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Safety and health in shipbuilding and ship repair

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Revised edition

ILO code of practice

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Preface

The ILO Code of practice on safety and health in shipbuilding and ship repair was adopted by a Meeting of Experts held in Geneva from 22 to 26 January 2018, in accordance with a Governing Body decision at its 329th Session (March 2017). The meeting was attended by 22 experts and their advisers - eight experts nominated by the Governments of Brazil, China, Italy, Japan, Republic of Korea, Nigeria, Philippines and Singapore; eight nominated by the Employers' group of the Governing Body; and six nominated by the Workers' group of the Governing Body. Expert observers from other governments, and observers from intergovernmental and non-governmental organizations, also attended the meeting.

This code of practice replaces an earlier code that was adopted in 1973 and was considered outdated, in view of technological and other developments that have taken place since then.

The good spirit of cooperation among all participants paved the way for developing consensus on a new, comprehensive and practical code that will help to raise the profile of safety and health issues in shipbuilding and ship repair in all parts of the world, and contribute to the health, morale and well-being of workers in the industry.

The text of the code was approved for publication by the Governing Body of the ILO at its 334th Session (October–November 2018).

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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 and Recommendations) and other sources, including Declarations, codes of conduct and other policy guidance adopted and endorsed by the International Labour Conference or the ILO Governing Body. 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

Acronyms, abbreviations and definitions

In this code of practice ("code"), the following terms are used in the meaning assigned to them below:

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

Competent person: A person with suitable training and sufficient knowledge, experience and skills for the safe performance of the specific work.

Contractor: A person or enterprise providing services to an employer at the employer's facility 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.

Dangerous occurrence: Readily identifiable event, as defined under national laws and regulations, with potential to cause injury or disease to people at work or the general public.

Employer: Any physical or legal person that employs one or more workers in a shipbuilding or ship repair facility and, as the context requires, the operator, the principal contractor, contractor or subcontractor.

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

Exposure limit: An exposure level specified or recommended by a competent authority to limit injury to health.

Guard: A part of machinery specifically designed to provide protection by means of a physical barrier.

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

Hazard: Has the inherent potential to cause injury or damage to a person's health.

IMO: International Maritime Organization.

IPCS: International Programme on Chemical Safety.

Occupational disease: A 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 in the facilities 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 light of their state of physical and mental health.

OSH: Occupational safety and health.

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

PPE: Personal protective equipment.

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 identifying, analysing and evaluating risks to safety and health arising from hazards at work.

Safety and health officer: A person with sufficient skills, knowledge and experience who assists employers and workers in assessing, designing, planning and implementing safety

activities and helps maintain an effective OSH management system.

Safety and health committee: A committee with representation of worker safety and health representatives and employer representatives, established and functioning according to national laws, regulations or practice.

Subcontractor: A person or an enterprise being contracted by the main contractor or employer to carry out work or deliver services, labour or materials as part of a larger project.

WHO: World Health Organization.

Worker: Any person who performs work, either regularly or temporarily, for an employer.

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.

Work-related injuries, ill health and diseases: Negative impacts on health arising from exposure to chemical, biological, physical, work-organizational and psychosocial factors at work.

Introduction

1. In accordance with the decision taken by the Governing Body of the ILO at its 329th Session in March 2017, a Meeting of Experts on Safety and Health in Shipbuilding and Ship Repair was convened in Geneva from 22 to 26 January 2018 to review and adopt a revised ILO code of practice ("code") on safety and health in shipbuilding and ship repair. The Meeting was composed of eight experts appointed following consultations with Governments, eight experts appointed following consultations with the Employers' group and six experts appointed following consultations with the Workers' group of the Governing Body.

2. Codes of practice are primarily designed as a basis for prevention, protective and corrective measures and are, in the area of safety and health, considered as ILO technical standards in occupational safety and health (OSH). The Governing Body agreed to the publication of the original code of practice on *Safety and Health in Shipbuilding and Ship Repairing* in 1973 and it was published the following year. This revised code reflects the many changes in the industry, its workforce, the roles of the competent authorities, shipowners, employers, workers and their organizations, and the development of new ILO instruments on OSH.

3. The first chapter provides an overview of the code's purpose, objectives and use. The general obligations, responsibilities, duties and rights of the stakeholders are outlined in the second chapter. Chapters 3–6 outline general principles, including on OSH management systems, management of change, OSH reporting and safety and health organization. Chapter 7 contains general preventive and protective measures

in the workplace, while Chapter 8 concerns operational planning, safe workplans and permit-to-work systems. Chapter 9 outlines health and safety requirements in the most common shipbuilding and ship repair operations. Chapters 10–13 provide detailed descriptions of hazardous substances, physical hazards, ergonomic and biological hazards, while Chapter 14 concerns safety requirements for tools, machines and equipment. Chapter 15 addresses the competence and training of managers, workers and contractors and Chapter 16 contains guidance on personal protective equipment (PPE). Finally, Chapters 17 and 18 outline measures for special protection and general welfare.

1. General provisions

1.1. Purpose and objectives

1. The purpose 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 shipbuilding and ship repair.

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

a) protecting all workers in shipbuilding and ship repair from workplace hazards;

b) preventing or reducing work-related injuries and diseases, ill health and dangerous occurrences;

c) formulating and implementing a coherent national policy and principles on OSH and the welfare of workers in shipbuilding and ship repair facilities and on the protection of the general working environment;

d) promoting effective consultation and cooperation between governments, shipowners, employers, workers and their organizations in the improvement of OSH in shipbuilding and ship repair;

e) establishing the respective role and obligations of the competent authorities and the responsibilities, duties and rights of shipowners, employers, workers and all other parties involved with regard to workplace hazards;

f) improving the management of OSH risks at each workplace through the implementation and integration of consistent OSH management systems; and

g) improving OSH knowledge and competence in shipbuilding and ship repair.

1.2. Application and scope

1. This code is applicable to all shipbuilding and ship repair facilities irrespective of the nature of the facility (pier, dry dock, building dock, slipway, workshops of contractors or other types of assembling locations).

2. The code provides guidance, in accordance with the provisions of national laws and regulations, to:

a) all government authorities, shipowners, employers, workers and their respective organizations and industry associations, whether they have a legislative or advisory role, whose activities influence the safety, health and welfare of workers in shipbuilding and ship repairing; and

b) all individuals at the level of shipbuilding and ship repair facilities, that is employers, persons in control of premises, workers, contractors and subcontractors, as appropriate to their duties and responsibilities for OSH.

3. The 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. More stringent applicable requirements have priority over the provisions of the code. 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.

4. The code addresses most of the currently identified hazards and risks associated with shipbuilding and ship repair. However, changes in the industry or in specific operations

may alter their risk profile and the code cannot therefore be assumed to address every hazard or risk.

5. 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 effective protection to all workers involved in shipbuilding and ship repair.

6. The 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.

7. Measures implemented to protect workers' health and safety in shipbuilding and ship repair facilities 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 safety and health policies and programmes.

8. The provisions of this code should be read in the context of national conditions and technical possibilities, and the scale of operations involved.

1.3. Reference to ILO instruments

1. In the establishment, implementation and review of policies and programmes on OSH in shipbuilding and ship repair under this code, competent authorities, shipowners and employers' and workers' organizations 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 relevant ILO instruments, including Conventions, Recommendations, codes of practice and guidelines. A list of these is contained in the bibliography at the end of this code.

2. General obligations, responsibilities, duties and rights

2.1. Cooperation

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

2. Measures for cooperation should be taken relating to the identification of hazards and the elimination or control of risks to safety and health from shipbuilding and ship repair operations. These measures should include the following:

a) shipowners should include OSH criteria in procedures for evaluating and selecting shipbuilding or ship repair facilities, including past OSH performance, and clearly communicate to the selected facility their expectation of the establishment and implementation of an OSH management system;

b) employers, in discharging their responsibilities, should cooperate and consult as closely as possible with all workers and/or their representatives;

c) workers should cooperate as closely as possible 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 relating to safety and health in shipbuilding and ship repair and receive the necessary education and training to do so;

d) manufacturers and suppliers should on request provide employers with all necessary information as is available and

required for the evaluation of any hazards or risks to safety and health that might result from a particular hazardous factor; and

e) the competent authority should endeavour to promote close cooperation between shipowners, designers, manufacturers, suppliers, employers, workers and their representatives on safety and health in shipbuilding and ship repair.

2.2. Competent authority

2.2.1. General provisions

1. The competent authority, in the light of national conditions and practice and the provisions of this code, in consultation with the most representative organizations of employers and workers concerned, should:

a) develop, maintain and control the application of laws and regulations on OSH in shipbuilding and ship repair facilities and identify and incorporate nationally and internationally recognized instruments into these;

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; and

c) consider making new, or updating existing, statutory provisions for the identification of hazards and the elimination or control of risks in shipbuilding and ship repair.

2. Statutory provisions should include national laws or regulations, codes of practice, exposure limits, standards of competency and training for all workers and establish a process for consultation with, and dissemination of, information to employers, workers and their representatives.

3. The competent authority should establish, in accordance with the provisions of relevant ILO Conventions and taking into account 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 shipbuilding and ship repair 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 shipbuilding and ship repair.

4. 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.

5. 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) 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 national laws or regulations.

6. The competent authority should ensure the enforcement of national laws and regulations concerning the policy mentioned above through an adequate and appropriate system of inspection. The system of enforcement should be developed through a consultative process involving employer and worker representatives. The system of enforcement should provide for corrective measures and adequate penalties for violations of national laws and regulations concerning the policy.

7. The measures to be taken to ensure that there is organized cooperation between employers and workers to promote safety and health at shipbuilding and ship repair facilities 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 representative of employers and workers with such powers and duties as may be prescribed;

b) the election or appointment of worker safety and health representatives with such powers and duties as may be prescribed;

c) the appointment by the employer of suitably qualified and experienced persons to promote safety and health; and

d) the training of safety and health representatives and safety and health committee members.

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

9. The competent authority should establish, apply, and periodically review a system for the sex-disaggregated recording and notification by employers of occupational accidents, occupational diseases and dangerous occurrences in shipbuilding and ship repair.

2.2.2. Inspectorates

1. Inspectorates designated by the competent authority should, in a manner prescribed by national laws and regulations:

a) enforce all relevant laws and regulations in shipbuilding and ship repair facilities;

b) periodically carry out inspections in the presence of the employer and worker representatives, and monitor compliance with all relevant laws and regulations;

c) assist employers, workers and their representatives with respect to their OSH responsibilities, duties and rights;

d) monitor the OSH requirements and performance of comparable national or international shipbuilding and ship repair facilities to provide feedback for further development and improvement of safety measures; and

e) 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. 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 shipbuilding and ship repair and be able to provide support and advice;

b) have the authority to investigate fatal and serious accidents, dangerous occurrences and diseases;

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 shipbuilding and ship repair activities on safety and health grounds, until the condition giving rise to the suspension or restriction has been corrected; and

g) have access to all worker health and safety education and training records.

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

2.3. Employers

1. Employers have a duty to coordinate, protect and promote the safety and health of all workers on site. Employers should comply with the measures to be taken regarding hazards or risks to safety and health in shipbuilding and ship repair, including appropriate nationally and internationally recognized instruments, codes and guidelines as prescribed, approved or recognized by the competent authority.

2. Employers should provide and maintain workplaces, plant, equipment, tools and machinery, and should design work so as to eliminate or, if this is not practicable, control hazards and risks in shipbuilding and ship repair, and be consistent with national laws and regulations.

3. Employers should set out in writing their respective programmes and arrangements as part of their general policy in the field of OSH, and the various responsibilities exercised under these arrangements. This information should be clearly communicated to their workers by oral, written or other suitable means, commensurate with the ability of the workers.

4. Employers, in consultation with workers and their representatives, should:

a) make an assessment of the hazards and risks to the safety and health of workers arising from shipbuilding and ship repair, requesting and making effective use of the information provided by the supplier of equipment or materials and from other reasonably available sources; and

b) take all reasonable, practicable and feasible measures to eliminate or, if this is not possible, control risks to safety and health identified in the above risk assessment, in order to reduce exposure.

5. In taking preventive and protective measures, the employer should address the hazardous factor or risk in accordance with the hierarchy set out in section 3.4, paragraph 3. If the employers, workers or their representatives cannot agree, the issue should be referred to the competent authorities in accordance with subsection 2.2.1, paragraph 8.

6. Employers should make the necessary arrangements to provide and integrate prevention activities as follows:

a) regular surveillance of the working environment and appropriate health surveillance;

b) adequate and competent supervision of work and work practices;

c) the application and use of appropriate control measures and the periodic review of their effectiveness;

d) education and training to managers, supervisors and workers, and to worker safety and health representatives, on issues relating to hazards in shipbuilding and ship repair;

e) where necessary, measures to deal with emergencies and accidents, including first-aid arrangements; and

f) investigate accidents, illnesses and incidents, in cooperation with health and safety committees and/or workers' representatives, to identify all causes, and measures necessary to prevent recurrences of similar accidents, illnesses and incidents.

7. Employers should be required to provide, where necessary, adequate protective clothing and protective equipment to prevent, so far as reasonably practicable, risks of accidents or adverse effects on health. OSH measures should not involve any expenditure for the workers.

8. Employers should have in place arrangements to:

a) deal with accidents and dangerous occurrences that may involve hazards or risks to safety and health in shipbuilding and ship repair; and

b) eliminate or control any risk to the safety and health of workers, and thereby to the public and the environment.

9. When an employer has more than one establishment, the employer should provide safety and health measures relating to the prevention and control of, and protection against, injuries and risks to safety and health in shipbuilding and ship repair to all workers without discrimination.

10. Shipbuilding or ship repair enterprises should maintain the highest standards of safety and health, in conformity with national requirements, bearing in mind their relevant experience within the enterprise as a whole, including any knowledge

of special hazards. They should also make available to the representatives of the workers, and upon request, to the competent authorities and the workers' and employers' organizations in all countries in which they operate, information on the OSH standards relevant to their local operations, which they observe in other countries. In particular, they should make known to those concerned any special hazards and related protective measures associated with new products and processes. They, like comparable domestic enterprises, should be expected to play a leading role in the examination of causes of industrial safety and health hazards and in the application of resulting improvements within the enterprise as a whole.

11. Employers should initiate and maintain a process of consultation and cooperation with workers and their representatives concerning all aspects of safety in shipbuilding and ship repair specified in this code, in particular as regards the measures of prevention and protection listed in paragraphs 1–10 above. This process should be carried out within the framework of safety and health committees, as recommended by the Occupational Safety and Health Convention, 1981 (No. 155), or through another mechanism determined by the competent authority or by voluntary agreements.

12. Employers should verify:

a) compliance with safety regulations;

b) maintenance of safe working techniques;

c) the care taken of machines and equipment, particularly any devices provided in the interest of safety;

d) training in the use of, and the care taken of, personal protective equipment (PPE); and

e) the competence of managers, supervisors and workers for their tasks.

13. Whenever two or more employers undertake activities simultaneously at one workplace, they should collaborate in order to comply with the prescribed OSH measures, without prejudice to the responsibility of each employer for the safety and health of all workers. In appropriate circumstances, the competent authority should prescribe general procedures for this collaboration.

14. Managers and supervisors should implement the enterprise's OSH policy, including through the selection of safe equipment, work methods and work organization, and the maintenance of high levels of skill. They should endeavour to reduce risks and hazards to safety and health in the activities for which they are responsible to as low a level as reasonably practicable.

15. Managers and supervisors should ensure that workers receive adequate information and training on safety and health regulations, policies, procedures and requirements, and satisfy themselves that this information is understood.

16. Managers and supervisors should assign tasks to their subordinates in a clear and precise way. They should satisfy themselves that workers understand and implement the OSH requirements.

17. Managers and supervisors should ensure that work is planned, organized and carried out in such a way as to eliminate or, if this is not possible, reduce the risk of accidents and the exposure of workers to conditions that may lead to injury or damage their health.

18. In consultation with workers and/or their representatives, managers and supervisors should assess the need for additional instruction, training and education of workers by monitoring compliance with safety requirements.

19. When managers or supervisors observe non-compliance with safety and health regulations or codes of practice by any person, they should take corrective action immediately. If such action is unsuccessful, the problem should be referred to a higher level of management immediately.

20. Employers should establish effective ongoing communication and coordination between appropriate levels of the shipbuilding and ship repair facility with contractors and subcontractors prior to the commencement of work.

2.4. Workers

1. Workers have the duty to cooperate with the employer to achieve compliance with the OSH duties and responsibilities of the employer.

2. When workers or their representatives observe non-compliance with safety and health regulations or codes of practice, they should take appropriate action immediately. If such action is unsuccessful, the problem should be referred to a higher level of management immediately.

3. Workers have the responsibility, in accordance with their training, and the instructions and means given by their employers, to:

a) comply with prescribed OSH measures;

b) take all steps to eliminate or control hazards or risks to themselves and to others arising during the construction or repair of ships, including the proper care and use of protective clothing, facilities and equipment placed at their disposal for this purpose;

c) report forthwith to their immediate supervisor or safety and health representative any unusual conditions at the facility or affecting installations and equipment which they believe

could present a hazard or risk to their safety or health or that of other people arising from the shipbuilding or ship repair operation, and which they cannot deal with effectively themselves; and

d) cooperate with the employer and other workers to permit compliance with the duties and responsibilities placed on the employer and workers, and to participate with the safety and health committee in the development and implementation of the OSH management system of the shipbuilding and ship repair facility.

4. Workers should participate in instruction and training programmes provided by the employer or required by the competent authority, and should demonstrate such acquired knowledge and understanding of safety and health measures on the job. Workers and their representatives should review the instruction and training programmes for effectiveness. Where they determine that these programmes are ineffective, they should make recommendations to the employer to improve their effectiveness.

5. Workers should participate and cooperate in exposure monitoring and health surveillance programmes required by the competent authority and/or provided by the employer for the protection of their health.

6. Workers and their representatives should participate in the process of consultation and cooperate with employers concerning all aspects of safety of shipbuilding and ship repair operations specified in this code, and in particular as regards measures of protection and prevention listed in section 2.3, paragraphs 1–10.

7. Workers and their representatives have the right to:

a) be consulted regarding any hazards or risks to safety and health in shipbuilding and ship repair;

b) inquire into and receive information from the employer regarding any hazards or risks to safety and health arising from shipbuilding and ship repair operations, including information from suppliers. This information should be provided in forms and languages easily understood by the workers;

c) take adequate precautions, in cooperation with their employer, to protect themselves and other workers against hazards or risks to safety and health from shipbuilding and ship repair operations; and

d) be consulted and be involved in the assessment of hazards and risks to safety and health from hazardous factors to be conducted by the employer and/or by the competent authority. They should also have the right to be involved in relevant control measures and investigations.

8. Workers and their representatives should be involved in the introduction and development of workers' health surveillance, and should participate and cooperate with their employers and with occupational health professionals in its implementation.

9. Workers should be informed in a timely, objective and comprehensible manner:

a) of the reasons for the examinations and investigations relating to the safety and health hazards involved in their work; and

b) individually of the results of medical examinations, including pre-assignment medical examinations, and of the respective health assessments. The results of medical examinations should be kept confidential in accordance with national laws and regulations and should not be used to discriminate against workers.

10. Workers have the right:

a) to bring to the attention of their representatives, the employer or the competent authority hazards or risks to safety and health arising from shipbuilding and ship repair operations;

b) to appeal to the competent authority if they consider that the measures taken and the means used by the employer are inadequate for the purpose of ensuring OSH at work;

c) to remove themselves and their co-workers in the vicinity from danger resulting from shipbuilding and ship repair operations when they have reasonable justification to believe that there is an imminent and/or serious risk to their safety and health. Such workers should inform their supervisor and/or safety and health representative immediately;

d) in the case of a safety or health condition that places them at increased risk of harm, to be transferred to alternative work not exposing them to that increased risk, if such work is available and if the workers concerned have the qualifications or can reasonably be trained for such alternative work;

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

f) to be provided with adequate medical treatment and compensation for occupational injuries and diseases resulting from shipbuilding and ship repair; and

g) to refrain from using or to shut down equipment or a process, or to refrain from using a substance which can reasonably be expected to be hazardous, if the relevant information is not available to assess the hazards or risks to safety and health.

