-, air- and vector-borne infections. Proper planning and preparation, involving workers and their representatives, can significantly reduce these risks.

23.1.2. The competent authority should conduct assessments of existing, increased or new OSH risks resulting from climate change, resource scarcity or other risks related to human health and the environment, and should identify adequate prevention and protection measures to seek to ensure OSH.

23.1.3. The competent authority should assess and define appropriate legislation to ensure that construction activities take appropriate steps to mitigate adverse impacts on safety and health and, where applicable, the wider environment, throughout the life cycle of products and processes.

23.1.4. The competent authority should establish standards with regard to the discharge of effluent, the disposal and transport of waste and the emission of smoke and chemicals. Such standards should be based on sound scientific criteria and accepted international practice.

23.1.5. As mentioned in paragraph 2.1.9 of this code, the competent authority should ensure that specific criteria are established for the disposal of hazardous chemicals and hazardous waste products, consistent with national laws and regulations, or other nationally and internationally recognized instruments (see section 23.7).

23.1.6. The competent authority should make available information on the prevention and reduction of emissions of smoke and chemicals, as well as solid waste, effluent and hazardous wastes and should provide additional support services with regard to OSH measures.

23.1.7. The competent authority should also regulate and incentivize construction sites to reduce, minimize and where possible eliminate emissions of smoke and chemicals, as well as the disposal and discharge of solid waste, effluent and hazardous waste, where applicable, across the supply chain of products and production processes.

23.1.8. Employers should inform themselves about relevant standards, national laws and regulations and the recommendations of the competent authority. They should carry out a risk assessment to determine the measures required to eliminate or control the hazards and reduce the risks associated with emissions of smoke and chemicals, as well as with solid waste, effluent and hazardous waste.

23.1.9. In accordance with national laws and regulations, the employer should undertake to eliminate or reduce emissions of smoke and chemicals, as well as the disposal and discharge of solid waste, effluent and hazardous waste.

23.1.10. The employer should dispose of hazardous wastes, both effluent and solid waste, in accordance with instructions guiding the hazardous chemicals and substances used or the safety practices applicable to hazardous materials and in compliance with national laws and

regulations concerning chemicals and effluent discharge and treatment (see sections 23.6 and 23.7).

23.2. Disaster preparedness

23.2.1. Employers should prepare emergency action programmes on construction and disaster management, in consultation with workers and their representatives. Workers should receive all necessary instruction, information and training in safe and healthy working practices during and after disasters, with particular attention given to those working in disaster relief and related remedial work.

23.3. Just transition

23.3.1. In line with the ILO *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, the competent authority in consultation with social partners should improve, adapt or develop and create awareness of OSH standards for technologies, work processes and new materials related to the transition.

23.4. Emissions of smoke and chemicals

23.4.1. In accordance with national laws and regulations, the employer should develop and implement policies and procedures to eliminate or reduce smoke and chemicals. The employer should inform, instruct and train workers on:

- (a) sources of emissions of smoke and chemicals and the location of exhaust vents;
- (b) the safe operation of ventilation, air pollution control and exhaust systems in place;
- (c) appropriate response procedures in the event of apparent failure of ventilation or pollution control devices and systems; and
- (d) the use of PPE in such an event.

23.4.2. The employer should provide workers who maintain and analyse the performance of pollution control devices and systems with training on the specific operating requirements and all necessary protocols, as well as emergency response measures.

23.5. Solid waste

23.5.1. In accordance with national laws and regulations, the employer should properly measure, segregate, manage, transport and dispose of all solid waste.

23.5.2. The employer should provide workers whose work involves solid waste handling with induction training and regular training thereafter. Training topics should include:

- (a) specific operational procedures for source reduction;
- (b) safe solid waste handling, storage, documentation and disposal techniques and procedures;
- (c) identifying hazardous waste and special procedures for the safe handling of such waste;
- (d) identifying and preventing contamination of materials collected for recycling; and
- (e) the use of PPE.

23.6. Effluent

23.6.1. In line with national laws and regulations, the employer should manage the construction site's water use and effluent, as well as the associated risk and minimize freshwater withdrawals and production of effluent.

23.6.2. The employer should provide workers with basic freshwater conservation and effluent awareness-training as part of their induction training. This should include training on:

- (a) types of effluent, discharge points and sources;
- (b) the consequences of uncontrolled releases to the environment; and
- (c) the use of PPE.

23.7. Hazardous wastes

23.7.1. Hazardous waste containing chemicals or other hazardous substances should be disposed of according to procedures based on criteria established by the competent authority or laid down in standards, codes or guidelines that have been approved or recognized by the competent authority for the treatment and disposal of hazardous chemicals and hazardous waste products, with a view to ensuring the safety of workers. These criteria should be consistent with the protection of the general public and the environment.