11. Workers who remove themselves from danger in accordance with the provisions of paragraph 10(c) above should be protected against undue consequences in accordance with national laws and regulations.

12. Workers who justifiably take those actions specified in paragraph 10(a), (b) and (g) should be protected from unwarranted discrimination, for which there should be recourse in national laws and regulations.

13. Workers and their elected safety and health representatives should receive appropriate education and training and, where necessary, retraining in the most effective methods available for minimizing risks to safety and health from the shipbuilding and ship repair operations, in particular in those areas referred to in Chapters 9–14 of this code.

14. Women workers have the right, in the case of pregnancy or when breastfeeding, to alternative work not hazardous to the health of the unborn or nursing child, where such work is available, in order to prevent exposure to hazards in shipbuilding and ship repair, and to return to their previous jobs at the appropriate time.

15. The supply of labour by private employment agencies is the subject of the ILO Private Employment Agencies Convention, 1997 (No. 181), and its accompanying Private Employment Agencies Recommendation, 1997 (No. 188).

2.5. Suppliers, manufacturers and designers

1. In accordance with the guidance contained in the ILO code of practice on safety and health in the use of machinery (2013), national laws, regulations and other measures should be taken to ensure that those who design, manufacture, import, provide or transfer machinery, equipment or substances for use in shipbuilding and ship repair:

a) ensure that the machinery, equipment or substances do not entail dangers for the safety and health of those using them correctly and are in compliance with national safety laws

and regulations or internationally recognized instruments applicable to their design and construction;

b) make available:

i) information concerning their requirements for the correct set up, use and maintenance of machinery and equipment and the correct use of substances;

ii) information concerning the hazards of machinery and equipment, including the dangerous part of machinery and hazardous components of equipment, and the dangerous properties of hazardous substances and physical agents or products; and

iii) information on how to eliminate or control risks arising from the identified hazards associated with the products; and

c) submit to the shipbuilding or ship repair facility a list of vehicles and workers delivering standard products (that is bolts, nuts and gaskets) and refilling stocks with products or chemicals on a regular basis.

2. In accordance with the ILO Chemicals Convention, 1990 (No. 170), suppliers of chemicals, whether manufacturers, importers or distributors should provide users with the relevant safety data sheets and with instructions for the safe use of chemicals.

2.6. Contractors and subcontractors

1. Contractors and subcontractors should ensure that any person under their control performing tasks that may affect OSH is competent in terms of education, training and experience, and should keep the associated records.

2. Contractors and subcontractors should comply with the arrangements established by the employer in charge of the shipbuilding or ship repair facility, which should:

a) include the contractor and subcontractor performing a risk assessment, establishing risk controls for their work and submitting a workplan to the employer. The contractor and subcontractor should comply with the workplan and risk controls and inform the employer of any changes;

b) include OSH criteria in procedures for evaluating and selecting contractors and subcontractors;

c) establish effective ongoing communication and coordination between appropriate levels of the shipbuilding and ship repair facility and the contractor and subcontractor prior to commencing work, which should include provisions for identifying hazards and the measures to eliminate and control risks;

d) include arrangements for reporting work-related injuries and diseases, ill health and dangerous occurrences among the contractor's and subcontractor's workers while performing work for the shipbuilding and ship repair facility;

e) provide relevant workplace safety and health hazard awareness, information and training to contractors and subcontractors or their workers prior to commencing work and as work progresses, as necessary;

f) include regular monitoring of their OSH performance;

g) include 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

h) ensure that on-site OSH procedures and arrangements are followed by the contractor(s) and subcontractor(s).

3. When using contractors and subcontractors, the shipbuilding and ship repair facility should ensure that:

a) contractors and subcontractors develop a safety and health plan in accordance with the shipbuilding and ship repair facility OSH management system that is approved by the employer in charge of the shipbuilding and ship repair facility prior to commencing work;

b) the same safety and health rights outlined in subsection 2.2.1, paragraph 7, apply to contractors and subcontractors and their workers as to the workers in the establishment, including education and training requirements and procedures to investigate accidents, occupational illnesses and dangerous occurrences;

c) where required, only such contractors and subcontractors are used that have been duly registered or hold licences; and

d) 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 employer in charge of the shipbuilding and ship repair facility to inspect work and to stop work whenever a risk of serious injury is apparent and to suspend operations until the necessary remedies have been put in place.

3. Occupational safety and health management systems

3.1. Introduction

1. The process of improving working conditions at a shipbuilding or ship repair facility should be approached in an inclusive and systematic way in order to bring them up to reasonable standards. With a view to achieving acceptable and environmentally sound OSH conditions, it is necessary to invest in permanent structures for their continuous review, planning, implementation, evaluation and action. This should be done through the implementation of OSH management systems. The systems should be specific to the facilities and appropriate to their size and the nature of their activities. Their design and application should be guided by the ILO *Guidelines on occupational safety and health management systems* (2001) and also by the ILO *10 Keys for Gender Sensitive OSH Practice – Guidelines for Gender Mainstreaming in Occupational Safety and Health* (2013).

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 below:

3. OSH measures and measures to protect the environment are intrinsically linked. It is strongly recommended that shipbuilding and ship repair facilities, in conjunction with an OSH management system, have an environmental management system in place which identifies the environmental impact and facilitates the setting of environmental performance targets and measurement of progress.

Figure 1. Main elements of the OSH management system

3.2. Occupational safety and health policy

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

a) specific to the shipbuilding and ship repair facility 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 shipbuilding and ship repair facility;

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.

2. The OSH policy should include, as a minimum, the following key principles and objectives to which the shipbuilding and ship repair facility is committed:

a) protecting the safety and health of all workers of the shipbuilding and ship repair facility by preventing work-related injuries, ill health, diseases and incidents;

b) complying with relevant OSH national laws and regulations, voluntary programmes, collective agreements on OSH and other requirements to which the shipbuilding and ship repair facility 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. The OSH management system should be compatible with or integrated in other management systems in the shipbuilding and ship repair facility.

3.2.1. Worker participation

1. Worker participation is an essential element of the OSH management system in the shipbuilding and ship repair facility.

2. 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. 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.

3.3. Initial review

1. Before works begin the employer should guarantee that an initial review is carried out by competent persons, in consultation with workers and their representatives, as appropriate. It should:

a) identify the necessary work procedures and the associated hazards;

b) assess the risks to safety and health arising from the existing or proposed work environment or work organization;

c) 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;

d) determine whether planned or existing controls are adequate to eliminate hazards or control risks; and

e) analyse other available data, in particular data provided from workers' health surveillance (see Appendix I), the surveillance of the working environment (see Appendix II) and active and reactive monitoring, if available.

2. The initial review should be used in the systematic development of safety arrangements in shipbuilding and ship repair and as the basis for the planning and practical implementation of the OSH policy.

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

1. For work which by its very nature exposes workers to hazardous chemical, physical or biological factors, psychosocial factors and climatic conditions, arrangements should be made for the identification and periodic assessment of these hazards and risks to safety and health at each permanent or temporary workplace in both the facility and every new ship, generated by the use of different operations, tools, machines, equipment and substances. This review, together with other available data disaggregated by sex, should be used for the development of safe workplans, as described in section 8.2.

2. Employers should plan and implement appropriate preventive and protective measures required to prevent the identified hazards and assessed risks, or reduce them to the lowest reasonable and practicable level, in conformity with national laws and regulations.

3. 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 control measures 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, provide for the use of PPE, including protective clothing, in various sizes, adaptable to

both women and men and at no cost to workers, and implement measures to ensure its use and maintenance.

4. 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.

3.4.1. Hazard identification

1. 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 injury or illness;

b) the nature of potential injury or illness relevant to the activity, product or service;

c) past injuries, dangerous occurrences and illness;

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.

3.4.2. Risk assessment

1. Risk assessment is a process used 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 have control priorities assigned, based on the assessed level of risk. The priority for control increases as the assessed level of risk rises.

2. The risk assessment process should take account of the likelihood and severity of injury or illness from the identified hazard. There are many established and recognized methods and techniques that can be implemented for the purpose of risk assessment.

3.4.3. Risk control

1. Unless a particular hazard or exposure to the hazard is removed, the risk associated with such a hazard can never be completely eliminated. In such cases such a risk should be controlled following the order of priority described in section 3.4, paragraphs 3 and 4.

2. The employer should plan the management and control of those activities, products and services that can or may pose a significant risk to safety and health.

3. 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. Control measures should also be reviewed and, if necessary, revised following an accident.

3.4.4. Evaluation

1. The processes of hazard identification, risk assessment and control should be subject to a documented evaluation of effectiveness and modified as necessary, to establish an ongoing process for continual improvement.

2. Evaluations should take into consideration advances in technology, knowledge and experiences nationally and internationally.

3. Practical examples and guidance can be found in *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. Contingency and emergency preparedness

3.5.1. Emergency preparedness

1. Emergency planning, prevention, preparedness and response arrangements should be established and maintained. 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 shipbuilding and ship repair facility and also take into account the size and nature of the activities associated with each shipbuilding and ship repair operation.

2. The emergency plans should be made and updated for every ship under construction and for each major repair or conversion in accordance with relevant internationally recognized instruments and national laws and regulations, taking into account the size and nature of the activities at the shipbuilding and ship repair facility. They should:

a) ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the facility;

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, firefighting and evacuation of all people at the facility; and

d) provide relevant information and training to all workers at a shipbuilding and ship repair facility 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. Emergency prevention, preparedness and response arrangements should be established by the employer in charge of the shipbuilding and ship repair facility in cooperation with workers, external emergency services and other bodies where applicable.

4. The emergency response plan should be developed locally for each shipbuilding and ship repair facility and should be sufficiently comprehensive to deal with all types of emergencies. The plan should include, for each foreseeable scenario, as a minimum:

a) emergency escape routes and procedures, including signings and markings indicating 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 worksite, especially from inside the hull of the ship and the surrounding area, premises or establishment;

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 fire and other emergencies; and

g) the provision of relevant information and training to all persons engaged in work in the facility, at all levels, including regular exercises, at least annually, in emergency prevention, preparedness and response procedures.

5. The emergency response plan should be evaluated periodically with the necessary improvements recorded and implemented.

6. A chain of command should be established to minimize confusion and ensure that workers have no doubt about who has the authority to make decisions. Responsible individuals should be selected to coordinate the work of the emergency response teams. 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 the fire, controlling leaks and spills, emergency shutdown, and 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.

7. The necessary and most recent information, as well as internal communication and coordination, should be provided to protect all persons in the event of an emergency at the worksite. Alarms should be capable of being seen and heard by everyone.

8. Emergency response teams should be established and capable, among others, of:

a) firefighting;

b) first aid;

c) resuscitation;

d) shutdown procedures;

e) evacuation procedures;

f) chemical spill procedures;

g) use of self-contained breathing apparatus and other PPE; and

h) search and rescue.

9. In the absence of formal medical facilities at the shipbuilding or ship repair facility, the following should be provided:

a) eye washes, showers or suitable equipment for quick drenching or flushing in the area for immediate use where the eyes or body of any worker may be exposed to injurious corrosive materials; and

b) emergency telephone numbers, or other contact information posted in conspicuous places.

10. Notwithstanding paragraphs 3–7 above, emergency procedures, first aid and firefighting 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 shipbuilding or ship repair

facilities 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). Where in a shipbuilding or ship repair facility hazardous chemicals are stored 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.

3.5.2. First aid

1. The employer should be responsible for ensuring that first aid, including the provision of trained personnel, is available. 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.

2. A sufficient number of workers for every shift should be trained in basic first aid and their contact details should be easily available. This training should include the treatment of open wounds and resuscitation. In areas where the work involves the risk of intoxication by chemicals, fumes or smoke, insect bites or other specific hazards, first-aid training should be extended accordingly in consultation with an appropriately qualified person or organization.

3. First-aid training should be repeated at regular intervals to ensure that knowledge and skills do not become outdated or forgotten.

4. Where the work involves a 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.

5. Suitable rescue and resuscitation equipment, as required, including stretchers, should be kept readily available at the shipbuilding and ship repair facility or ship, as appropriate. All workers should be informed of the location of this equipment and the procedure for obtaining stocks.

6. First-aid kits or boxes, as appropriate, containing prescribed items, should be provided and be readily accessible at all workplaces, including isolated locations, lifting appliances, boats, transport and floating equipment, and for maintenance teams, and should be protected against contamination by dust, moisture, etc. These containers should be clearly marked and contain nothing other than first-aid equipment.

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

8. 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 and as a rest place for seriously sick or injured workers.

9. Unless there is a hospital or other suitable medical facility nearby and conveniently accessible to the shipbuilding and ship repair facility and a suitable ambulance properly maintained and available at all times during working hours, a convenient location should be provided, furnished with a sufficient number of beds, together with the necessary equipment and supplies, for the preliminary treatment of injuries or illness and suitable for the temporary use of persons injured at the shipbuilding and ship repair facility.

10. A first-aid register should be kept at the shipbuilding and ship repair facility for recording the names and sex of persons to whom first aid has been rendered and particulars of injuries and treatment. The register should only be accessible to authorized persons. The register may be made available, excluding confidential information, to a competent authority and the safety and health committee for the purposes of incident and injury analysis.

11. Persons in supervisory positions should hold a recognized first-aid certificate. First-aid training should be made available to all workers.

3.5.3. Rescue

1. Provision should be made for rapid evacuation in the event of injury or illness which requires medical assistance.

2. Transport or a means of communication should be available at the worksite to contact rescue services in case of an emergency. The functioning of the communication arrangements should be checked periodically.

3. All workers should be informed of the procedures to be followed in case of emergency. Information should also be provided on the worksite and on the location of meeting points for evacuation.

4. A place should be provided at worksites where an ill or injured person can rest in comfort until evacuated.

5. Vehicles should always be available for transportation to a point where an ambulance can be met.

6. Where professional help is not available within a reasonable distance, particularly in remote areas, consideration should be given to the creation of the necessary dispensing and health-care facilities.

4. Management of change

1. The impact on OSH of internal changes (for example in staffing or due to new processes, working procedures, organizational structures or acquisitions) and external changes (for example as a result of amendments of 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.

2. A workplace hazard identification and risk assessment should be carried out before any modification of the project schedule or introduction of new work methods, materials, processes or machinery.

3. While much of what happens in shipbuilding or ship repair 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 a need to develop and implement processes to identify such "non-routine" work, or instances where established procedures are seen as inadequate.

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;

e) work that must be performed in a different way to a documented procedure (including due to an approaching

deadline or instances where a procedure is identified as inadequate); and

f) "routine" tasks that carry a particular risk and warrant oversight before proceeding.

5. The key to managing the risks of such work is to halt the ongoing operation to allow for an established degree of assessment before proceeding. This provides an opportunity for situational awareness to be improved before proceeding.

6. Responses to the identification of non-routine work might include:

a) discussion with a supervisor;

b) performance of an "on-the-job" assessment to an established standard before proceeding;

c) performance of a more formal job safety analysis to an established standard prior to the work proceeding;

d) development or revision of a documented procedure or safe workplan to cover the work;

e) conduct of a formal risk assessment and development of appropriate controls; or

f) implementation of an established permit to work system (this is commonly the case for work such as work at heights, or work in a confined space).

7. Whenever new ships or equipment are introduced and new working methods are needed, special attention should be paid to informing and training workers with respect to the implications for safety and health.

8. Arrangements to support this approach should be in place very early on in the development and operation of a shipbuilding and ship repair facility. It should be made clear, and accepted, that an unacceptable response to non-routine work is to "do nothing".

5. Reporting, recording and notification of work-related injuries and diseases, ill health and dangerous occurrences

5.1. General provisions

1. In the establishment, review and application of systems for the reporting, recording and notification of work-related injuries and 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 ILO 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 diseases.

2. Reporting, recording, notification and investigation of work-related injuries and diseases, ill health and dangerous occurrences are essential for preventive as well as reactive monitoring and should be undertaken to:

a) provide reliable sex-disaggregated information about occupational accidents, dangerous occurrences and occupational diseases at the facility and national level;

b) identify major safety and health problems for both women and men arising from shipbuilding and ship repair activities;

c) define priorities of action;

d) evolve effective and inclusive methods for dealing with occupational accidents and diseases;

e) monitor the effectiveness of measures taken to secure satisfactory levels of safety and health; and

f) monitor improvements over time and reveal new developments and issues.

3. By national laws or 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 work-related injuries and diseases, ill health and dangerous occurrences are subject to requirements for reporting, recording and notification; these should comprise, as a minimum:

i) all fatal accidents;

ii) occupational accidents causing loss of working time, other than insignificant loss; and

iii) all occupational diseases;

b) establish and apply uniform requirements and procedures for facility-level reporting and recording of work-related injuries and diseases, ill health, 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-disaggregated data, and specify, 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 enterprises 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 shipbuilding and ship repair activities, regardless of their employment status or type of work performed.

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 the Employment Injury Benefits Convention, 1964 (No. 121), as amended in 1980; and

b) comprise, to the extent possible, other diseases contained in the List of Occupational Diseases Recommendation, 2002 (No. 194), and the ILO List of Occupational Diseases (revised 2010).

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

a) the system for benefits in case of occupational injury and occupational disease; and

b) the system for the recording and notification of work-related injuries and diseases, ill health and dangerous occurrences.

6. Workers and their representatives in the facility should be given appropriate information by the employer about the arrangements for:

a) the recording and notification of information required for benefits in the case of occupational injury and occupational disease; and

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

5.2. Reporting at the level of the facility

1. 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 work-related injuries and diseases, ill health and dangerous occurrences, as appropriate.

5.3. Recording at the level of the facility

1. The employer should ensure that records of work-related 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 facility, guidance should be drawn from this code, as well as from other relevant nationally and internationally recognized instruments.

2. 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.

3. 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.

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

5. Workers in the course of performing their work should cooperate with the employer in carrying out the arrangements within the facility for recording and notification of work-related injuries and diseases, ill health and dangerous occurrences.

6. 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 work-related injuries and diseases, ill health and dangerous occurrences.

7. The employer should provide appropriate information to workers and their representatives on all work-related injuries and diseases, ill health and dangerous occurrences in the facility, as well as commuting accidents, to help workers and employers reduce the risk of exposure to similar events.

5.4. Notification of work-related injuries

1. All fatalities and serious occupational accidents should be notified to the direct family of the accident victim, which should be informed as soon as possible and, as required by national laws or regulations, to the competent authority, the labour inspectorate, the appropriate insurance institution or any other body:

a) immediately after the reporting of an occupational accident causing loss of life; and

b) within a prescribed time for other occupational accidents.

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

a) an accident report for the labour inspectorate;

b) a compensation report for the insurance institution;

c) a report for the statistics-producing body; or

d) a single form which contains all essential sex-disaggregated data for all bodies.

3. With a view to meeting the requirements of labour inspectorates, insurance institutions and the statistics producing body, the forms prescribed in either a specific or single format should include at least the following minimum information:

a) facility and employer;

b) injured person (name, address, gender and age; employment status; occupation);

c) type, nature and location of injury; and

d) accident and its sequence (geographical location of the place of the accident, date and time, action leading to injury, type of accident).

4. National laws or regulations should provide for the specification of the relevant necessary information to be notified for commuting accidents and of more detailed information, if available.

5.5. Notification of occupational diseases

1. National laws or regulations should specify that notification of occupational diseases include at least the following information:

a) facility and employer;

b) person affected by the occupational disease (name, sex, employment status, occupation at the time when the disease was diagnosed, work history); and

c) occupational disease (name, nature, harmful agents, processes or exposure, description of work, length of exposure, date of diagnosis).

6. Safety and health organization

6.1. Occupational health services

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

a) by laws or regulations;

b) by collective agreements or as otherwise agreed upon by the employers and workers concerned; or

c) in any other manner approved by the competent authority after consultation with the representative organizations of employers and workers concerned.

2. Occupational health services may be organized as a service for a single facility or as a service common to a number of facilities, as appropriate, and by:

a) facilities or groups of facilities concerned;

b) public authorities or official services; or

c) social security institutions or any bodies authorized by the competent authority.

3. 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) and working practices which may affect workers' health, including sanitary installations, canteens 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 in 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);

g) the adaptation of work to the worker;

h) the contribution to measures of vocational rehabilitation;

i) collaboration in providing information, training and education in the fields of OSH, hygiene and ergonomics;

j) the organizing of first aid and emergency treatment; and

k) participation in analysis of occupational incidents, accidents and diseases.

4. A multiplicity of health hazards is present in shipbuilding and ship repair work and every effort should be made to promote awareness of this fact and of the need to safeguard health.

5. All workers should be subject to health surveillance which should be provided in line with the ILO *Technical and*

ethical guidelines for workers' health surveillance (1998) and as prescribed by national laws and regulations. These guidelines require arrangements, in particular regarding the following activities (see Appendix I):

a) organization of workers' health surveillance at different levels;

b) health assessments and collection, analysis and evaluation of information;

c) pre-assignment, regular and post-employment medical examinations; and

d) use of the results and records of workers' health surveillance.

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 of these guidelines and as prescribed by national laws and regulations.

6.2. Safety and health officers

1. In every shipbuilding and ship repair facility the employer should appoint (a) safety and health officer(s) to be in charge of all matters relating to safety and hygiene on the project.

2. All safety and health officers should have qualifications and training to perform this role.

3. At all shipbuilding and ship repair facilities at which a minimum number of workers, as prescribed by national laws or regulations, is regularly employed, the safety and health officer should be employed full time on safety and health activities.

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

a) advise management and other persons responsible for OSH, especially on:
   i) the planning and installation of plant, and of welfare and sanitary facilities;
   ii) the acquisition of working equipment and the introduction of work processes;
   iii) the selection of PPE;
   iv) the organization of workshops, the methods of work and the working environment; and
   v) the daily measurement of oxygen in confined spaces as well as other general preventive and protective measures described in chapter 7 of this code.

b) make appropriate safety inspections of working installations and technical devices, especially before they are put into service, and of processes, especially before they are brought into operation;

c) exercise surveillance of OSH measures, and for that purpose:
   i) visit workplaces at regular intervals and report any deficiencies to the employer or to other persons responsible for OSH, and propose measures for remedying such deficiencies;
   ii) observe whether PPE is being used;
   iii) investigate the causes of accidents and compile reports on the causes and circumstances of every lost-time accident, minor accident and dangerous occurrence, the statistics produced to be such as to ensure their comparability with those of other shipbuilding and ship repair facilities;
   iv) compile and evaluate the results of investigations and propose to management measures to prevent the occurrence and recurrence of accidents;

v) exercise surveillance over the execution of specific accident prevention measures; and

vi) ensure that official regulations, instructions and other nationally and internationally recognized instruments relating to safety and hygiene are complied with;

d) assist workers to comply with the requirements of OSH, and especially instruct them in the occupational hazards to which they are exposed and in the equipment and measures for preventing these hazards, and cooperate and participate in the periodic training of first-aid workers;

e) if necessary to prevent danger, report to the official occupational health services any unsatisfactory conditions as regards safety and health that the employer fails to remedy within a reasonable time; and

f) 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.

6.3. Safety and health committees

1. Employers should establish safety and health committees with representatives of workers and management or make other suitable arrangements 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 shipbuilding and ship repair facility.

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.

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 shipbuilding and ship repair facility; and

b) in good time of any inspection or investigation by the competent authority at the shipbuilding and ship repair facility regarding which the employer has received advance notice.

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

6.4. Worker safety and health representatives

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

2. The safety and health representatives have the following rights:

a) to represent workers in all matters bearing on safety and health in the shipbuilding and ship repair facility;

b) to participate in inspections and investigations conducted by the employer and by the competent authority at the workplace and monitor and investigate OSH matters;

c) to have recourse to advisers and independent experts;

d) to consult with the employer in a timely fashion on OSH matters, including policies and procedures;

e) to consult with the competent authority; and

f) to receive, relevant to the area for which they have been selected, notice of accidents and dangerous occurrences.

3. Workers and safety and health representatives are entitled to exercise their rights without discrimination or retaliation.

4. Worker safety and health representatives should receive adequate periodic training in all OSH aspects of the work during paid working hours.

7. General preventive and protective measures

7.1. General provisions

1. All appropriate precautions should be taken:

a) to ensure that all workplaces are safe through the elimination or control of hazards to minimize risks to the safety and health of workers; and

b) to protect persons present at, or in the vicinity of, a shipbuilding and ship repair facility from all risks which may arise from the site or associated shipbuilding and ship repair operations.

7.2. Means of access and egress

1. Adequate and safe means of access and egress should be provided for all workplaces during all shipbuilding and ship repair operations on- and offshore. These means of access and egress should be maintained in a safe condition.

2. Means of access to vessels should be:

a) where practical, the ship's accommodation ladder, a gangway, a service tower, construction elevator or similar appliance;

b) in other cases, ladders, stairs, or, if necessary, adequate stepladders or similar appliances; or

c) approved lifting cages.

3. Where portable stairs are used as a means of access to sections that are being fabricated or outfitted, they should be equipped with handrails and mid-rails if the height is above 1 m. Portable stairs should have a platform.

4. Means of access should be:

a) kept free from obstructions;

b) protected against falling objects if they pass under workplaces; and

c) 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.

5. Hatches, openings or any other means of access to holds, ships' decks or between decks should be provided with safety barriers. If it is not practicable to provide fixed hold ladders, portable metal ladders or appropriate wooden ones should be provided. All ladders should be secured before being used. They should be used in accordance with section 7.11 of this code.

7.3. Prevention of unauthorized entry

1. Visitors should not be allowed access to shipbuilding and ship repair facilities or ships, as appropriate, unless accompanied by or authorized by a responsible and competent person and provided with the appropriate PPE and made aware of emergency procedures and all risks they might be exposed to.

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

7.4. Roadways, quays, yards and other places

1. Roadways, quays, yards and other places where persons or vehicles move or are stationed should be so constructed and maintained as to be safe for the traffic that they have to carry.

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

3. Yards and other places that are surrounded by fencing should have separate gates for pedestrians and vehicles.

4. Warehouses and workshops should have separate doors for pedestrians and vehicles or other means of effective separation.

5. Dedicated travel lines for pedestrians and cyclists should be established and marked to separate them from vehicle traffic or crane operation areas. This should be done by physical barriers, crosswalks and stop signs, and the painting of yellow lines on the ground of the facility and on the decks of ships under construction or repair.

6. Dangerous crossings where transport of heavy objects is carried out should be protected by automatic signals or gates, whenever possible, or be guarded by watchpersons. Speed limits should be established for forklift trucks or other heavy traffic, and all drivers should be trained.

7. Delivery times and/or no-driving periods should be scheduled to avoid or reduce the need for interaction between pedestrians and vehicles.

7.5. Transport of workers by water

1. Boats used to transport workers by water should comply with the requirement of the competent authority. In particular:

a) the boats should be appropriately staffed by a competent team;

b) the maximum number of persons transported should not be greater than safety allows, and this number should be displayed in a conspicuous place;

c) suitable and adequate life-saving and firefighting appliances should be provided and properly placed and maintained; and

d) boats carrying persons should have a valid certificate issued by the competent authority.

2. 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.

3. Rafts for work on water should be:

a) sufficiently stable, strong and adapted for their purpose;

b) their capacity and buoyancy should be displayed;

c) be securely moored or anchored;

d) have suitable life-saving equipment; and

e) not be overloaded.

4. If trestle scaffolds are used on rafts, adequate precautions should be taken to prevent the overturn of scaffolds or rafts.

7.6. Multiple people carriers

1. Before using multiple people carriers such as buses and aircraft to transport workers to and from a remote shipbuilding or ship repair facility, or using helicopters to transport workers to and from a ship requiring repair, consideration should be given to:

a) whether the transport is absolutely necessary;

b) whether the same purpose could be achieved by another means (for example, by accommodating workers closer to the site);

c) the safest mode of transport available (for example, is the time saved on a notoriously dangerous flight route justified, compared with road transport or other safer means);

d) reducing exposure by transporting fewer people, or using multiple vehicles (for example, conduct a number of flights to transport key personnel, or use of more and smaller buses); and

e) whether the weather is safe for transport, particularly in the case of travel by helicopter.

2. Multiple people carriers should comply with the requirement of the competent authority. They should be fitted with seatbelts for drivers or pilots and passengers, and the use of these belts should be ensured.

3. In the case of aircraft, all workers should be given a pre-flight safety briefing.

4. Workers should only approach the helicopter when they have the approval of the pilot to do so. When approaching or leaving a helicopter with blades rotating, all workers should remain in full view of the pilot, keep in a crouched position and stay away from the rear of the helicopter. Anyone entering a helicopter should have received suitable training, wear a safety suit and there should be no loose items inside the helicopter.

5. The age and the mechanical and design integrity of the multiple people carrier should be assessed by a competent person to ensure that the transport is fit for purpose. There should be regular inspection and maintenance of critical controls (for example, braking and steering systems).

6. Only reputable and licensed transport providers should be used, and their credentials and past performance should be checked.

7. The operator of the multiple people carrier (driver, pilot) should be licenced and have an acceptable level of competence (qualifications, skill and experience), and his or her licences and past performance should be checked.

7.7. Heating, cooling and ventilation

7.7.1. Heating and cooling

1. Where necessary to prevent danger or preserve health and to provide adequate comfort, workplaces indoors and enclosed spaces on board should be:

a) adequately heated in cold weather; and

b) adequately cooled by ventilation in hot weather.

7.7.2. Ventilation

1. Whenever natural ventilation does not ensure safe and healthy conditions with regard to temperature and the composition of the atmosphere, artificial ventilation should be provided.

2. If necessary to prevent danger, local exhaust ventilation should be provided at places where dust, gas, vapour, steam, mist or fumes are formed.

3. If it is not practicable to ventilate workplaces sufficiently to ensure safe and healthy conditions, the workers should be provided with suitable respirators. In accordance with section 7.9, whenever there is the potential for an unsafe atmosphere to accumulate, such as a confined space, the air should be tested for oxygen level and for the presence of flammable, explosive or toxic substances and the area made safe before any person is allowed to enter.

4. Compressed air should not be used for ventilation unless supplied by unit approved for the delivery of respirable air and the air has been cleaned, temperature controlled and pressure regulated to safe levels.

5. Oxygen should never be used for ventilation.

6. Polluted or stale air should be so led off that it cannot cause any risk of fire, explosion or illness.

7.8. Housekeeping

1. A suitable housekeeping programme should be established and continuously implemented on each shipbuilding and ship repair facility and on each ship under construction or repair. It should include provisions for:

a) the proper storage of materials and equipment; and

b) the removal, at appropriate intervals, of scrap, waste and debris.

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

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

4. Tools, bolts, nuts and other objects should not be left lying about where they could create a tripping hazard.

5. Scrap, waste, rubbish and dirt should not be allowed to accumulate at workplaces or in passageways.

6. Rubbish, dirt and refuse should not be thrown overboard and should be removed in an environmentally sustainable manner according to internationally recognized instruments.

7.9. Dangerous atmospheres and confined spaces

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.

2. The measures to be taken regarding dangerous atmospheres should be prescribed by the competent authority in conformity with the IMO recommendations for entering enclosed spaces aboard ships (Appendix 5 to IMO Resolution A.962(23)) and should include prior 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.

3. Confined spaces should have signs to prevent inadvertent entry.

4. Inside a confined space or area, no naked light or flame or hot work should be permitted unless the level of flammable or explosive gas is lower than the level specified in national regulation, and it has been tested and found safe by a competent person. Only explosion-proof lights, and tools 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. Any gas used in production should be removed from the space at the end of the shift.

5. While a worker is in a confined space:

a) adequate facilities and equipment, including breathing apparatus, first-aid kit, resuscitation apparatus and oxygen, should be readily available for rescue purposes;

b) a fully trained attendant(s) should be stationed at or near the opening and should have no other assignments;

c) suitable means of communication should be maintained between the worker and the attendant(s); and

d) means should be available for the attendant(s) to effect rescue from the confined space without the necessity of they themselves entering it.

7.10. Scaffolds

7.10.1. General

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

2. The competent authority should establish and enforce laws and regulations and other nationally and internationally recognized instruments covering detailed technical provisions for the design, construction, erection, use, maintenance, dismantling and inspection of the different kinds of scaffolds and ladders used.

3. Scaffolds should be provided with safe means of access, such as gangways, stairways or ladders. Ladders should be secured against inadvertent movement.

4. Every scaffold and part thereof should be:

a) designed so as to prevent hazards for workers and 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, as appropriate, can be easily put together; and

c) of adequate size and strength for the purpose for which it is to be used and maintained in a proper condition.

5. Scaffolds over the height specified by national regulations should not be erected, substantially altered or dismantled except by or under the supervision of a competent person, and properly signed.

7.10.2. Materials

1. Sufficient suitable and sound material should be provided and used in the construction of scaffolds.

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

3. All tubes, couplers and fittings used in metal tubular scaffolding should be of a standard and type approved by the competent authority or certifying body. All couplers and fittings should be free from damage and distortion, and should be maintained in a clean and operable condition.

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

5. 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.

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

7.10.3. Design and construction

1. Scaffolds should be designed for their maximum load and with a safety factor of at least four, or as prescribed by the competent authority.

2. Scaffolds should be adequately braced.

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

4. Anchoring is needed if the scaffold is higher than 10 m.

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

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.

7. Drain pipes, ladder rungs or other unsuitable material should not be used for the construction or support of scaffolding.

8. When necessary to prevent danger from falling objects, working platforms, gangways and stairways of scaffolds should be provided with overhead screens of adequate strength and dimensions.

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. Metal scaffolds should not be erected in closer proximity than 5 m 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.

11. 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 of 2 m or as prescribed in the national laws or regulations, should be provided with guard rails and toe boards complying with the relevant nationally and internationally recognized instruments.

7.10.4. Prefabricated scaffolds

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.

2. Frames of different types should not be intermingled in a single scaffold.

7.10.5. Use of scaffolds

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.

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

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

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.

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

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

7. Platforms on scaffolds should be of adequate dimension, especially in width, for the tasks performed from the scaffold.

8. Scaffolds should be covered in order to prevent rain or winds affecting welding or other hot work.

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

7.10.6. Lifting appliances on scaffolds

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

a) the parts of the scaffold should be 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;

c) if practicable, the uprights should be rigidly connected to a solid part of the vessel at the place where the lifting appliance is erected.

7.10.7. Inspection and maintenance

1. Scaffolds, as prescribed by national laws and regulations or other nationally and internationally recognized instruments, should be inspected, 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.

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.

3. Every scaffold should be maintained in good and proper condition, and every part should be kept fixed or secured so that no part can be displaced in consequence of normal use.

7.10.8. Dismantling

1. 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.

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

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.

7.10.9. Suspended scaffolds

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 an extra rope having a point of attachment independent of the anchorage arrangements of 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, or other nationally and internationally recognized instruments; and

f) before use, the whole structure should be checked by a competent person.

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

1. If necessary to prevent danger when a working platform is attached to a lifting appliance, the lifting appliance should be provided with means of positively locking the supports so as to prevent inadvertent movement of the platform.

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

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

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.

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.

6. While the platform is in use the lifting appliance should not be moved on any surface. The lifting appliance should be so installed and fixed that its position cannot be changed by either the load or by any other influence.

7. All lifting appliances used with working platforms should be fitted with over-hoisting limit switches.

7.10.11. Mobile scaffolding

1. Scaffolding supported on wheels should be adequately braced and stiffened to prevent dangerous distortion in use and, if necessary for stability, be adequately weighted at the base.

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

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

4. Ladders giving access to mobile scaffolding should be secured to the structure.

5. When mobile scaffolding is in use the castors or wheels should be adequately blocked.

6. No person, material or tool should be on scaffolding that is being moved.

7.11. Ladders

1. Ladders are not designed to replace working platforms.

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.

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.

4. Rungs, cleats and steps of ladders must not be spaced less than 25 cm apart, nor more than 36 cm apart, along the ladder's side rails.

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 maximum intended load nor beyond their manufacturer's rated capacity.

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.

7. Unless secured to prevent accidental movement, ladders should be used only on stable and level surfaces. They should not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement.

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.

9. Hand ladders for access should extend at least 1 m beyond the platform.

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

11. Before using the ladder, workers should check overhead and avoid using it near power lines or exposed energized electrical equipment. Metal ladders should not be used in proximity of electrical equipment.

12. Rope ladders should be used only as supplementary means of access to holds.

13. Workers using ladders should:

a) leave both hands free for climbing up and down;

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.

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

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

16. If a task requires staying up for more than 30 minutes at a time, the use of scaffolds should be considered.

17. Painted wooden ladders and improvised hand ladders should not be used.

18. To ensure effective inspection ladders should never be painted or coated in any way that could conceal defects or cover up the manufacturers' specifications or capacity labels.

7.12. Precautions against the fall of persons and materials

1. The competent authority should establish regulations, specifying requirements for fall prevention or work at height. This should include the requirements for preventing falls from height; the certification, inspection, testing and use of fall-prevention and fall-protection equipment; and the required controls to prevent falling objects striking a person.

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, there should be a fall-prevention programme developed. The programme should include:

a) procedures for working at height;

b) a process for preparing, testing and implementing emergency rescue procedures for fall scenarios; and

c) the certification, provision, use inspection, testing and maintenance of fall-prevention and fall-protection equipment.

3. The employer should 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, 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, each shipbuilding and ship repair facility should develop control strategies for the prevention of falling objects or protecting persons from the risk of falling objects.

4. Elimination of the risk of a fall from height is a priority and 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.

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 should be used.

6. Where work at height occurs, the employer should develop work at heights procedures and a permitting process. This should include a process for preparing, testing and implementing emergency rescue procedures for fall scenarios.

7. The employer should develop a procedure to define barricading requirements where there is a risk of falling over an unprotected edge and barricading or protective covers where there is a risk of falling through an opening. The procedures should also address the control measures required to prevent or protect a person from falling through a brittle surface, for example, working on or accessing roofs among other things.

8. Where elimination of the fall risk 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, mobile work platforms, 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 consist of a harness, connected by a lanyard to an anchorage point or static line.

9. Fall-prevention measures should be designed, installed, 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.

10. Wherever practical, a safe working area should be provided by means of work platforms or scaffolds that have complete floors, guardrails, toe-boards, and safe access and egress.

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' pre-operational 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 at all times.

12. Where the above fall-prevention strategies cannot be used, fall protection or fall arrest systems should be used. A fall-arrest system 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.

13. The fall-arrest system should consist of:
a) an approved body harness;
b) a shock-absorbing lanyard, where the potential to fall is greater than 4 m or a short restraining lanyard, where the potential to fall is less than 4 m;
c) double or triple action snap hooks (or karabiner type rings); and
d) secure anchorage points or static lines.

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 or where inspection shows evidence of excessive wear or mechanical malfunction.

15. Permanent anchorage points should be designed and rated to take the required load 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.

16. Work from portable ladders should be minimized. If required, it should be carried out in accordance with an approved procedure. Portable ladders should be safely stored, inspected before use and maintained. A person may climb or descend a ladder without fall protection provided that they are able to use both hands and legs to do so; facing the ladder, and using one step at a time. Where a person could fall more than 6 m, or as specified by national regulations, a fixed ladder installation should be fitted with a side screen, or a ladder cage.

17. 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.

18. 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.

19. Loose articles should not be left lying about in places where they could fall on persons underneath.

20. Workers employed at elevated workplaces should be provided with containers for screws, bolts, nuts and the like.

21. 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; and

f) inspect and maintain scaffolding and working at heights equipment.