► Bibliography

ILO Declarations, Conventions, Recommendations, codes of practice and guidelines (non-exhaustive list)

A. Declarations

- ILO Declaration on Fundamental Principles and Rights at Work and its Follow-up, 1998
- ILO Declaration on Social Justice for a Fair Globalization, 2008
- ILO Centenary Declaration for the Future of Work, 2019

B. Conventions

- Forced Labour Convention, 1930 (No. 29), and the Protocol of 2014
- Labour Inspection Convention, 1947 (No. 81)
- Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- Labour Clauses (Public Contracts) Convention, 1949 (No. 94)
- Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- Equal Remuneration Convention, 1951 (No. 100)
- Abolition of Forced Labour Convention, 1957 (No. 105)
- Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- Radiation Protection Convention, 1960 (No. 115)
- Guarding of Machinery Convention, 1963 (No. 119)
- Employment Injury Benefits Convention, 1964 [Schedule I amended in 1980] (No. 121)
- Maximum Weight Convention, 1967 (No. 127)
- Workers' Representatives Convention, 1971 (No. 135)
- Minimum Age Convention, 1973 (No. 138)
- Occupational Cancer Convention, 1974 (No. 139)
- Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (No. 148)
- Occupational Safety and Health (Dock Work) Convention, 1979 (No. 152)
- Occupational Safety and Health Convention, 1981 (No. 155)
- Protocol of 2002 (recording and notification of occupational accidents and diseases) to the Occupational Safety and Health Convention, 1981
- Labour Statistics Convention, 1985 (No. 160)
- Occupational Health Services Convention, 1985 (No. 161)

- Asbestos Convention, 1986 (No. 162)
- Safety and Health in Construction Convention, 1988 (No. 167)
- Chemicals Convention, 1990 (No. 170)
- Night Work Convention, 1990 (No. 171)
- Prevention of Major Industrial Accidents Convention, 1993 (No. 174)
- Part-Time Work Convention, 1994 (No. 175)
- Private Employment Agencies Convention, 1997 (No. 181)
- Worst Forms of Child Labour Convention, 1999 (No. 182)
- Maternity Protection Convention, 2000 (No. 183)
- Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)
- Violence and Harassment Convention, 2019 (No. 190)

C. Recommendations

- Labour Inspection Recommendation, 1947 (No. 81)
- Equal Remuneration Recommendation, 1951 (No. 90)
- Protection of Workers' Health Recommendation, 1953 (No. 97)
- Discrimination (Employment and Occupation) Recommendation, 1958 (No. 111)
- Radiation Protection Recommendation, 1960 (No. 114)
- Reduction of Hours of Work Recommendation, 1962 (No. 116)
- Guarding of Machinery Recommendation, 1963 (No. 118)
- Employment Injury Benefits Recommendation, 1964 (No. 121)
- Maximum Weight Recommendation, 1967 (No. 128)
- Workers' Representatives Recommendation, 1971 (No. 143)
- Minimum Age Recommendation, 1973 (No. 146)
- Occupational Cancer Recommendation, 1974 (No. 147)
- Working Environment (Air Pollution, Noise and Vibration) Recommendation, 1977 (No. 156)
- Occupational Safety and Health (Dock Work) Recommendation, 1979 (No. 160)
- Occupational Safety and Health Recommendation, 1981 (No. 164)
- Labour Statistics Recommendation, 1985 (No. 170)
- Occupational Health Services Recommendation, 1985 (No. 171)
- Asbestos Recommendation, 1986 (No. 172)
- Safety and Health in Construction Recommendation, 1988 (No. 175)
- Chemicals Recommendation, 1990 (No. 177)

- Night Work Recommendation, 1990 (No. 178)
- Prevention of Major Industrial Accidents Recommendation, 1993 (No. 181)
- Private Employment Agencies Recommendation, 1997 (No. 188)
- Worst Forms of Child Labour Recommendation, 1999 (No. 190)
- Maternity Protection Recommendation, 2000 (No. 191)
- List of Occupational Diseases Recommendation, 2002 (No. 194)
- Promotional Framework for Occupational Safety and Health Recommendation, 2006 (No. 197)
- Employment Relationship Recommendation, 2006 (No. 198)
- HIV and AIDS Recommendation, 2010 (No. 200)
- Social Protection Floors Recommendation, 2012 (No. 202)
- Violence and Harassment Recommendation, 2019 (No. 206)

D. ILO codes of practice, guidelines and relevant publications

- ILO. 2009. *Workers' housing*, ILO Helpdesk Factsheet No. 6:
- —. 2013. *ILO code of practice on safety and health in the use of machinery*
- —. 2015. *Guidelines for a just transition towards environmentally sustainable economies and societies for all*
- —. 2017. *Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy*. Fifth edition
- —. n.d. "Occupational Safety and Health in the Construction Sector". Resource list ¹
- —. n.d. "On-line resource kit: Construction". Resource list ²
- —. n.d. *Resource library* on "Occupational Safety and Health" ³
- —. n.d. *Encyclopaedia of Occupational Health and Safety*