7.13. Fire prevention and firefighting

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

a) avoid the risk of fire;

b) control quickly and efficiently any outbreak of fire; and

c) bring about a quick and safe evacuation of persons.

2. The employer in charge of the shipbuilding and ship repair facility should provide for the establishment of a team or teams of trained persons, compatible with the size of the facility and the number of persons employed, to be deployed in case of fire.

3. National laws or regulations should establish standards requiring automatic fire sensor and warning device systems to be used to actuate deluge-type water systems, foam generator systems, multipurpose dry-powder systems, or other equivalent automatic fire suppression systems. Smoke detection and alarm systems should be installed as early as possible. Alarm system and evacuation testing should be carried out at least once during the construction or repair of a ship.

4. Sufficient and secure storage areas should be provided for flammable liquids and solids and gases, such as liquefied petroleum gas (LPG) tanks and acetylene cylinders, paints and other such materials. The storage tanks for flammable liquids and gases should be earthed to discharge the accumulation of static energy. The trucks loading or unloading fuel from tanks should also be earthed before connecting to the tanks.

5. Smoking should be prohibited and "No smoking" notices prominently displayed in all places containing readily combustible or flammable materials. Employers should consider introducing a non-smoking policy and enforce it.

6. In confined spaces and other places in which flammable 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;

e) adequate ventilation should be provided; and

f) persons wearing clothes likely to cause static electricity or shoes likely to cause sparks should be excluded.

7. Combustible materials, greasy or oily waste, and scrap wood or plastics should be kept in closed containers made of non-combustible material in a safe place.

8. 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, welding and cutting operations.

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

10. In accordance with national laws and regulations, places where the danger of fire has been identified should be provided with:

a) suitable and sufficient fire-extinguishing equipment, which should be readily available, and easily visible and accessible; and

b) an adequate water supply at ample pressure.

11. Fire-extinguishing equipment should be selected and provided in accordance with the provisions of internationally

recognized instruments and national laws and regulations, the results of the initial hazard identification and risk assessment and based on the processes identified in the safe workplans. Equipment deployed should be suitable for, and consistent with, the following demands and applications:

a) the restricted access, egress and confined spaces inside the ship;

b) the quantity and characteristics of hazardous, flammable and explosive substances handled in shipbuilding and ship repair operations;

c) site transport and storage facilities; and

d) first-stage firefighting purposes (hand-held or trolley-mounted portable firefighting extinguishers).

12. 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.

13. Suitable training, instruction and information should be given to all supervisors and a sufficient number of both men and women workers about the hazards of fires, the appropriate precautions to be taken and the use of fire-extinguishing equipment, so that adequate trained personnel are readily available during all working periods. The training, instruction and information provided should include, in particular:

a) the circumstances in which workers should not attempt to deal with a fire themselves, but should evacuate the area and call in firefighters;

b) when and where to raise the alarm;

c) the action to be taken in the event of fire, including the use of means of escape;

d) the correct use of firefighting and fire-protection equipment, for workers expected to use it;

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

f) the proper use of appropriate PPE; and

g) evacuation plans and procedures.

14. Sufficient, suitable and effective means (sight and sound signals) should be installed to give warning in case of fire. There should be an effective evacuation plan so that all persons are evacuated speedily without panic.

15. Notices should be posted at conspicuous places, indicating, if applicable:

a) the nearest fire alarm;

b) the telephone number and address of the nearest emergency services; and

c) the nearest first-aid post.

7.14. Means of escape in case of fire or other dangers

1. Means of escape should be kept clear at all times.

2. Escape routes should be frequently inspected and continuously modified on the ship according to the progress of the construction and repair work. Where appropriate, suitable visual signs should be provided to indicate clearly the direction of escape in case of fire.

3. Means of escape should be:

a) provided on the ship and from the ship during all construction and repair operations;

b) clearly marked; during night work this should be done with emergency lighting; and

c) shown on plans, which should be posted at the access to and inside the ship and landside facilities, as appropriate.

4. In order to provide adequate emergency access to and from the ship, there should always be a minimum of two separate points of access. These should be located as far apart as is practicable and, where possible, on opposite sides and ends of the ship.

5. Where there is a large workforce in a confined space such as an engine room or pump room, consideration should be given to cutting an access point through the hull to the space. In any event, a safe clear way should always be maintained from the lower to the main deck level.

7.15. Signs, notices, colour codes and communication

1. Signs and symbols are a very effective method of warning against hazards and of presenting information in a non-linguistic form. Safety signs and notices should conform in shape and colour to the requirements of the competent authority. Signs should be posted to ensure that workers are not unnecessarily exposed to hazards.

2. The contents of portable fire extinguishers should be indicated by a colour code, in compliance with the requirements of the competent authority. Each fire extinguisher should have a label affixed to it providing instructions for its use.

3. Various technical standards exist for the colour coding of electrical wiring cores and care should always be taken to ensure that personnel are aware of the meaning of the core colours on board each ship. If a replacement is required, it should be in accordance with the coding system.

4. Gas cylinders should be clearly marked with the name and symbol of the gas and the body should be coloured

according to its contents. A colour coding card should be provided.

5. Protocols for communicating via radios or other electronic means should be established to ensure that the risk of misunderstanding is minimized, particularly for critical information. These protocols should be conveyed to all involved in such activities and strictly monitored.

8. Operational planning

8.1. General requirements

1. Safe ship construction and repair requires facilities to plan operations in advance and to continually review such plans as operations are carried out and completed. Shipbuilding and ship repair facilities should prepare safe workplans for each operation or task in advance to ensure the safety and health of workers.

2. By segmenting shipbuilding and ship repair processes and operations, tasks that are hazardous for the safety and health of workers can be identified and quantified more easily. Using this approach, the construction and repair of ships can be undertaken in a controlled and managed manner and the safety and health of workers can be protected by eliminating or minimizing any risks involved in the work to be undertaken.

3. Operational planning should also be a means of systematically improving working conditions. The benefits of the sound planning of shipbuilding and ship repair operations include a reduction in the number and severity of occupational accidents and increased productivity through the adoption of safe work practices and the associated psychological assurance borne out of knowing that control is being exercised at the workplace.

4. Shipbuilding and ship repair facilities should promote a "safety first" culture and reassure workers through the provision of health services, workers' health surveillance (see Appendix I), surveillance of the working environment (see Appendix II) and other welfare and social security benefits.

8.2. Preparation of safe workplans

1. Safe workplans should be developed by competent persons possessing a thorough knowledge of safe shipbuilding and ship repair practices and procedures, in consultation with all workers and their representatives, and should include the necessary precautionary and preventive measures to safeguard the safety and health of workers.

2. To prepare a safe workplan, the work processes involved in the specific shipbuilding or ship repair operation, including surface preparation, painting, welding, work in enclosed spaces and other key operations, should be examined carefully to identify the tasks that make up each operation. Each task should then be analysed to determine the hazards involved, assess the risks and devise suitable means of performing the task as safely as possible.

3. When preparing safe workplans, consideration should be given to:

a) the selection of appropriate and adequate preventive and protective measures for each operation or task, using information on safety and health measures from international and national sources, as appropriate;

b) consideration of any additional requirements, such as responsibility, accountability, supervision, competence and training, and OSH requirements in relation to purchasing, leasing and contract specifications; and

c) the required PPE or protective clothing that is adapted for use for both women and men.

4. Model safe plans may be developed with input at the initial stages from managers, supervisors and workers, and then adapted to specific ships as information and details are acquired for each ship to be constructed or repaired. As the plans are

developed, input should be sought from specialists and contractors who are likely to become involved in the actual operation, in accordance with the specific ship to be constructed or repaired.

5. In the case of ship repair, the shipowner should provide information on any hazardous substance and the ship's condition upon arrival, including specific information on the contents of cargo tanks, before any repair work is carried out in cargo and ballast tanks, void spaces, pipe tunnels, cofferdams, pump rooms and empty fuel and lubrication oil tanks. This should be verified by the employer using suitable detectors to measure the levels of oxygen, carbon dioxide vapours and toxic gasses. This information should be used to adapt safe workplans, if necessary.

6. Safe workplans applicable to each operation and task should be readily available to the workers involved in a language that they understand. Such plans may include photos for ease of understanding. Each worker and team should review the safe workplan for the task before performing it for the first time, and frequently thereafter.

7. All workers should receive induction and basic safety training in safe working operations and tasks, and be issued with relevant PPE and protective clothing, whenever appropriate. Trained workers with tested competence and specialized skills should be used for demanding and hazardous tasks identified in the safe workplan.

8. All safe workplans should be designed to protect against fatigue by the provision of reasonable hours of work, rest days at reasonable intervals, the necessary breaks during working hours (especially when the work is strenuous, dangerous or monotonous) and an acceptable workload.

9. Regular meetings between the employer, workers, main contractors and safety and health committee representatives should be held to update the safe workplans.

8.3. Permit-to-work system

8.3.1. Application

1. This section should apply to the following types of high-risk work:

a) work which involves the use of any hazardous, volatile, corrosive or flammable chemical, material or solvent in significant quantities;

b) work involving entry into any confined space;

c) work at heights;

d) spray painting work;

(e) abrasive blasting work carried out in a confined space;

f) testing or dismantling of any pipe or equipment that contains steam or contains, or had contained, oil or substances that are flammable, toxic or corrosive;

g) ballasting and de-ballasting of a ship;

h) repair or maintenance work carried out on the hydraulic system of a ship;

i) bunkering and transferring of fuel oil;

j) radiography work;

k) pressure testing;

l) electrical work;

m) such other work as the competent authority may specify; and

n) such other work identified as high-risk by the employer.

8.3.2. Implementation of permit-to-work system

1. Where any high-risk work is or is to be carried out, it should be the duty of the employer in charge of the ship-building or ship repair facility to:

a) develop and implement a permit-to-work system; and

b) appoint a workplace safety and health officer or a competent person to issue a permit to work.

2. The permit-to-work system should provide that:

a) the high-risk work is carried out with due regard to the safety and health of persons carrying out the work; and

b) such persons are informed of the hazards associated with the high-risk work and the precautions they have to take.

3. Where any high-risk work is or is to be carried out, it should be the duty of the employer under whose direction any person carries out the high-risk work, to ensure that no such high-risk work is carried out without a permit to work in respect of that high-risk work.

9. Health and safety requirements for the most common hazardous operations and tasks in the construction and repair of ships

9.1. Docks and docking operations

1. Wet, dry and floating docks should be provided at approximate places with life-saving equipment such as life-saving buoys.

2. When a vessel is entering or leaving a dock, only the persons required for the docking or undocking operation should be on board. During the docking or undocking operation, the workers should remain on the open deck. The only exceptions to this rule should be the persons required to operate the vessel.

3. During docking and undocking operations, the dock should be securely closed so that persons not engaged in the operation are not exposed to danger. Cranes in floating docks should always be secured against any inadvertent movement during docking or undocking operations.

4. Before docking and undocking of the ship, the stability of the operation should be checked by the dock manager in cooperation with the competent ship's officer.

5. Before floating the dock, an inspection of the valves and draining openings in the bottom and side of the ship should be carried out to ensure that the openings are closed and properly secured.

6. Tankers that are carrying or have carried volatile liquids as cargo should not enter a dock unless their cargo tanks,

spaces and piping have been emptied, cleaned, ventilated, and tested for gas, and the master has obtained a certificate from the competent authority, or its authorised representative, that there is no fire or explosion hazard connected with the vessel.

7. Before work begins on a vessel in dock it should be cleared of silt, dirt or ice, and be cleaned; the hull should be earthed; the propellers and the rudder should be blocked; and the fire-extinguishing system should be connected to the dock water mains.

8. Temporary piping, hose or electric cables laid from the shore to the vessel should be supported on ladders, gangways or the like. Piping, hose and cables should be kept clear of the passageway on gangways.

9.2. Hull construction

1. Hulls under construction should be so fixed as to be incapable of overturning. The safety factor against tipping should be at least 1.5. Measures to ensure stability should include:

a) a supporting base of adequate strength;

b) underlying structures of sufficient strength and stability;

c) supports for the hull;

d) stays on the outside of the hull; and

e) anchoring.

2. If there is any danger that the stability of the hull will be affected as work proceeds, stability should be ensured at each stage by suitable measures. No structures supporting the vessel on the slipway, and no part of the hull, should be dismantled or removed without the permission of the management. Supports, stays and anchors should be properly secured against sliding, overturning, falling down and buckling.

3. When sternposts, propeller shaft brackets, rudders and similar structures are being placed in position, use should be made of props, stays, cages, keel blocks, guy ropes, ropes with stretching screws or special rigging.

4. When fore and aft and thwartship bulkheads are being installed they should be secured against falling by means such as steel wires with stretching screws.

5. When fittings are being placed in position under decks and secured with bolts, the work should be done from a safely secured floor footing and not from any suspended part.

6. When floors of double bottoms, decks, platforms, compartments, bridges and the infrastructure of engine and boiler rooms, corridors and similar spaces are being installed, at the end of the day or shifts, no extraneous, abandoned or unsecured objects should be left behind.

7. Before holes are flame cut or drilled in floors, decks or bulkheads, the workers on the other side of such structures should be informed of the risk from the flame or drill.

8. Before temporary partitions are installed or adjusted in holds, all other work over the hatches of such holds should be stopped.

9. Steel girders that are being erected should be adequately shored or braced until they are permanently secured in position.

10. No load-bearing structural member should be dangerously weakened by cutting, holing or other means.

11. If harmful substances have to be removed from steel surfaces, the work should comply with the relevant requirements of section 9.3.

9.2.1. Prefabricated sections

1. Sections should be assembled only at places intended for the purpose in the building plans. Assembly work should not be carried on in passageways.

2. For the storage of finished sections, spaces or places of adequate dimensions should be provided, and equipped with transport and lifting appliances that ensure the easy and safe installation, storage and removal of the sections. Sections taken into storage should be placed securely in position.

3. Whenever possible, welding, assembly work, fitting or other work should not be done on sections in storage.

4. Before being taken on board, prefabricated sections should be:

a) complete, completely finished and ready for placing in position;

b) provided with adequately dimensioned and placed attachments such as fixed eyes or U-bolts to facilitate lifting them, placing them and securing them to supports; any welding attachment should be done by competent welders and subjected, when necessary, to non-destructive testing by a competent person; and

c) provided with the necessary indications for placing them in position on the hull.

5. Fitting work for the equipment of sections should be done in places specially provided for the purpose. Fitting work should not be done on sections placed on platforms for transport.

6. Sections should be tilted with the help of special mechanical equipment and structures. The tilting equipment should have a locking device that ensures secure control at any

angle of tilt. The operations of placing sections in the tilting equipment, tilting them and removing them should be carried out under competent supervision.

7. No welding, assembly or other work should be done on sections until they are placed in position and firmly secured.

9.2.2. Hoisting

1. While structural members are being moved into place, the load should not be released from the hoisting rope until the members are securely fastened in place.

2. Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.

3. Open-web steel girders that are hoisted singly should be directly placed in position and secured against dislodgement.

4. Bundles of girders should be secured against dislodgement after being hoisted.

5. No load should be placed on open-web steel girders until they have been placed in position and secured.

9.3. Surface preparation and preservation

1. Various methods are used to prepare and preserve surfaces at different stages in shipbuilding and ship repair processes. These include:

a) toxic cleaning solvents;

b) chemical paint and preservative removers;

c) power tools;

d) flame removal;

e) abrasive blasting; and

f) high-pressure water.

2. Each of these operations involves hazards, including work with acid and heat sources, toxic vapours, fumes and dust, noise and vibration, electricity and machinery, as well as the risk of eye injury. Abrasive blasting operations cause high levels of noise and dust. This dust can be flammable or contain toxic materials.

9.3.1. Toxic cleaning solvents

1. When toxic solvents are used for surface cleaning:

a) the cleaning operation should be completely enclosed to prevent the escape of vapour;

b) either natural ventilation or mechanical exhaust ventilation should be used to remove vapour at source and to dilute the concentration of vapours to a level that is safe for the entire work period;

c) workers should be protected against toxic vapours by suitable respiratory protective equipment and, where necessary, against exposure of the skin and eyes to toxic solvents and their vapours by appropriate PPE; and

d) when flammable solvents are used, precautions should be taken in accordance with the requirements concerning fire prevention and firefighting (section 7.13).

9.3.2. Chemical paint and preservative removers

1. Workers should be protected against skin exposure when handling and applying chemical paint and preservative removers, and against eye injury by goggles or face shields. In addition:

a) when using flammable paint and preservative removers, precautions should be taken in accordance with the requirements concerning fire prevention and firefighting (section 7.13);

b) when using chemical paint and preservative removers which contain volatile and toxic solvents, such as benzol, acetone and amyl acetate, the requirements for toxic cleaning solvents apply;

c) when using paint and rust removers containing strong acids or alkalis, workers should be protected by suitable face shields to prevent chemical burns on the face and neck;

d) when steam guns are used, all workers within range of the blast should be protected by suitable face shields. Metal parts of the steam gun should be insulated to protect the operator against heat burns; and

e) when this type of work is conducted, no other worker should enter the exclusion zone.

9.3.3. Power tools

1. Workers using power or pneumatic tools for the removal of paints, preservatives, rust or other coatings should be protected against eye injury by goggles or face shields. In addition, and as described in section 14.3:

a) all portable rotating tools used for the removal of paints, preservatives, rusts or other coatings should be adequately guarded to protect both the operator and nearby workers from flying particles;

b) portable electric tools which do not have batteries should be grounded as indicated by the manufacturer's specifications;

c) in a confined space, mechanical exhaust ventilation sufficient to keep the dust concentration to a minimum should be used, or workers should be protected by respiratory protective equipment; and

d) pneumatic tools should have a secure connection between the tool and the air hose.

9.3.4. Flame removal

1. Hardened preservative coatings should not be removed by flame in enclosed spaces unless the workers exposed to fumes are protected by airline respirators. Workers engaged in flame removal in the open air, and those exposed to the resulting fumes, should be protected by fume filter type respirators. Flame or heat should not be used to remove soft and greasy preservative coatings.

9.3.5. Abrasive blasting

1. No sand or other substance containing free silica should be used for abrasive blasting on board ships. Used abrasive should not be used again except in closed systems.

2. When this type of work is being conducted, no other workers should enter the exclusion zone.

3. Where the blasting process may give rise to flammable dusts, such as those of aluminium or zinc, deposits should not be allowed to accumulate to such an extent that they give rise to the risk of secondary dust explosion. Additionally, all dust separation and collection equipment should be in the open air and, where necessary, fitted with explosion relief.

4. Abrasive blasting should, if possible, be carried out in a blasting enclosure, such as a chamber or cabinet, which should be kept completely closed while blasting is in progress. Every blasting enclosure should be inspected and tested at suitable intervals, not exceeding one week in the case of inspections and one month in the case of tests.

5. Blasting enclosures should be equipped with exhaust ventilation adequate to remove and safely discharge the dust produced during blasting. Dust extraction equipment should not allow dust to escape into places where workers are engaged

or pass through. Exhaust ventilation should be in operation whenever the blasting enclosure is in use, and whenever any worker is in the enclosure for the purpose of maintenance, repair and similar operations.

6. Hoses and fittings used for abrasive blasting should meet the following requirements:

a) hoses of a type to prevent shocks from static electricity should be used;

b) hose lengths should be joined by metal couplings secured to the outside of the hose to avoid erosion and weakening of the couplings;

c) nozzles should be attached to the hose by fittings that prevent the nozzle from unintentionally becoming disengaged. Nozzle attachments should be of metal and should fit onto the hose externally; and

d) a dead man control device should be provided at the nozzle end of the blasting hose, either to provide direct cut-off or to signal the pot tender by means of a visual and audible signal to cut off the flow in the event that the blaster loses control of the hose. The pot tender should be available at all times to respond immediately to the signal.

7. Hoses and all fittings used for abrasive blasting should be inspected frequently to ensure timely replacement before an unsafe amount of wear has occurred.

8. Workers engaged in abrasive blasting should be provided with suitable PPE, including filter type respirators used in conjunction with appropriate eye, face, hearing and head protection, overalls and gloves. When abrasive blasting is carried out in confined spaces, operators should be protected by hoods and airline respirators, or by air helmets of a positive pressure type.

9. Workers, other than blasters, including machine tenders and those that recover abrasive materials, working in areas where unsafe concentrations of abrasive materials and dusts are present, should be protected by eye and respiratory protective equipment.

10. As surges from drops in pressure in the hose line can be sufficient to throw the blaster off the staging, the blaster must be protected by a fall protection system when blasting is being carried out at heights at which adequate protection against falls cannot be provided by railings.

11. Persons engaged in abrasive blasting should undergo periodical medical examinations, including a chest radiographic examination.

9.4. Painting

1. The hazards involved in painting include toxic fumes or vapours, and the risk of eye injury and irritation of lungs and skin. Repeated exposure to solvents can have long-term effects on health, including dermatitis. Painting in confined spaces where vapours cannot escape is particularly hazardous, as solvents can displace air and may be poisonous, flammable or explosive.

2. Every effort should be made to substitute hazardous substances, especially carcinogens, mutagens and reproductive toxicity, used in painting operations with less hazardous paints and solvents that still meet the technical specifications required. Hazardous substances should only be used if the workers are informed about the risks of fire, toxicity or other hazards which may occur in the transport, use or disposal of such substances and their prevention, and trained in their safe use or disposal.

3. Containers and packages containing hazardous substances used in painting should:

a) be plainly marked to indicate the contents, using the name of the chemical and its hazardous nature, and labelled with the appropriate hazard symbol; and

b) carry or be accompanied by instructions for the safe handling and use of the contents.

4. Approaches to work areas where hazards from toxic or irritant fumes may exist should be provided with notices or signs indicating the hazards involved and the prevention measures to be taken.

5. The preparation and mixing of hazardous substances for painting should be carried out in special preparation premises, separated from other workplaces and well ventilated. All operations involving any handling of hazardous substances, whether liquid or solid, such as transfer from one container to another, should only be carried out in premises equipped with exhaust ventilation and using tools and appliances that prevent the spillage of such substances.

6. In spaces in which work is carried out using paints, adhesives, resins and similar preparations containing volatile, flammable or otherwise harmful substances:

a) adequate ventilation, whether general or local, should be provided;

b) smoking, open flames, arcs and spark-producing equipment should be prohibited in the area;

c) only explosion-proof lights should be used;

d) a competent person should inspect all power and lighting cables to ensure that: the insulation is in excellent condition and free of any cracks or worn spots; there are no

connections within 15 m of the operation; and lines are not overloaded and are suspended with sufficient slack to prevent undue stress or chafing;

e) the metallic parts of air moving devices, including fans, blowers and jet-type air movers, and all duct work, should be electrically bonded to the structure of the vessel;

f) ventilation should be such as to keep the concentration of flammable vapours below 10 per cent of their lower explosive limit; frequent tests should be made by a competent person to ascertain the concentration;

g) suitable fire-extinguishing equipment must be immediately available in the work area and be maintained in a state of readiness for instant use;

h) if necessary to prevent danger, workers should wear respiratory protective equipment that operates independently of the surrounding atmosphere; and

i) when paint is being applied in parts of the interior of a vessel, no other work should be carried out in such parts, either during that time or for a certain period afterwards, until it is safe.

9.4.1. Spray painting

1. Spray painting should not be carried out using any toxic material, such as lead, carbon bisulphide, carbon tetrachloride, mercury, antimony, arsenic, arsenic compounds or methanol, or a mixture containing more than 1 per cent of benzene, unless the workers wear adequate airline breathing apparatus.

2. All other hazards associated with this work, such as noise and manual handling, should be controlled.

3. Any place in which spray painting is being carried out should be ventilated by either natural or mechanical means.

Workers should be so protected by adequate airline breathing apparatus that the solvent concentration they inhale is kept within safe limits.

4. Spray painting of internal surfaces, such as those of cisterns, tanks and compartments, should only be allowed when:

a) airline breathing apparatus is supplied and used, the air to be pre-warmed if necessary;

b) the workers are provided with PPE; and

c) no other work is carried out in the area.

5. A sufficient number of fire extinguishers of the foam or another suitable type should be maintained at the place where any material having a nitrocellulose or other flammable content is being used.

6. No person should smoke, or have any fire, naked flame or other source of ignition in any place in which spray painting is being carried out, or in its vicinity.

7. All metal parts of equipment and appliances used for spray painting, and also metal articles to be spray painted, should be electrically bonded and earthed. The proper condition of the earthing system, conductors, earthing connections, equipment and appliances should be verified at least once a month.

8. Painting appliances working under pressure, such as oil separators and oil pump tanks, should be equipped with the necessary fittings: a valve for reducing the pressure of the air entering the appliance and a tested and sealed pressure gauge. The gauge dial should be marked with a red line indicating the maximum permissible working pressure. Connections in the air hose should be firmly secured so as to prevent them from being impaired by the pressure of the compressed air.

9. Spray-gun operators should:

a) adjust the atomization pressure of the gun so as not to create excessive mist;

b) use the gun so that neither they nor any other workers remain between the gun and any ventilation fan;

c) not test the gun by spraying it indiscriminately; and

d) when the outside of vessels is being spray painted, pay due regard to the direction of the wind and paint downwind.

10. Workers employed in spray painting should be provided with:

a) overalls, head and face coverings, hearing protection, respirators and gloves; and

b) a sufficient quantity of material capable of removing the paint or spraying mixture from the hands and face.

9.4.2. Paints and tank coatings dissolved in highly volatile, toxic and flammable solvents

1. Work involving organic coatings, adhesives and resins dissolved in highly toxic, flammable and explosive solvents with low flash points should only be carried out when all of the following special precautions have been taken:

a) sufficient exhaust ventilation is provided to keep the concentration of solvent vapours below 10 per cent of the lower explosive limit. Frequent tests should be made by a competent person to ascertain the concentration;

b) if the ventilation fails, or if the concentration of solvent vapours reaches or exceeds 10 per cent of the lower explosive limit, painting must be stopped and the compartment evacuated until the concentration again falls below 10 per cent of the lower explosive limit. If the concentration does not

fall when painting is stopped, additional ventilation should be provided to bring the concentration below 10 per cent of the lower explosive limit;

c) ventilation should be continued after the completion of painting until the space or compartment is gas free. The final determination as to whether the space or compartment is gas free should be made after the ventilation equipment has been shut off for at least ten minutes;

d) exhaust ducts should discharge clear of working areas and away from sources of possible ignition. Periodic tests should be made to ensure that the vapours removed are not accumulating in other areas within or around the vessel or facility;

e) all motors and control equipment must be of the explosion-proof type in accordance with nationally and internationally recognized instruments covering explosion protection. All motors and associated control equipment should be properly maintained and grounded;

f) only non-sparking paint buckets, spray guns and tools should be used. Metal parts of paint brushes and rollers should be insulated. Staging should be erected in a manner which ensures that it is non-sparking;

g) only explosion-proof lights should be used;

h) a competent person should inspect all power and lighting cables to ensure that the insulation is in excellent condition, free of all cracks and worn spots, that there are no connections within an unsafe distance of the operation, that lines are not overloaded, and that they are suspended with sufficient slack to prevent undue stress or chafing;

i) the face, eyes, head, hands and all other exposed parts of the bodies of operators handling highly volatile paints must

be protected. All footwear should be non-sparking, such as rubbers, rubber boots or rubber-soled shoes without nails. Coveralls or other outer clothing should be of cotton. Rubber, rather than plastic, gloves should be used because of the danger of static sparks;

j) no matches, lighted cigarettes, cigars or pipes, and no cigarette lighters or ferrous articles should be taken into the area where work is being undertaken;

k) all solvent drums taken into the compartment should be placed on non-ferrous surfaces and grounded to the vessel. Metallic contact should be maintained between containers and drums when materials are being transferred from one to another;

l) spray guns, paint pots and metallic parts of connecting tubing should be electrically bonded, and the bonded assembly should be grounded to the vessel;

m) all workers continuously in a compartment in which such painting is being undertaken must be protected by airline respirators and suitable protective clothing, and the atmosphere should be monitored as set out in section 10.3;

n) workers entering such compartments for a limited time should be protected by filter cartridge respirators; and

o) all workers engaged in exterior paint spraying with such paints should be protected by suitable filter cartridge respirators and suitable protective clothing.

9.4.3. Drying

1. Painted articles should not be dried without local exhaust ventilation.

2. Artificial drying of painted objects should be carried out in specially equipped chambers with reliable thermal

insulation and ventilation that prevent the formation of explosive concentrations of solvent vapour.

9.4.4. Other provisions

1. Paints and other coating materials accidentally sprayed or spilled on the floor or other surfaces should be immediately cleaned up and removed.

2. Used wiping materials and rags should be kept in metal containers with self-closing lids. At the end of the shift, used wiping materials should be removed from the workplace and stored in a safe place.

3. When not in use, packages containing paints, varnishes, lacquers and other combustible or volatile substances should be:

a) kept tightly closed; and

b) kept away from sparks, flames, sources of heat and the sun's rays.

4. At the close of work:

a) the remains of adhesives, lacquers, solvents, thinners and insulating materials should be kept in closed containers; and

b) brushes, spray guns, hoses and other equipment should be cleaned of residues of paint, lacquer and adhesive outside the ship and be kept in a cupboard in tightly closed containers.

5. Empty containers for painting and other coating materials should be taken to a special storeplace equipped with exhaust ventilation or to a special place set aside for the purpose at an appropriate distance from the vessel. Empty containers should not be kept at the workplace.

6. Workers exposed to toxic or irritating substances should promptly report any physical complaints to the medical services, first-aid post or a supervisor.

9.5. Welding, flame-cutting and hot work

1. Common hazards associated with welding, cutting and heating include: electric shocks, radiation, fumes (particularly when working in confined spaces), fire, radiation, noise and vibration.

9.5.1. General

1. No welding or steel cutting should be carried out on board a vessel except on the orders of a competent supervisor.

2. Before any local heating, welding or flame-cutting or other hot work is begun, it should be ascertained that the place and the surfaces inside and outside to be treated are free from flammable substances, including gases, coatings and materials.

3. Where reasonably practicable, the paint should be removed over a width of at least 20 cm, that is 10 cm on each side of the cut or seam to be made.

4. Heating of surfaces in isolated or confined spaces should be allowed only if an exhaust ventilation system is provided that will maintain the atmospheric concentration of toxic gases or other toxic substances generated by the process at a level below the relevant permissible limits and that will carry the dangerous airborne substances to the outside air. Where that is not practicable, the operator should be equipped with adequate airline breathing apparatus.

5. When welding, cutting or heating is being carried out on materials containing zinc, lead, cadmium, chromium, beryllium, copper, nickel, manganese or other toxic or harmful substances, precautions should be taken to protect workers from the fumes by the provision of an effective ventilation system which includes:

a) clean respirable air;

b) cartridge respirators, depending on what the exposure risk is;

c) effective local exhaust ventilation; or

d) airline respirators.

6. In addition:

a) the fume concentration of the working environment should be assessed; and

b) the workers should undergo special medical examinations.

7. Other workers exposed to the same atmosphere as welders or burners should be protected in the same manner as the welder or burner. Adequate precautions should be taken to protect persons working or passing near welding operations from dangerous sparks and radiation.

8. A suitable fire extinguisher should be kept ready for immediate use at a reasonable distance from any place where hot work is being undertaken.

9. Floors of places at which welding is being carried out should be kept free from pools of water.

10. In no circumstances should oxygen be used to ventilate, cool or blow dust off clothing.

11. Welders should wear suitable PPE, such as fire-resistant gauntlets and aprons, helmets and goggles with suitable filter lenses. Welders should wear clothing that is free from grease, oil and other flammable material.

12. Workers engaged in the removal of excess metal or slag, or in other similar operations, should:

a) wear gloves and goggles or a face screen;

b) chip away from the body; and

c) ensure that other persons are not struck by chips.

9.5.2. Welding at places with fire risks

1. As far as practicable, objects to be welded, cut by flame or heated should be taken to a place free from fire risks.

2. If objects cannot be taken to a safe place, all combustible waste and other combustible material should be at a safe distance from welding, flame or heating.

3. If these measures cannot be adopted, precautions should be taken to prevent the dispersion of slag, sparks and heat and to protect combustible material in the vicinity by effective means. The work should in all instances be authorized by a competent person.

4. Before any welding, cutting or heating is undertaken on any surface covered with a preservative coating of unknown flammability, the flammability should be tested by a competent person.

5. While surfaces that have been covered by highly flammable preservative coatings are being heated, suitable fire-extinguishing equipment, such as a hose, should be kept ready for use at the workplace.

6. If hydrocarbons exist in the welding area, positive pressure should be created around the area where welding is due to take place. Controls must be continuously kept in place during the hot work.

9.5.3. Heating in confined spaces

1. Welding, cutting and heating operations in confined spaces should comply with the relevant requirements of section 7.9.

2. When sufficient ventilation cannot be obtained without blocking the means of access, workers in the confined space

should be protected by airline respirators, and a person on the outside of the confined space should be assigned to maintain communication with those working within the space and to aid them in an emergency.

3. Before welding, cutting or heating is commenced in enclosed spaces on metals covered by soft and greasy preservatives, the following precautions should be taken:

a) the atmosphere in the space should be tested by a competent person to ensure that it does not contain explosive vapours, as there is a possibility that some soft and greasy preservatives may have flash points below temperatures that may be expected to occur naturally. If the presence of such vapours is determined, no hot work should be commenced until precautions have been taken to ensure that the welding, cutting or heating can be performed in safety; and

b) the preservative coatings should be removed for a sufficient distance from the area to be heated to ensure that the temperature of the unstripped metal is not raised appreciably. Artificial cooling of the metal surrounding the heated area may be used to limit the size of the area that needs to be cleaned.

4. Immediately after welding, cutting or heating is commenced in enclosed spaces on metal covered by soft and greasy preservatives, and at frequent intervals thereafter, it is necessary for a competent person to make tests to ensure that no flammable vapours are being produced by the coatings. If the presence of such vapours is determined, the operation must be stopped immediately and not be resumed until the necessary additional precautions have been taken to ensure that the operation can be resumed safely.

9.5.4. Welding on containers for explosive or flammable substances

1. Welding or cutting operations on containers in which there are explosive or flammable substances is not allowed.

2. Welding or cutting operations on any container that has held explosive or flammable substances, or in which flammable gas may have been generated, should be undertaken only after:

a) the container has been thoroughly cleaned by steam or other effective means and found by air tests to be completely free from combustible gases and vapours; or

b) an inert gas has been substituted for the air in the container.

3. If an inert gas is used for this purpose, after the container has been filled, the gas should be allowed to continue to flow slowly into it throughout the welding or cutting operation.

4. Before starting any welding operations on, or otherwise applying heat to, closed or jacketed containers or other hollow parts, such containers or parts should be adequately vented in a suitable manner to ensure the release of any pressure built up during the application of heat.

5. Before any welding, cutting or heating is undertaken on hollow structures, such as skegs, bilge keels, fairwaters, masts, booms, stanchions or railings, a competent person should inspect the structure, and if necessary test it, for flammable liquids and vapours, and certify it as safe for the work to be done.

9.5.5. Gas welding and cutting

1. The oxygen pressure for welding should always be high enough to prevent acetylene from flowing back into the oxygen line.

2. Acetylene should not be used for welding at a pressure exceeding 1 atm gauge.

3. At the close of work for the day and before any lengthier interruption of work:

a) supply valves of cylinders, acetylene generators and gas mains should be safely closed; and

b) blowpipes and movable pipes or hoses for flammable or oxidizing gas should be taken to the topmost completed deck or to another safe place that is adequately ventilated and supervised to prevent any dangerous concentration of gas or fumes, unless adequate testing for explosive concentrations of gas or oxygen is made by a competent person before torches are relighted.

4. Cylinders used for gas welding and cutting should be transported, moved and stored in accordance with the provisions of section 14.6.

9.5.5.1. Use of fuel gas

1. The employer should thoroughly instruct workers in the safe use of fuel gas, as follows:

a) in ships under construction, temporary piping for oxygen, acetylene, inert gas and pressurised air should be tested by pressure test after assembly or modification before starting the work;

b) where gas cylinders are used, welders should not tamper with, or attempt to repair, safety devices and valves on gas cylinders. No damaged or defective cylinder should be used;

c) cylinders should be kept far enough away from the actual welding or cutting operation so that sparks, hot slag or flames do not reach them. When this is impractical, fire resistant shields should be provided;

d) cylinders should be placed where they cannot become part of an electrical circuit. Electrodes should not be struck against a cylinder to strike an arc;

e) fuel gas cylinders should be placed with the valve end up whenever they are in use. They must not be placed in a location where they would be subject to open flame, hot metal or other sources of artificial heat;

f) cylinders containing oxygen or acetylene or other fuel gas must not be taken into confined spaces;

g) cylinder valves, pressure-reducing valves and torches should be kept free from grease, oil, dust and dirt;

h) before connecting a regulator to a cylinder valve, the valve should be opened slightly and closed immediately. This action is generally termed "cracking" and is intended to clear the valve of dust or dirt that might otherwise enter the regulator. The person cracking the valve should stand to one side of the outlet, not in front of it. The valve of a fuel gas cylinder should not be cracked where the gas would reach welding work, sparks, flame or other possible sources of ignition;

i) the cylinder valve should always be opened slowly to prevent damage to the regulator. To permit quick closing, valves on fuel gas cylinders should not be opened more than one-and-a-half turns. When a special wrench is required, it should be left in position on the stem of the valve while the cylinder is in use so that the fuel gas flow can be shut off quickly in case of an emergency. In the case of manifolded or coupled cylinders, at least one such wrench should always be available for immediate use. Nothing should be placed on top of a fuel gas cylinder, when in use, which may damage the safety device or interfere with the quick closing of the valve;

j) fuel gas should not be used from cylinders through torches or other devices that are equipped with shut-off valves without reducing the pressure through a suitable regulator attached to the cylinder valve or manifold;

k) when acetylene cylinders are coupled, flash arrestors should be installed between each cylinder and the coupler block, or between the coupler block and the regulator. Only acetylene cylinders of approximately equal pressure should be coupled;

l) before a regulator is removed from a cylinder valve, the cylinder valve should always be closed and the gas released from the regulator;

m) if, when the valve on a fuel gas cylinder is opened, there is found to be a leak around the valve stem, the valve must be closed and the gland nut tightened. If this action does not stop the leak, it is necessary to discontinue the use of the cylinder, which should be properly tagged and removed. In the event that fuel gas leaks from the cylinder valve rather than from the valve stem and the gas cannot be shut off, the cylinder should be properly tagged and removed. If a regulator attached to a cylinder valve will effectively stop a leak through the valve seat, the cylinder need not be removed;

n) if a leak develops at a fuse plug or other safety device, the cylinder must be removed; and

o) cylinders found to have leaks that cannot be stopped by closing the valve should be taken into the open away from any source of heat and slowly drained of gas.

9.5.5.2. Manifolds

1. Manifolds should be clearly marked to show the substance that they contain.

2. Manifolds should be placed only in safe and accessible positions in the open air. Manifold hose connections, including inlet and outlet connections, should be such that the hose cannot be interchanged between fuel gas and oxygen manifolds and headers. Adaptors should not be used to permit the interchange of hose. Connections should be kept free from grease and oil.

3. When not in use, manifold and header hose connections should be capped.

4. Nothing should be placed on a manifold that might damage it or impede the quick closing of the valves.

9.5.5.3. Hose

1. Only hose specially designed for welding and cutting operations should be used to connect an oxyacetylene torch to gas outlets.

2. All hose carrying acetylene, oxygen, natural or manufactured fuel gas, or any gas or substance that may ignite or enter into combustion or be in any way harmful to workers, should be inspected at the beginning of each shift. Defective hose should be removed from service.