E. Other international instruments and processes

- FAO, IAEA, ILO, OECD/NEA, PAHO and WHO. 1996. *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*
- ILO. 2007. *ILO/WHO Global Programme for the Elimination of Silicosis (GPES)*
- —. 2016. *WASH@Work: A Self-Training Handbook*
- —. n.d. *Outline for a National Programme for the Elimination of Silicosis (NPES)*

¹ ILO online list of key resources on OSH in construction; regularly updated.

² ILO online list of key resources in construction; regularly updated.

³ ILO online library of key resources on OSH; regularly updated.

- ILO/IEA. 2021. *Principles and guidelines for human factors/ergonomics (HF/E) design and management of work systems*
- ILO/WHO. 2007. *Outline for the Development of National Programmes for Elimination of Asbestos-Related Diseases*
- United Nations. 2021. *Globally Harmonized System of Classification and Labelling of Chemicals (GHS)* (GHS, Rev. 9)

In addition to these publications, the Office consulted relevant laws, regulations, directives, guidelines and web pages of a number of ILO Member States and other sources concerning occupational safety and health for the preparation of this code.

► Appendix I

Workers' health surveillance

(adapted from ILO, *Technical and Ethical Guidelines for Workers' Health Surveillance*, 1998)

1. General principles

1. Competent authorities should ensure that laws and regulations governing workers' health surveillance are properly applied.

2. Workers' health surveillance should be carried out in consultation with workers and/or their representatives:

- (a) with the central purpose of the primary prevention of occupational and work-related injuries and diseases; and
- (b) under controlled conditions within an organized framework, as may be prescribed by national laws and regulations and in accordance with the Occupational Health Services Convention (No. 161) and Recommendation (No. 171), 1985 and the ILO *Technical and Ethical Guidelines for Workers' Health Surveillance* (1998).

2. Organization

1. The organization of workers' health surveillance at different levels (national, industry, enterprise) should take into account:

- (a) the need for a thorough investigation of all work-related factors and the nature of the occupational hazards and risks in the workplace which may affect workers' health;
- (b) the health requirements of the work and the health status of the working population;
- (c) the relevant laws and regulations and the available resources;
- (d) the awareness of workers and employers of the functions and purposes of such surveillance; and
- (e) the fact that surveillance is not a substitute for monitoring and control of the working environment.

2. In accordance with the needs and available resources, workers' health surveillance should be carried out at the national, industry, enterprise and/or other appropriate levels. Provided that surveillance is carried out or supervised by qualified occupational health professionals, as prescribed by national laws and regulations, it can be undertaken by:

- (a) occupational health services established in a variety of settings, for example within an enterprise or among enterprises;
- (b) occupational health consultants;
- (c) the occupational and/or public health facilities available in the community where the enterprise is located;
- (d) social security institutions;

- (e) worker-run centres;
 - (f) contracted professional institutions or other bodies authorized by the competent authority; or
 - (g) a combination of any of the above.
3. A comprehensive system of workers' health surveillance should:
- (a) include individual and collective health assessments, occupational work injury and disease recording and notification, sentinel event notification, surveys, investigations and inspections;
 - (b) comprise the collection of information from various sources and analysis and evaluation with regard to quality and intended use; and
 - (c) determine action and follow-up, including:
 - (i) guidance on health policies and OSH programmes; and
 - (ii) early warning capabilities so that the competent authority, employers, workers and their representatives, occupational health professionals and research institutions can be alerted to existing or emerging OSH problems.

3. Assessment

1. Medical examinations and consultations, as the most commonly used means of health assessment of individual workers, either as part of screening programmes or on an as-needed basis, should serve the following purposes:

- (a) the assessment of the health of workers in relation to hazards or risks, giving special attention to workers with specific needs for protection in relation to their health condition;
- (b) detection of pre-clinical and clinical abnormalities at a point when intervention is beneficial to the health of the individual;
- (c) prevention of further deterioration in workers' health;
- (d) evaluation of the effectiveness of control measures in the workplace;
- (e) reinforcement of safe methods of work and health maintenance; and
- (f) assessment of fitness for a particular type of work, with due regard to the adaptation of the workplace to the worker, taking into account individual susceptibility.

2. Pre-assignment medical examinations, where appropriate, carried out before or shortly after employment or assignment, should:

- (a) collect information which serves as a baseline for future health surveillance; and
- (b) be adapted to the type of work, vocational fitness criteria and workplace hazards.