3. An efficient back pressure valve and flame arrestor should be provided in the acetylene supply line between each burner or blowpipe and the source of supply as near as practicable to the burner or blowpipe.

4. Hose lines for oxygen and for acetylene should be of different colours, or otherwise equally clearly and appropriately identified. Oxygen and fuel gas hoses should not be interchangeable.

5. Hose connections should be sufficiently tight to withstand without leakage twice the maximum delivery pressure of the pressure regulators in the system. They should be of the

type that cannot be unlocked or disconnected by means of a straight pull without rotary motion.

6. Care should be taken to ensure that hoses are always laid in good order so as not to become kinked or tangled, stepped on, run over or otherwise damaged. Hoses laid in passageways should be completely protected with covers. Hangers should be provided to hang the hoses.

7. Hose which has been subjected to flashback or which shows evidence of severe wear or damage should be tested to twice the normal pressure to which it is subject, but in no case less than 13.6 atm. Defective hose or hose in doubtful condition should not be used.

8. No hose with more than one gas passage should be used.

9. Compressed air should not be used to clean any hose that may contain oil residues from the compressor. An inert gas may be used for this purpose.

10. Open-end fuel-gas and oxygen hoses should be removed from confined spaces as soon as they are disconnected from the torch. The connections between hose and torch and between hoses should be securely fixed with metal fittings, such as hose bands. Valves or cocks at the gas and oxygen inlet of hoses should have identification numbers of users.

11. All hoses should be inspected at least every four months by competent persons. Any repair should be carried out by a competent person.

9.5.5.4. Torches

1. Torches should be inspected at the beginning of each shift for leaking shut-off valves, hose couplings and tip connections. Defective torches should not be used.

2. Clogged torch-tip openings should be cleaned with suitable cleaning wires, drills or other devices designed for that purpose.

3. When torches are being changed, the gases should be shut off at the pressure-reducing regulators, and not by crimping the hose.

4. Torches should be lit with friction lighters, stationary pilot flames or by other safe means. They should not be lit with matches or from hot work.

5. The operating valves of torches should be so constructed or protected that they cannot be opened accidentally.

6. All torches should be inspected at least every four months by competent persons. Any repair should be carried out by a competent person.

9.5.6. Electric arc welding

1. A welding machine should be controlled by a switch mounted on or near the machine framework. When opened, the switch should immediately cut off the power from all conductors supplying the machine.

2. Welding circuits should be supplied only through generating or converting equipment or a double-wound transformer. The maximum open-circuit no-load voltage should be in accordance with nationally and internationally recognized instruments.

9.5.6.1. Manual electrode holders

1. Only manual electrode holders should be used that are specifically designed for arc welding and cutting and are of a capacity capable of safely handling the maximum rated current required by the electrodes.

2. Any current carrying parts passing through the portion of the holder that arc welders or cutters grip in their hands,

and the outer surfaces of the jaws of the holder, should be fully insulated against the maximum voltage encountered to ground.

9.5.6.2. Welding cables and connectors

1. All arc welding and cutting cables must be completely insulated, flexible and capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welders or cutters are working.

2. Only cable free from repair or splices for a minimum distance of 3 m from the cable end to which the electrode holder is connected should be used, although cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cable may be permitted.

3. When it becomes necessary to connect or splice lengths of cable, substantial insulated connectors of a capacity at least equivalent to that of the cable should be used. If connections are effected by means of cable lugs, they should be securely fastened together to give good electrical contact, and the exposed metal parts of the lugs should be completely insulated.

4. Cables in poor repair should not be used. When a cable becomes worn to the extent of exposing bare conductors, the portion thus exposed should be protected by means of rubber and friction tapes or other equivalent insulation.

9.5.6.3. Ground returns and machine grounding

1. Ground return cables should have a safe current carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit that they service. When a single ground return cable services more than one unit, its safe current carrying capacity should be equal to, or exceed, the total specified maximum output capacities of all the units that it services.

2. Structures or pipelines, except pipelines containing gases of flammable liquids or conduits containing electrical circuits, may be used as part of the ground return circuit.

3. When a structure or pipeline is employed as a ground return circuit, it should be determined that the required electrical contact exists at all joints. The generation of an arc, sparks or heat at any point should cause rejection of the structure as a ground circuit.

4. When a structure or pipeline is continuously employed as a ground return circuit, all joints should be bonded and periodic inspections conducted to ensure that no condition of electrolysis or fire hazard exists by virtue of such use.

5. The frames of all arc welding and cutting machines should be grounded, either through a third wire in the cable containing the circuit conductor, or through a separate wire grounded at the source of the current. Grounding circuits, other than by means of the vessel's structure, should be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current.

6. All ground connections should be inspected to ensure that they are mechanically strong and electrically adequate for the required current.

9.5.6.4. Operations

1. When arc welding is carried out in damp or otherwise conductive confined spaces:

a) the electrode holders should be completely insulated; and

b) the welding machine should be either outside the confined space, or equipped with a voltage-reducing device in the case of arc welding with alternating current.

2. Adequate precautions should be taken to prevent:

a) damage to fibre ropes from heat, sparks, slag or hot metal;

b) fires started by sparks, slag or hot metal; and

c) penetration into the working area of flammable vapours and substances.

3. Electric arc welders should not stand on wet ground or have wet hands or gloves.

4. Welders should take adequate precautions to prevent:

a) any part of their body from completing an electric circuit;

b) any part of their body coming into contact with the exposed part of the electrode or electrode holder when they are in contact with metal; and

c) wet or damaged clothing, gloves and boots from touching any live part.

5. Hot electrode holders should not be dipped in water, as doing so may expose the arc welder or cutter to electric shock. Live parts of electrode holders that are not in use should not be allowed to come into contact with metallic objects.

6. Welding circuits should have identification numbers of users when in use, and should be switched off when not in use.

7. When electrode holders are to be left unattended, the electrodes should be removed and the holders so placed or protected that they cannot make electrical contact with workers or conducting objects.

8. When inserting electrodes in the holder, a means of insulation, such as insulating gloves, should always be used.

9. Electrode and return leads should be adequately protected against damage.

10. Whenever necessary, electrode stubs should be deposited in a fire-resistant container.

11. Electric arc welding equipment should not be left unattended with the current switched on.

12. Any faulty or defective equipment should be reported to the supervisor.

9.5.7. Gas metal arc welding

1. Since the inert-gas metal-arc welding process involves the production of ultraviolet radiation of intensities of five to 30 times that produced during shielded metal-arc welding, the decomposition of chlorinated solvents by ultraviolet rays, and the liberation of toxic fumes and gases, workers should not be permitted to engage in, or be exposed to the process until the following special precautions have been taken:

a) the use of chlorinated solvents should be kept at least 60 m from the exposed arc, and surfaces prepared with chlorinated solvents should be thoroughly dry before welding is permitted on such surfaces;

b) other workers in the area who are not protected from the arc by screening should be protected by appropriate filter lenses. When two or more welders are exposed to each other's arc, filter lens goggles of a suitable type should be worn under welding helmets or hand shields to protect the welder against flashes and radiant energy when either the helmet is lifted or the shield is removed;

c) welders and other workers who are exposed to radiation should be suitably protected so that the skin is covered completely to prevent burns and other damage by ultraviolet rays. Welding helmets and hand shields should be free of leaks and openings, and free of highly reflective surfaces;

d) when inert-gas metal-arc welding is performed on stainless steel, measures should be taken to protect against dangerous concentrations of chromium, nitrogen dioxide and inert gases; and

e) when inert-gas metal-arc welding is performed on aluminium, measures should be taken to protect against dangerous concentrations of ozone and inert gasses.

2. Safe working procedures for workers using inert gas in confined spaces should be implemented to prevent suffocation through:

a) ensuring a safe way of connecting gas hoses;

b) applying permit-to-work system in accordance with section 8.3 of this code; and

c) ensuring sufficient ventilation or providing airline respirators.

9.5.8. Protective clothing and equipment

1. Welders should be supplied with and wear garments of leather or equivalent material, and should avoid wearing highly flammable clothing, such as untreated cotton or greasy garments. Protective clothing should cover as much of the skin as practicable.

2. When welding, welders should be protected by a welding helmet, face shield or hand shield made of heat-resisting and electrically insulating material and fitted with a window that filters infrared and ultraviolet radiation, as well as visible radiations.

3. Where persons other than the welders are likely to be exposed to harmful radiations or sparks from electric arc welding, they should be protected by non-combustible or flame-proof screens or other effective means.

4. Workers, such as crane drivers, who cannot be protected from radiations by screens, should wear suitable tinted goggles.

5. Welders should be protected by gloves, sleeves, aprons, leggings and spats against burns from metal splashes and electrode stubs.

6. Workers using pneumatic hammers or chisels to remove slag from welds should wear suitable goggles.

9.6. Installation or repair of boilers, piping and ship machinery

9.6.1. Boilers

1. Boilers should comply with national laws and regulations, or other nationally and internationally recognized instruments as regards materials, design, construction, inspection and testing. Only competent persons should operate boilers. Boiler operators and attendants should be trained and certified.

2. The space around a boiler should be kept clear of obstructions and rubbish. Safety valves should operate freely at all times.

3. Boilers should be blown off into a sump or pit, or other effective precautions should be taken to avoid scalding persons.

4. Every boiler, whether separate or part of a range, should be provided with:

a) a suitable safety valve;

b) a suitable steam gauge and a suitable water gauge to show respectively the pressure of steam and the height of the water in that boiler; and

c) an effective guard or other protection for the gauges provided on each boiler.

5. The maximum pressure at which steam should be generated, and the blow-off pressure should be marked on each steam gauge, and each boiler attendant should be made familiar with this arrangement.

6. All working parts of steam boilers such as valves, cocks, injectors and pumps should be frequently inspected by the operator. Each boiler attendant should receive adequate instruction and training for the duties they have to perform.

7. Boilers should be repaired only by competent persons, after all pressure and heat has been removed.

8. Before work is performed in the fire, steam, or water spaces of a boiler where workers may be subject to injury from the direct escape of a high-temperature medium such as steam, or water, oil, or other medium at a high temperature entering from an interconnecting system, the employer should ensure that the following steps are taken:

a) the isolation and shut-off valves connecting the dead boiler with the live system or systems should be secured, blanked, and then locked and tagged to indicate that workers are working on the boiler. This lock and tag and blank of the valves should only be removed by those persons who installed them or by authorized personnel only after it is verified that this may be done without creating a hazard to the workers. When valves are welded instead of bolted, at least two isolation and shut-off valves connecting the dead boiler with the live system or systems should be secured, and then locked and tagged;

b) drain connections to atmosphere on all of the dead interconnecting systems should be opened for visual observation of drainage; and

c) a warning sign calling attention to the fact that workers are working in the boilers should be hung in a conspicuous

location in the engine room. This sign should not be removed until it is determined that the work is completed and all workers are out of the boilers.

9.6.2. Piping

1. Before work is performed on a valve, fitting, or section of piping in a piping system where workers may be subject to injury from the direct escape of steam, or water, oil, or other medium at a high temperature, the employer should ensure that the following steps are taken:

a) the isolation and shut-off valves connecting the dead system with the live system or systems should be secured, blanked, and then locked and tagged, indicating that workers are working on the systems. The lock and tag and blank of the valves should only be removed by those persons who installed them or by authorized personnel only after it is verified that this may be done without creating a hazard to the workers. When valves are welded instead of bolted, at least two isolation and shut-off valves connecting the dead system with the live system or systems should be secured, and then locked and tagged; and

b) drain connections to the atmosphere on all of the dead interconnecting systems should be opened for visual observation of drainage.

2. If a steam hose from a steam source outside the vessel is connected to the vessel's steam piping, the employer should ensure that the vessel's steam piping system, including hoses, is designed to safely handle the working pressure prior to supplying steam from an outside source. The employer should obtain a written or oral determination from a responsible vessel's representative, a contractor, or any other person who is qualified by training, knowledge, or experience to make

such determination that the working pressure of the vessel's steam piping system is safe. The employer should ensure that each outside steam supply connected to a vessel's steam piping system meets the following requirements:

a) a pressure gauge and a relief valve are installed at the point where the temporary steam hose joins the vessel's steam piping system;

b) each relief valve is set to relieve excess steam at, and is capable of relieving steam at, a pressure that does not exceed the safe working pressure of the system in its present condition;

c) there are no means of inadvertently disconnecting any relief valve from the system that it protects;

d) each pressure gauge and relief valve is legible and located so it is visible and readily accessible; and

e) each relief valve is positioned so it is not likely to cause injury if steam is released.

3. Steam hose and piping should be shielded or insulated if necessary to prevent accidental contact with workers.

4. When pressure testing a vessel's piping system, the pipes concerned should be clearly marked. Valves should be closed and locked or tagged, indicating that workers are working on the systems. The testing should be carried out by a competent person.

9.6.3. Propulsion machinery

1. Before work is performed on the main engine, reduction gear, or connecting accessories, the employer should ensure that the following steps are taken:

a) the jacking gear should be engaged to prevent the main engine from turning over. A sign should be posted at the

throttle indicating that the jacking gear is engaged. This sign should not be removed until the jacking gear can be safely disengaged;

b) if the jacking gear is steam driven, the employer should ensure that the stop valves to the jacking gear are secured, and then locked and tagged; and

c) if the jacking gear is electrically driven, the circuit controlling the jacking gear should be de-energized by tripping the circuit breaker, opening the switch, or removing the fuse, whichever is appropriate, and then locked and tagged.

2. Locks and tags indicated in subparagraphs (b) and (c) above should only be removed by those persons who installed them or by authorized personnel only after it is verified that this may be done without creating a hazard to the workers.

3. Before the jacking engine is operated, the following precautions should be taken:

a) a check should be made to ensure that all workers, equipment, and tools are clear of the engine, reduction gear, and its connecting accessories;

b) a check should be made to ensure that all workers, equipment and tools are free of the propeller;

c) before work is started on, or in the immediate vicinity of, the propeller, a warning sign calling attention to the fact that workers are working in that area should be hung in a conspicuous location in the engine room. This sign should not be removed until it is determined that the work is completed and all workers are free of the propeller; and

d) before the main engine is turned over (for example, when warming up before departure or testing after an overhaul) a check should be made to ensure that all workers, equipment, and tools are free of the propeller.

9.6.4. Deck machinery

1. Before work is performed on the anchor windlass or any of its attached accessories, the employer should ensure that the following steps are taken:

a) the devil claws (also known as chain stoppers) should be made fast to the anchor chains;

b) the riding pawls should be in the engaged position; and

c) in the absence of devil claws and riding pawls, the anchor chains should be secured to a suitable fixed structure of the vessel.

10. Hazardous substances

10.1. General provisions

1. As a basis for eliminating or controlling exposure to hazardous substances (including dusts, fumes and gases), the provisions of the ILO code of practice on ambient factors in the workplace (2001) should be consulted. Where workers are exposed to hazardous chemicals, the provisions of the ILO code of practice on safety in the use of chemicals at work (1993), the Occupational Cancer Convention, 1974 (No. 139), and Occupational Cancer Recommendation, 1974 (No. 147), should apply.

2. The competent authority should ensure that criteria are established governing the measures to be adopted for safety and health, in particular in respect of:

a) the handling, storage and transport of hazardous substances; and

b) the disposal and treatment of hazardous chemicals and hazardous waste products, consistent with national laws and regulations, or other nationally and internationally recognized instruments.

3. The employer should prepare, if not already available, an inventory of hazardous substances involved in shipbuilding or ship repair, and require from contractors and subcontractors an inventory of hazardous substances used in their project. This list should highlight those substances which are mutagens, carcinogens and reproductive toxins.

4. In the case of ship repair, the employer should ensure that each ship for repair is in a safe condition, has the necessary

certifications and licences, and meets the conditions for repair in accordance with nationally and internationally recognized instruments, and particularly that:

a) hazardous substances have been removed and recycled in an environmentally sustainable manner;

b) the ship and its tanks are gas free; and

c) the ship has an asbestos register to ensure that the ship repair facility can take preventative measures.

5. In the case of ship repair, the employer should also require or prepare, if not already available, an inventory of hazardous substances on the ship. The inventory should be used especially for identifying hazardous substances present that are listed in Appendices 1 and 2 of the IMO Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009, on board ships and their locations and quantities, if applicable.

6. As prescribed by national laws and regulations, employers should ensure that workers are not exposed to hazardous substances to an extent that exceeds exposure limits or other exposure criteria for the evaluation and control of the working environment. They should identify whether hazardous substances are present in the workplace and monitor and record the exposure of workers to ensure their safety and health. Based on the monitoring data, employers should assess the exposure of workers to hazardous substances.

7. Employers should ensure that all chemicals handled, stored and transported or otherwise used are marked, giving their relevant characteristics and instructions on their use, in accordance with the provisions of:

a) the ILO code of practice on safety in the use of chemicals at work (1993); and

b) the chemical safety data sheets provided by the supplier.

8. Chemicals which have not been marked or are not provided with chemical safety data sheets should not be handled and stored until similar relevant information has been obtained by the employer and has been made available to workers and their representatives.

9. Where necessary in order to minimize the risk to workers, written instructions should be prepared specifying the correct procedure to be observed in these circumstances. The necessary steps should also be taken to inform all workers of possible hazards and the precautions to be taken when hazardous substances are likely to be encountered at the workplace, including evacuation procedures.

10.2. Assessment

1. Based on the inventory of hazardous substances, the workplace should regularly be inspected and information obtained on:

a) hazardous substances that are present or likely to occur, along with other hazardous ambient factors; and

b) hazardous activities and processes.

2. In the case of identified chemicals, the employer should obtain information on the intrinsic hazards of the substances or products according to the physical state (for example solid, liquid, gas) in which they are provided by suppliers and the inventory of hazardous materials, if available. Where this is not practicable, employers should obtain information provided by other bodies such as the International Agency for Research on Cancer (IARC), the World Health Organization (WHO), the International Programme on Chemical Safety (IPCS), the European Union and other competent international and national institutions.

3. Where the expected risk is from exposure to mineral or synthetic fibres, mineral dusts and vegetable dusts, employers should consider, in particular, the provisions in the Asbestos Convention, 1986 (No. 162), and the Asbestos Recommendation, 1986 (No. 172), the ILO codes of practice on occupational exposure to airborne substances harmful to health (1980), safety in the use of asbestos (1984), and safety in the use of synthetic vitreous fibre insulation wools (glass wool, rock wool, slag wool) (2001); and the ILO guide on *Dust control in the working environment (silicosis)* (Occupational Safety and Health Series No. 36, 1977).

4. When obtaining information for assessment, employers should take account of specific work situations where workers are likely to be exposed, for example, to:

a) hazardous fumes as by-products (for example welding);

b) hazardous substances and oxygen deficiency in confined spaces;

c) prolonged periods (such as during overtime) with the risk of accumulation of higher doses;

d) higher concentrations due to fluctuations in ambient conditions (for example hot environments where vapour pressures of hazardous substances may be elevated);

e) absorption through multiple routes (inhalation, ingestion, absorption through the skin); and

f) hazardous substances that may be present even in concentrations below exposure limits while performing arduous tasks.

5. In the situations listed in the paragraph above, the exposure limits specified by the competent authority for normal work situations would in some cases not reflect the workers' exposures. Employers should accordingly obtain practical information from

the competent authority, international organizations and institutions (ILO, WHO, IPCS) or other bodies.

6. As the second stage of the assessment, the employer should use the information obtained to assess the risk to health resulting from exposure, especially from the effects of chemical mixtures, and should also take account of:

a) routes of entry (skin, inhalation, ingestion);

b) the risk of penetration through damaged skin or seepage through PPE;

c) the risk of ingestion;

d) levels of airborne concentrations of hazardous substances;

e) the rate at which work is performed (for example arduous tasks);

f) the length of exposure (for example higher exposures resulting from prolonged overtime); and

g) the influence of other ambient factors (for example heat) in enhancing the risk of exposure.

7. As the third stage of the assessment, the need for a programme for the measurement of airborne contaminants (monitoring) should be determined. Such a programme is required to:

a) determine the extent of exposure of workers; and

b) check the effectiveness of engineering control measures.

10.3. Monitoring for chemical hazards in the workplace

10.3.1. General principles

1. Measurements of airborne contaminants (monitoring) in the workplace are necessary if other techniques do not suffice to provide a valid estimate of the risk of exposure and to assess the existing control measures. They should be undertaken in

accordance with Chapter 12 of the ILO code of practice on safety in the use of chemicals at work (1993).

2. Techniques for this risk assessment may include the following:

a) information on the intrinsic health and physical hazards, obtained from the ship's inventory of hazardous substances and chemical safety data sheets which correspond to the requirements established in Chapter 5 of the ILO code of practice on safety in the use of chemicals at work (1993), in particular the International Chemical Safety Cards provided by the IPCS;

b) estimation of exposure based on the method of work and work pattern;

c) experience of exposure in the workplace or that of other users; and

d) simple qualitative tests, such as the use of smoke tubes or pellets to determine ventilation characteristics, and dust lamps for illuminating dust emissions.

10.3.2. Measuring methods

1. Sampling equipment should be compatible with the analytical methods available and should have been validated over a suitable range of concentrations above and below the exposure limits or other exposure criteria, in accordance with nationally and internationally recognized instruments, where they exist.

2. Static monitoring should be used to determine the distribution of an airborne chemical throughout the general atmosphere of the working area and to identify problems and priorities.

3. Personal monitoring and area monitoring should be used to evaluate the risk of exposure to the individual worker. Air

samples for personal monitoring should be collected in the worker's breathing zone by means of personal samplers. Sampling should be carried out while the work activity is being undertaken.

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

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

6. Exposure profiles of particular jobs or occupational categories (such as gas cutters, removers of asbestos, polychlorinated biphenyl, paint, etc.) should be constructed from the air sampling data for different operations and from the workers' exposure time in these jobs.

10.3.3. Monitoring strategy

1. A systematic measurement programme should evaluate whether the exposure of workers to certain hazardous chemicals prescribed by the competent authority or determined by the initial assessment is being kept under control.

2. The aims of this programme should be to:

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

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

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

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

e) promote the implementation of more efficient preventive measures.

3. The monitoring of airborne contaminants should be performed using adequate equipment and only by competent persons.

4. The employer should arrange for regular inspection, maintenance and proper calibration of monitoring equipment.

10.3.4. Record keeping

1. Employers should keep dated records of measurements of airborne contaminants:

a) by technique and type (for example static, personal), including data on plant location, work area, work processes, nature of hazardous substances, names and lists of exposed workers, their sex, and control measures in place; and

b) for a period of time, as determined by the competent authority.

2. Workers and their representatives, and the competent authority, should have access to these records.

3. In addition to the numerical results of measurements, the monitoring data should include, for example:

a) the marking of the hazardous chemical;

b) the location, nature, dimensions and other distinctive features of the workplace, and the names, sex and job titles of the workers involved;

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

d) relevant information on the work process, engineering and personal protection means, and weather conditions with respect to the emissions;

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

f) the date and exact time of sampling;

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

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

10.3.5. Interpretation and application of monitoring data

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

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

10.4. Control measures

1. For any situation or operation involving a risk of occupational exposure to airborne asbestos dust in the repair or

removal of structures containing asbestos materials and in the handling, transportation and storage of asbestos or asbestos-containing materials, the provisions of the ILO code of practice on Safety in the use of asbestos (1984), the WHO–ILO joint publication *Outline for the Development of National Programmes for Elimination of Asbestos-Related Diseases* and the ILO resolution concerning asbestos (2006), should apply. No new asbestos product should be used in shipbuilding, ship conversion or ship repair.

2. Appropriate preventive and protective measures should be taken in relation to the following most common hazardous activities involving chemical substances:

a) asbestos removal and disposal;

b) disposal of polychlorinated biphenyl;

c) bilge and ballast water removal;

d) oil and fuel removal;

e) paint removal and disposal;

f) metal cutting and metal disposal; and

g) removal and disposal of miscellaneous ship machinery.

3. In accordance with the provisions of sections 6.5–6.9 of the ILO code of practice on safety in the use of chemicals at work (1993), specific control measures should be carried out for:

a) chemicals hazardous to health;

b) flammable, dangerously reactive or explosive chemicals;

c) the storage of hazardous chemicals;

d) the transport of chemicals; and

e) the disposal and treatment of chemicals;

4. The employer should:

a) inform each worker who could be exposed to dangerous substances about the hazards related to the chemicals, and other on-site employers whose workers could be exposed, about chemical hazards and appropriate protective measures;

b) ensure workers and/or trained first-aid personnel are aware of emergency procedures related to exposure to hazardous chemicals; and

c) provide workers with the necessary training and protection to prevent exposure to hazards, including protective clothing that is adaptable for both women and men.

5. Each employer should:

a) develop and implement a written hazard communication programme;

b) maintain it for as long as a hazardous chemical is known to be at the shipbuilding and ship repair facility; and

c) share relevant information with other on-site employers whose workers could be affected.

6. The employer should ensure:

a) proper storage of chemicals by:

i) storing separately chemicals which react with one another;

ii) minimizing volumes of stored chemicals;

iii) providing for containment of spills; and

iv) ventilating storage areas;

b) that, where hazardous chemicals are used, handled or stored, measures are in place to minimize workers' exposure (for example, ventilated fume hoods, remote handling), with reasonable accommodation for pregnant workers;

c) that, where necessary, appropriate PPE that is adaptable for use by both women and men is provided and workers are trained in its correct use, and it is used properly;

d) that emergency showers and eyewash stations are available where hazardous chemicals are used and/or stored;

e) the cleaning of work clothes that have been polluted by chemicals (if reusable) or their disposal; and

f) the provision of appropriate hygienic conditions and facilities (for washing) in places where food or tobacco are consumed.

10.5. Chemical safety data sheets

1. Chemical safety data sheets (also called "material safety data sheets" or "safety data sheets" in some countries) should be obtained and made available for each of the hazardous substances identified. The *Globally Harmonized System of Classification and Labelling of Chemicals (GHS)* (sixth revised edition, United Nations, 2015) provides guidance on the preparation of labels, safety data sheets and the provision of information to workers.

2. In accordance with the requirements of Chapter 5 of the ILO code of practice on safety in the use of chemicals at work (1993), safety data sheets for hazardous chemicals should be provided by the supplier. The production of safety data sheets in electronic format should be encouraged. Safety data sheets should, as a minimum, meet the requirements of the competent authority and should contain 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; protective clothing and PPE; first aid, firefighting and chemical spills.

3. Labels should, as a minimum, meet the requirements of the competent authority, and should contain the following core information:

a) signal word or symbol; identification information, including the manufacturer, product and ingredients;

b) risks and safety phrases, first-aid and disposal procedures; and

c) reference to the chemical safety data sheets, and date of issue.

4. The International Chemical Safety Cards of the IPCS, available on the Internet, should serve as the international model and reference.

5. Employers should ensure that the safety data sheet is displayed in print or digitally on site and easily available to workers in appropriate languages. Workers should be informed of the hazards that they may be exposed to, how to protect themselves from that hazard, and what to do if they are exposed.

10.6. Health surveillance

1. The provisions of Appendix I of these guidelines concerning workers' health surveillance, the use of the results of health surveillance and record keeping, should apply.

2. Exposure to the following types of hazardous substances may require appropriate health surveillance:

a) substances (dusts, fibres, solids, liquids, fumes, gases) that have a recognized systemic toxicity (that is, an insidious poisonous effect);

b) substances known to cause chronic effects;

c) substances known to be sensitizers, irritants or allergens;

d) substances that are known or suspected carcinogens, teratogens, mutagens or harmful to reproductive health; and

e) other substances likely to have adverse health effects under particular work conditions or in case of fluctuations in ambient conditions.

3. In the case of exposure of workers to specific hazards, health surveillance should include biological monitoring for the early detection of the effects on health when:

a) a valid and generally accepted reference method exists;

b) it may be used to identify workers who need detailed medical examination (subject to the individual worker's consent); or

c) it may be necessary to detect exposure levels and early biological effects and responses.

11. Physical hazards

11.1. General provisions

1. For eliminating or controlling exposure to physical hazards, the provisions of the ILO code of practice on ambient factors in the workplace (2001), should be consulted.

11.2. Slips and trips

1. Slips and trips are the most common type of hazards in shipbuilding and ship repair.

2. Injuries (for example strains, sprains, bruises to joints and muscles, ligaments, tendons and bones) often occur because of poor initial design and maintenance. These include missing walkways, materials left in walking aisles, deterioration of steps and stairs, unprotected openings, poorly maintained ladders and walking surfaces rendered slippery by:

a) wet or oily surfaces;

b) occasional spills;

c) weather hazards;

d) loose covers of decks or floors; or

e) low friction of wet or steel decks.

3. Inadequate lighting, poor visibility, waste, uncovered electrical cables or air and gas hoses, and uneven walking surfaces can also be significant factors. The risk of accidents is increased when workers carry objects that block their view or are too heavy or awkward.

4. Employers should assess the risk of slips and trips, especially during maintenance, when the risk can be higher.

5. Slipping should be prevented, for example by placing rubber mats on decks and on travel lines for pedestrians in front of ships, particularly in wet or icy conditions.

6. Tripping should be prevented through the use of handrails and of battery-operated power tools to minimize the need for electric cables. Walkways and floors should be kept clean and free from tools, including:

a) additional tools, material and equipment that are not necessary to perform the job in progress;

b) debris, including solid and liquid wastes at the end of each work shift or job; and

c) all cables and hoses crossing walkways.

11.3. Noise

1. The competent authority should set standards for the maximum noise dose considered acceptable to prevent hearing impairment in the working environment on a daily basis and for the maximum peak noise level.

2. When monitoring areas of high noise exposure, the employer should, as appropriate, consider the:

a) risk of hearing impairment;

b) degree of interference to communication essential for safety purposes; and

c) risk of fatigue, with due consideration of the mental and physical workload and other non-auditory hazards or effects.

3. In order to prevent adverse effects of noise on workers, employers should:

a) identify the sources of noise and the tasks that give rise to exposure to noise;

b) seek the advice of the competent authority and/or the occupational health service about exposure limit standards and other nationally and internationally recognized instruments to be applied;

c) seek the advice of the suppliers of processes and equipment used in shipbuilding and ship repair facilities about expected noise emission; and

d) if this advice is incomplete or in doubt, arrange for measurements by competent professionals in accordance with current nationally and internationally recognized instruments.

4. Noise measurements should be used to:

a) quantify the level and duration of the exposure of workers and compare it with exposure limits, as established by the competent authority or internationally recognized instruments;

b) identify and characterize the sources of noise and exposed workers;

c) create a noise map for the determination of risk areas;

d) assess the need both for engineering noise prevention and control and for other appropriate measures and their effective implementation; and

e) evaluate the effectiveness of existing noise prevention and control measures.

5. Based on the assessment of the exposure to noise in the working environment, the employer should establish a noise prevention programme with the aim of eliminating the hazard or risk, or reducing it to the lowest practicable level by all appropriate means. The employer should review the effectiveness of any engineering and administrative controls to identify and correct any deficiencies. If a worker's noise exposure exceeds the

permissible level, the employer should use all feasible engineering and administrative controls to reduce the worker's noise exposure to the permissible exposure level, and enrol the worker in a hearing conservation programme that would include:

a) audiometric testing;

b) training and education on hearing loss;

c) provision of effective hearing protection;

d) additional noise measurements to determine continued exposure; and

e) continued examination of methods and controls to lower noise levels causing the overexposure.

6. In the case of new processes and equipment, as far as practicable:

a) low noise output of the process and equipment should be specified as a condition of purchase, alongside production-related specifications; and

b) the workplace layout should be arranged to minimize the noise exposure of workers.

7. In the case of existing processes and equipment, it should first be considered whether the noisy process is necessary at all, or whether it could be carried out in another way without generating noise. If the elimination of the noisy process as a whole is not practicable, improving maintenance or replacing its noisy parts with quieter alternatives should be considered. Machinery and tools should be checked periodically since wear on components could lead to an increase in noise levels.

8. If the elimination of noisy processes and equipment as a whole is impracticable, individual sources should be separated out and their relative contribution to the overall sound pressure level identified. Once the causes or sources of noise are

identified, the first step in the noise control process should be to attempt to control it at source. Such measures may also be effective in reducing vibration.

9. If prevention and control at source do not reduce exposure sufficiently, enclosure of the noise source should be considered as the next step. In designing enclosures, several factors should be taken into consideration if the enclosure is to prove satisfactory from both an acoustical and a production perspective, including workers' access and ventilation. Enclosures should be designed and manufactured in accordance with the requirements and needs indicated by the user, consistent with internationally recognized instruments.

10. If enclosure of the noise source is impracticable, consideration should be given to alternative sound transmission path treatment using a barrier to block or shield the worker from the noise hazard. Barriers should be designed and manufactured in accordance with the requirements and needs indicated by the user, consistent with nationally and internationally recognized instruments.

11. If reducing the noise at source or intercepting it does not reduce workers' exposure sufficiently, then the final options for reducing exposure should be to:

a) install an acoustical booth or shelter for those job activities where the movement of the worker is confined to a relatively small area;

b) minimize, by appropriate organizational measures such as job rotation, the time workers spend in the noisy environment;

c) designate specific areas with high noise levels and install appropriate warning signs indicating that hearing protection is mandatory; and

d) provide hearing protection.

12. Workers who may be, or have been, exposed to noise levels exceeding occupational standards should receive initial and further regular audiometric testing (for example within three months of commencing work, and at least annually). Workers who may be exposed to significant levels of noise should be trained in:

a) the effective use of hearing protection devices;

b) identifying and reporting on new or unusual sources of noise that they become aware of; and

c) the role of audiometric examination.

13. Workers in noisy environments should be informed of the:

a) results of their audiometric tests;

b) factors leading to noise-induced hearing loss and the consequences, in terms of non-auditory effects and social consequences;

c) noise level;

d) the precautions necessary, especially those requiring the intervention of workers or the use of hearing protection devices;

e) effects that a noisy environment may have on their general safety; and

f) symptoms of adverse effects of exposure to high levels of noise.

14. For further information, refer to Chapter 9 of the ILO code of practice on ambient factors in the workplace (2001).

11.4. Vibration

1. Exposure of workers to hazardous vibration mainly comprises:

a) whole-body vibration, when the body is supported on a surface that is vibrating, such as in vehicles or when working near vibrating industrial machinery; or

b) hand-transmitted vibration, which enters the body through the hands and is caused by various processes in which vibrating tools or work pieces are grasped or pushed by the hands or fingers.

2. Employers should comply with exposure limit standards and other nationally and internationally recognized instruments, as required by the competent authority. If workers are frequently exposed to hand-transmitted or whole-body vibration, and obvious steps do not eliminate the exposure, the employer should assess the hazard and risk to safety and health resulting from the conditions, and:

a) identify the sources of vibration and the tasks that give rise to exposure;

b) seek the advice of the supplier of vehicles, machinery and equipment about their vibration emissions; or

c) if this advice is incomplete or in doubt, arrange for measurements by a competent person, in accordance with nationally and internationally recognized instruments and currently available knowledge.

3. Vibration measurements should be used to:

a) quantify the level and duration of exposure of workers, and compare it with exposure limits as established by the competent authority or other nationally and internationally recognized instruments to be applied;

b) identify and characterize the sources of vibration and the exposed workers;

c) assess the need both for engineering vibration control and for other appropriate measures, and for their effective implementation;

d) evaluate the effectiveness of particular vibration prevention and control measures; and

e) if possible, determine the resonance frequencies.

4. The assessment should identify the ways in which vibrating tools are used and determine, in particular, whether:

a) the high-risk use of tools can be eliminated;

b) workers have had sufficient training in the use of the tools; and

c) the use of tools can be improved by supports.

5. With a view to establishing appropriate prevention and control measures, the assessment should take into account:

a) exposure to cold at the workplace, which can bring on symptoms of vibration white finger (Raynaud's phenomenon) in those exposed to vibration;

b) vibration of the head or eyes, as well as vibration of the displays themselves, which can affect the perception of displays; and

c) body or limb vibration, which can affect the manipulation of controls.

6. Employers should ensure that workers who are exposed to significant vibration hazards are:

a) informed about the hazards and risks of prolonged use of vibrating tools;

b) informed about the measures within the workers' control which will minimize risk, particularly the proper adjustment of seating and working positions;

c) instructed in the correct handling and use of hand tools with a light but safe grip; and

d) encouraged to report finger blanching, numbness or tingling, without unwarranted discrimination, for which there should be recourse in national law and practice.

7. Manufacturers should:

a) provide vibration values for their tools;

b) redesign processes to avoid the need to use vibrating tools;

c) provide information to ensure that vibration is controlled by correct installation;

d) avoid resonance frequencies of the component parts of machinery and equipment;

e) consider including remote control capabilities into equipment that causes vibration hazards; and

f) use, where practicable, anti-vibration handles.

8. When purchasing equipment and industrial vehicles, employers should ascertain that the vibration exposure of the user is in line with national laws and regulations or other nationally and internationally recognized instruments.

9. Where old machinery is still in use, sources of vibration that present a risk to safety and health should be identified, and suitable modifications made by employing current knowledge of vibration damping techniques.

10. Seating in vehicles, including static plant with integral seating, should be designed to minimize transmission of vibration to the operator, and should permit an ergonomically good working position.

11. Where workers are directly or indirectly exposed to vibration transmitted via the floor or other structures, the

vibrating machines should be mounted on vibration isolators (anti-vibration mounts), installed according to the manufacturer's instructions, or designed and manufactured according to internationally recognized instruments for plants and equipment.

12. Machinery or vibrating tools should be maintained regularly, because worn components may increase vibration levels.

13. Where exposure might lead to injury if workers continue to work for a longer period, and reduction of the vibration is impracticable, the work should be rearranged to give rest periods or job rotation sufficient to reduce overall exposure to a safe level with reasonable accommodation for pregnant workers.

11.5. Lighting

1. The task area should be sufficiently lighted to ensure that work can be effectively performed and poses no risk to workers' eyesight.

2. Where natural lighting is not adequate to ensure safe working conditions, and at night, adequate and suitable artificial lighting, including portable lighting where appropriate, should be provided at every workplace and any other place on the shipbuilding or ship repair facilities or vessel, where a worker may have to pass.

3. Where possible and appropriate, the permanent lighting of a ship should be assembled as early in the operation as possible.

4. Electric lighting should comply with the relevant requirements, particularly in respect of prevention of sparks and sources of ignition and minimum lighting levels. Only persons authorized to do so should switch off or displace lamps in the

general lighting system. Matches and open-flame lamps should not be used for lighting on board the ship. Explosion-proof work lights with low voltage specified by nationally and internationally recognized instruments (for example, 12–24 V) should be used in confined spaces.

5. If the lighting in a ship is provided solely by sources outside the ship, adequate emergency lighting should be available on board during the whole shipbuilding or ship repair operation. Workers should be provided with, or have access to, hand lights in case of blackouts.

6. Artificial lighting should not, as far as practicable, produce glare or disturbing shadows.

7. Where necessary to prevent danger from electric shock, wiring, lamps and electric machinery should be protected by suitable guards against accidental breakage.

8. 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 shipbuilding and ship repair operations.

11.6. Electricity

11.6.1. General provisions

1. Electrical equipment should only be installed in a manner consistent with national laws and regulations or other nationally and internationally recognized instruments. Sufficient numbers of suitably certified and competent persons should be assigned to develop, implement and maintain all electrical equipment in conformity with those requirements. Such persons should be competent to a level commensurate with any qualification requirements of a competent authority.