3. During employment, medical examinations should take place at periodic intervals, as prescribed by national laws and regulations, and be appropriate to the occupational risks of the enterprise. These examinations should also be repeated:

- (a) on resumption of work after a prolonged absence for health reasons; and
- (b) at the request of the worker, for example, in the case of a change of work and, in particular a change of work for health reasons.

4. Where persons have been exposed to hazards and, as a consequence, there is a significant risk to their health in the long term, suitable arrangements should be made for post-employment medical surveillance for the purposes of ensuring the early diagnosis and treatment of such diseases.

5. Biological tests and other investigations should be prescribed by national laws and regulations. They should be subject to the worker's informed consent and performed according to the highest professional standards and least possible risk. These tests and investigations should not unnecessary new hazards to the workers.

6. Genetic screening should be prohibited or limited to cases explicitly authorized by national legislation, in accordance with the ILO code of practice on protection of workers' personal data (1997).

4. Collection, processing, communication and use of data

1. Workers' personal medical data should:

- (a) be collected and stored in conformity with medical confidentiality, in accordance with the ILO code of practice on protection of workers' personal data (1997); and
- (b) be used to protect the health of workers (physical, mental and social well-being) individually and collectively, in accordance with the ILO *Technical and Ethical Guidelines for Workers' Health Surveillance* (1998).

2. The results and records of workers' health surveillance should:

- (a) be clearly explained by professional health personnel to the workers concerned or to persons of their choice;
- (b) not be used for discrimination, for which there should be recourse in national law and practice;
- (c) be made available, where requested by the competent authority, to any other party agreed by both employers and workers, to prepare appropriate health statistics and epidemiological studies, provided anonymity is maintained, where this may aid in the recognition and control of occupational injuries and diseases; and
- (d) be kept for the time and under the conditions prescribed by national laws and regulations, with appropriate arrangements to ensure that workers' health surveillance records are securely maintained in the case of establishments that have closed down.

► Appendix II

Surveillance of the working environment (based on the Occupational Health Services Recommendation, 1985 (No. 171))

1. The surveillance of the working environment should include:
 - (a) identification and evaluation of the hazards and risks which may affect workers' safety and health;
 - (b) assessment of conditions of occupational hygiene and factors in the organization of work which may give rise to hazards or risks to the safety and health of workers;
 - (c) assessment of collective and PPE;
 - (d) assessment where appropriate of exposure of workers to hazardous agents by valid and generally accepted monitoring methods; and
 - (e) assessment of control systems designed to eliminate or reduce exposure.
2. Such surveillance should be carried out in liaison with the other technical services of the undertaking and in cooperation with the workers concerned and their representatives in the undertaking and/or the safety and health committee, where they exist.
3. In accordance with national law and practice, data resulting from the surveillance of the working environment should be recorded in an appropriate manner and be available to the employer, the workers and their representatives in the undertaking concerned or the safety and health committee, where they exist.
4. These data should be used on a confidential basis and solely to provide guidance and advice on measures to improve the working environment and the safety and health of workers.
5. The competent authority should have access to these data. They may only be communicated to others with the agreement of the employer and the workers or their representatives in the undertaking or the safety and health committee, where they exist.
6. The surveillance of the working environment should entail such visits by the personnel providing occupational health services as may be necessary to examine factors in the working environment which may affect workers' health, environmental health conditions at the workplace and working conditions.
7. Without prejudice to the responsibility of each employer for the safety and health of workers in their employment and with due regard to the necessity for workers to participate in OSH matters, personnel providing occupational health services should have such of the following functions as are adequate and appropriate to the occupational risks of the undertaking:
 - (a) carrying out monitoring of workers' exposure to hazards and risks, when necessary;
 - (b) advising on the possible impact on the workers' health of the use of technologies;
 - (c) participating in and advising on the selection of the equipment necessary for the personal protection of the workers against occupational hazards;
 - (d) collaborating in job analysis and in the study of organization and methods of work with a view to securing a better adaptation of work to the workers;

- (e) participating in the analysis of occupational accidents and occupational diseases and in accident prevention programmes; and
- (f) supervising sanitary installations and other facilities for the workers, such as drinking water, canteens and living accommodation, when provided by the employer.

8. Personnel providing occupational health services should, after informing the employer, workers and their representatives, where appropriate:

- (a) have free access to all workplaces and to the installations the undertaking provides for workers;
- (b) have access to information concerning the processes, performance standards, products, materials and substances used, or the use of which is envisaged, subject to their preserving the confidentiality of any secret information they may learn which does not affect the safety and health of workers; and
- (c) be able to take, for the purpose of analysis, samples of products, materials and substances used or handled.

9. Personnel providing occupational health services should be consulted concerning proposed modifications in work processes or in conditions of work liable to have an effect on the safety or health of workers.