2. An electrical control plan respecting all the electrical equipment at the shipbuilding and ship repair facility and the ship under construction should be prepared and implemented. The electrical control plan should cover:

a) the examination and testing of all electrical equipment before use, after installation, reinstallation or repair;

b) the systematic examination and testing of all electrical equipment at the shipbuilding and ship repair facility and the ship under construction to ensure its proper maintenance, including ensuring that accumulation of dust is not permitted;

c) the intervals, which may differ for different equipment and parts of equipment, within which all electrical equipment should be examined and tested;

d) the nature of the examination and testing to be carried out; and

e) the manner in which the results of every examination and test made pursuant to the control plan are to be durably recorded.

3. No one, except a competent person or persons working directly under their close personal supervision, should undertake any electrical work where technical knowledge or experience is required.

4. Notices should be posted at prominent positions at the shipbuilding and ship repair facility and the ship under construction:

a) prohibiting any unauthorized person from handling or interfering with electrical equipment; and

b) setting out directions as to the rescue and first aid of persons suffering from electric shocks or burns.

5. Electrical installations should be protected from inadvertent access by fencing or locked installations, and appropriate warning signs posted.

11.6.2. Insulation

1. All power wires and cables should be adequately insulated where they pass into or out of electrical compartments. Cables should enter metal frames of motors, splice boxes and electrical compartments only through proper fittings. When insulated wires, other than cables, pass through metal frames, the holes should be substantially bushed with insulated bushings.

2. Communication conductors for telephone and low potential signalling systems should be protected by isolation or suitable insulation, or both, from contacting energized power conductors or any other power source.

3. High-voltage electrical conductors should be covered, insulated or so placed as to prevent contact with low-voltage conductors. The voltage on bare signal wires accessible to contact by persons should not exceed a voltage likely to result in a fatal shock. In the selection of insulating material, consideration should be given to the conditions under which the conductors will be used.

11.6.3. Control devices

1. All electrical equipment and circuits should be provided with properly designed switchgear to facilitate control and, when necessary, isolation or lock-out. Principal power switches and terminals should be appropriately labelled to show which units they control.

2. Control devices need to be maintained and inspected at regular intervals.

3. In case there are multiple controllers for a motor, the circuit should be so arranged that the motor can be started again only from the same controller from which it was stopped.

11.6.4. Distribution boxes

1. Distribution boxes should be provided with a disconnecting device for each branch circuit. Such disconnecting devices should be equipped or designed in such a manner that it can be determined visually when the device is open and the circuit de-energized. Distribution boxes should display single-line diagrams and be labelled to show which circuit each device controls.

2. Inspection and cover plates on electrical equipment and junction boxes should be kept in place at all times, except during testing or repair.

11.6.5. Earthing systems

1. All earthing conductors should be electrically continuous throughout, and in effective electrical connection with earth and with the equipment they are intended to earth. Individual earthing conductors should be connected in parallel and it should be strictly forbidden to connect them in series.

2. All metal enclosing or encasing of electrical circuits should be earthed or provided with equivalent protection. This requirement does not apply to battery-operated equipment.

3. Frame earthing or equivalent protection should be provided for mobile equipment powered through trailing cables. Metal fencing and metal buildings enclosing electrical apparatus should be earthed.

4. A specific requirement should be established within the scheme of maintenance for verifying resistance and continuity of earth leads and establishing that the maximum resistance specified in national laws and regulations or nationally and internationally recognized instruments is not exceeded.

11.6.6. Overload and earth leakage protection

1. The current in all systems should be so controlled that when, in any circuit, the current exceeds a specified value, it is automatically cut off. Fuse links of all fuses and circuit breakers should be calibrated by the manufacturer and the rated current should be indicated.

2. The use of unmarked or uncalibrated fuses and circuit breakers, or defeating fuses or bridges, should be prohibited.

3. The conditions under which automatic earth leakage current protection is required together with the current levels at which the protection should operate should be defined and applied (for example, each circuit supplying portable electrically operated handheld equipment should operate at no more than 250 V and have earth leakage current protection of no more than 30 milliamps at 30 milliseconds sensitivity).

11.6.7. Transformers

1. Transformers should be suitably housed and where necessary fenced. Transformer enclosures, where provided, should be kept locked against unauthorized entry.

2. Any transformer, installed for the first time, should not contain polychlorinated biphenyls (PCBs) or other materials likely to release toxic gases when ignited. In-service transformers containing these materials should be removed from service and marked as PCBs and disposed of responsibly as soon as practicable.

11.6.8. Conductors

1. Conductors or wiring, and the conditions under which they are installed and used, should be in accordance with national laws and regulations or nationally and internationally recognized instruments.

2. All overhead power lines should be constructed and maintained in accordance with national laws and regulations or nationally and internationally recognized instruments.

3. Temporary overhead power lines in a shipbuilding and ship repair facility and ship under construction or repair should conform to the following requirements:

a) a table of distances of the lowest phase wire of a power line to the ground should be prepared;

b) no other materials should be made below overhead power lines; and

c) no forklift or lifting appliances should be used under or near power lines unless the lifting or extending part of the machine does not approach nearer than a safe distance from the power lines (for example 1 m for lines up to 1 kV, 3 m for lines up to 33 kV, 6 m for lines up to 132 kV, or 7 m for lines up to 400 kV. Where the rating is unknown, the distance should be no nearer than 6 m).

4. Any work in the vicinity of overhead power lines should be the subject of a risk assessment and permits prior to commencement.

5. Trailing cables should be attached to machines in a suitable manner to protect the cable from damage and to prevent strain on the electrical connections. Surplus trailing cable on cranes and similar equipment should be:

a) stored in cable boats;

b) stored on reels mounted on the equipment; and

c) otherwise protected from mechanical damage.

6. While it should be avoided, workers who have to manually handle trailing cables in the course of their duties should be provided with the necessary equipment, such as insulated hooks, tongs, gloves and aprons for this purpose. Trailing cables feeding mobile machinery should be so laid as to avoid their being damaged or run over. In inundated areas, cables should be laid on supports.

7. A cable that has been mechanically damaged should be taken out of service as soon as possible. Notwithstanding this provision, a damaged cable may remain temporarily in use only if it is examined by a person with appropriate electrical expertise and rendered safe. Any cable requiring repair should be disconnected from the feed point and any residual electrical charges should be discharged.

8. Electric power lines should not be worked on during thunderstorms.

9. Permanent splices and repairs made in power cables, including the earth conductor where provided, should be:

a) mechanically sound and with electrical conductivity which is equivalent to that of the original;

b) insulated to a degree at least equal to that of the original, and sealed to exclude moisture; and

c) provided with damage protection as near as possible to that of the original, including good bonding to the outer jacket.

10. Power cables energized to potentials in excess of 150 V, phase-to-earth, should not be moved by equipment unless sleds or slings insulated from such equipment are used. When such energized cables are moved manually, insulated hooks, tongs, ropes or slings should be used unless suitable protection for

persons is provided by other means. This does not prohibit the pulling or dragging of a cable by the equipment it powers when the cable is physically attached to the equipment by suitable mechanical devices, and the cable is suitably insulated from the equipment. Power cables should be routed and separated from torch cables.

11.6.9. Switchboards and switchgear

1. Switchboards and switchgear should be so installed, located and guarded that:

a) the control means are safely and readily accessible to authorized persons;

b) live parts are inaccessible to unauthorized persons;

c) adequate working space is provided for manual operation where required, including at the back of any switchboard having exposed live parts lower than 2.5 m from the ground; a clear space of not less than 1 m is provided between the top of the equipment and any ceiling having exposed combustible material;

d) adequate illumination is provided;

e) interrupting capacity adequate to handle the short circuit current of the system is incorporated;

f) access by unauthorized persons is prevented or prohibited and a notice to this effect posted at the entrance; and

g) a notice is posted describing the procedure for first aid in case of electric shock.

11.6.10. Protection of portable, transportable and mobile machines

1. Transportable and mobile machines and their associated trailing cables operating above extra-low voltage (normally less than or equal to 50 V AC (rms) and less than or equal

to 120 V DC (ripple free)) should be protected by automatic earth leakage devices and by automatic earth continuity devices capable of cutting off the voltage in the event of a break in the earth conductor of the cable between the supply or control box and the machine.

2. In the case of earth leakage devices and related equipment, as defined in national laws and regulations or other nationally and internationally recognized instruments, the following should be specified:

a) the leakage current at which the equipment should be set to operate;

b) the time to trip the circuit supplying the equipment; and

c) in the case of any portable machine or equipment and its associated trailing cable operating at a voltage above extra low voltage, the value in milliamps at which an instantaneous-type earth leakage tripping device should be set to operate.

3. Portable electrical equipment and flexible cables should be protected by automatic continuity protection, capable of cutting off the voltage in the event of a break in the earth conductor of the cable between the supply or control box and the machine.

4. Any device limiting the fault current should have a time rating which is certified as being manufactured to an approved standard.

5. The inspection and testing intervals of equipment should be based on its use.

11.6.11. Miscellaneous safety procedures

1. Controls should be in place to prevent mobile equipment running over power conductors, nor should loads be

dragged over power conductors, unless the conductors are properly bridged or otherwise protected.

2. Power circuits should be de-energized before work is done on such circuits unless hot-line tools are used. Suitable warning signs should be posted by the persons doing the work. Switches should be locked out or, where not possible, other measures taken to prevent the power circuits from being energized without the knowledge of the persons working on them. Such locks, signs or preventive devices should be removed only by the person who installed them or by authorized persons.

3. Electrically powered equipment should be de-energized before mechanical work is done on such equipment. Power switches should be locked out or, where not possible, other measures taken to prevent the equipment from being energized without the knowledge of the persons working on it. Suitable warning notices should be posted at the power switch and signed by the persons who are to do the work. Such locks, notices or preventive devices should be removed only by the persons who installed them or by authorized persons.

4. If equipment has to be moved or operated near energized high-voltage power lines where the clearance is less than 3 m, the lines should be de-energized and earthed or other precautionary measures taken.

5. When a potentially dangerous condition is found, it should be corrected before equipment or wiring is energized.

6. Appropriate danger signs should be posted at all major electrical installations.

11.7. Electric and magnetic fields

1. Electric and magnetic fields are found around all equipment that passes an electric current, including in

welding and inspection, using techniques based on magnetic particles. Some studies indicate that exposure to magnetic fields might cause certain types of cancers and brain tumours. They can also affect a person's mood, alertness, heart function, and the immune and reproductive systems. Some individuals suffer from skin irritation in the presence of electrical fields.

2. Unlike electric fields, magnetic fields cannot be easily screened off, as they can pass through all materials. However, the power of the field rapidly diminishes as the distance from the source of the magnetic field increases. It is generally advisable to shut down all electrical equipment when not in use.

3. Workers with heart pacemakers should not be exposed to magnetic fields of a strength likely to affect the device. Pregnant women should not be exposed to magnetic fields of a strength likely to affect the foetus. Equipment producing such fields should be clearly signposted.

4. Fixed installations which generate high strength fields, such as transformers and switching stations, should be sited as far away from work areas as possible.

5. Further guidelines and recommendations can be found in *Protection of workers from power frequency electric and magnetic fields: A practical guide*, ILO Occupational Safety and Health Series No. 69 (Geneva, 1994).

11.8. Optical radiation

1. Workers performing operations where they are exposed to optical radiation – ultraviolet (UV), visible light including sunlight and infrared (IR) – should be provided with adequate personal face and eye protective equipment, particularly in flame-cutting and welding operations.

2. For the purpose of detecting precancerous lesions of the skin, workers continually working under optical radiation exposure, including exposure to the sun, should be under medical surveillance at regular intervals.

11.9. Ionizing radiation

1. Equipment that is a source of ionizing radiation includes:

a) devices using sealed radioactive sources, for example:
   i) density gauges;
   ii) level gauges;
   iii) multiphase flow meters;
   iv) smoke detectors;
   v) moisture gauges; or
   vi) non-destructive testing equipment (gamma rays); and

b) irradiating devices (X-rays), for example:
   i) XRF analytical equipment (handheld or in on-site laboratories); and
   ii) non-destructive testing equipment.

2. The presence and form of these sources and the radiation dose to which workers may be exposed form the basis for the risk assessment of the hazard of ionizing radiation exposure.

3. Radiation exposure monitoring should be implemented in accordance with nationally and internationally recognized instruments.

4. Equipment which produces ionizing radiation should be correctly used and maintained in accordance with recognized international instruments.

5. Signs should be used when using ionizing radiation devices to ensure that other workers are not exposed to the hazard.

6. Exclusion zones should be developed as per the manufacturer's instructions and access should be restricted to areas where ionizing radiation devices are used, and these should be marked with appropriate signs and safety flag lines.

7. Health surveillance measures for a shipbuilding and ship repair facility and for a ship under construction and repair should take into account the potential of exposure to ionizing radiation where this is an issue at the facility. Workers should be instructed about radiation types, their potential effects and how they are monitored and measured.

8. Further information: *International basic safety standards for protection against ionizing radiation and for the safety of radiation sources* (FAO, IAEA, ILO, OECD/NEA, PAHO and WHO), Vienna, 1996 and the ILO code of practice on radiation protection of workers (ionizing radiations) (1987).

11.10. Radiography

1. The use of fissionable material for the inspection of material and welds is the most common source of radiation in shipbuilding and ship repair processes. Radiation is produced by X-ray machines or by radiographic substances, such as iridium-192 or cobalt-60. Radiographic substances emit radiation constantly.

2. The competent authority should ensure that the necessary criteria, regulations and other instruments for radiation protection are formulated in consultation with the representative organizations of employers and workers.

3. Radiation exposure monitoring should be implemented in accordance with nationally and internationally recognized instruments.

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

5. 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.

11.11. Heat and cold stress and wet conditions

1. Risks arise in special conditions, including when:

a) temperature and/or humidity are unusually high;

b) workers are exposed to high radiant heat;

c) high temperatures and/or humidity occur in combination with heavy protective clothing or a high work rate;

d) temperature is unusually low;

e) high wind speed (more than 5 m per second) prevails with a low temperature;

f) work is carried out for extended periods of time at low temperatures; or

g) work is carried out in rainy or wet conditions that cause poor visibility and slippery surfaces, and can increase the risk of hypothermia.

2. If workers are exposed in all or some of their tasks to any of the conditions listed above, and the hazard cannot be eliminated, employers should assess the hazards and risks to safety and health from extreme temperatures and wet conditions, and determine the controls necessary to remove the hazards or risks, or to reduce them to the lowest practicable level.

3. The assessment should take 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 are uncomfortable and less likely to be used in extremely hot working environments.

4. In assessing the hazards and risks, employers should:

a) make comparisons with other similar workplaces where measurements have been made; where this is not practicable, arrange for measurements to be performed by a technically capable person, using appropriate and properly calibrated equipment;

b) seek the advice of the occupational health service or a competent body about the exposure standards to be applied; and

c) bear in mind that the accuracy of manual work is adversely affected by cold temperatures.

5. When the assessment reveals that workers may be at risk of heat stress or hypothermia, employers should, as far as practicable, eliminate the need for work in such conditions or take measures to reduce the risks from extreme temperatures.

6. Workers exposed to heat, cold or wet conditions, as well as their supervisory officials, should be trained:

a) to recognize symptoms which may lead to heat stress or hypothermia, in themselves or others, and the steps to be taken to prevent onset and/or emergencies;

b) in the use of rescue and first-aid measures; and

c) in the action to be taken in the event of the increased risk of accidents because of high or low temperatures or wet conditions.

7. Workers should be advised of:

a) the importance of physical fitness for work in hot, cold or wet environments; and

b) the importance of drinking sufficient quantities of a suitable liquid and a diet that ensures the intake of salt and potassium and other elements that are depleted due to sweating.

11.11.1. Hot working environments

1. Where unhealthy or uncomfortable conditions arise from increased air temperature, the employer should implement means to reduce air temperature, which may include ventilation or air cooling.

2. Employers should take particular care with ventilation design where work is undertaken in enclosed spaces or areas. When fail-safe systems are not in operation, there should be adequate supervision of workers at risk to ensure that they can be removed from danger.

3. Where part of the risk arises from the metabolic heat produced during work, and other methods of eliminating the risk are impracticable, employers should arrange a work–rest cycle for exposed workers preferably in an air-conditioned or cooler resting room. The rest periods should be as prescribed by the competent authority and should be sufficient to allow the worker to recover. Employers should ensure that the appropriate mechanical aids are available to reduce workloads and that tasks performed in hot environments are well designed ergonomically for both women and men to minimize physical stress.

4. For hydration maintenance, employers should make available sufficient quantities of drinking water, with the proper electrolytes, where appropriate.

5. Where a residual risk of heat stress remains even after all the control measures have been taken, workers should be adequately supervised so that they can be withdrawn from the

hot conditions if symptoms occur. Employers should ensure that first-aid facilities, and staff trained in the use of such facilities, are available.

6. Extra care should be taken when workers are required to move from a very hot working environment to a much colder one, especially when exposed to a strong wind, as the wind-chill factor can result in exposed flesh cooling very rapidly.

11.11.2. Cold working environments

1. Workers should be protected against the severest forms of cold stress, hypothermia and cold injury. In cold climates, during the cold season, as far as practicable:

a) exposed working places should be enclosed or screened against the wind;

b) facilities should be provided for workers to warm themselves when working in exposed conditions; and

c) if enclosure or screening (subparagraph (a)) is not possible, suitable protective clothing should be provided and worn.

2. The core body temperature should not be allowed to fall below 36°C (96.8°F). Suitable protection should be provided to prevent injury to body extremities.

11.11.3. Rainy or wet working environments

1. Workers in wet conditions should not use electrical tools or equipment that are not specifically designed for outdoor use. Employers should provide appropriate rain gear, non-slip grip gloves and footwear for use in inclement weather.

2. Employers should provide protection and procedures against risks created by lightning during thunderstorms, in particular in relation to work in high locations such as work around exhaust chimneys and cranes.

12. Ergonomical hazards

1. Where workers are using machinery, the provisions of the ILO code of practice on safety and health in the use of machinery (2013) should apply, in particular reference is made to figure 5 of that code.

2. Manual carrying and lifting of large, bulky and/or heavy objects is common in shipbuilding and ship repair, and can cause musculoskeletal injuries. Besides, long-lasting repetitive work movements, excessive force and awkward postures may also cause musculoskeletal injuries.

3. Measures should be taken to ensure the appropriate selection or adaptation of tools, machines and equipment, including PPE, taking into account local conditions in user countries and, in particular, ergonomic implications and the effect of climate.

4. The competent authority, after consulting the representative organizations of employers and workers concerned, should establish safety and health requirements for repetitive work, working postures, physical load and the handling and transport of materials, particularly for manual handling. Such requirements 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.

5. Workers should not be required or permitted to engage in repetitive work, the manual handling or transport of a load which due to posture required by them or by reason of its weight, size, shape and nature is likely to jeopardize their safety or health. In such situations, mechanization of work processes

should be introduced progressively to replace manual lifting and handling, with reasonable accommodation for pregnant workers.

6. 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.

7. If complete elimination is not practicable, the time that workers are required to spend in such conditions should be as short as possible by sufficient rest periods and job rotations. Changes in posture should be possible.

8. Workers should be informed about the hazards related to physical work, work postures, repetitive movements and lifting and carrying loads, including physical limits for force, frequency and posture.

9. Workers should be trained in using correct work techniques, where they have been established, to reduce the risk of disorders. They should receive all the necessary information about the process, equipment, their co-workers and any risks associated with the job in the correct form and in due time to enable them to complete the tasks without risks to their health and safety.

13. Biological hazards

1. National laws and regulations should ensure that risks, such as those of infection, allergy or poisoning due to biological agents, are prevented or kept to a minimum when the work activities comply with relevant nationally and internationally recognized OSH instruments.

2. In areas where biological agents pose a hazard (sludge evacuation, bilge- and sediment-clearing operations, etc.), preventive measures should be taken which consider 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, both women and men;

c) action against vectors, such as rats and insects;

d) chemical prophylaxis and immunization;

e) the provision of first aid, antidotes and other emergency procedures in case of contact with poisonous animals, insects or plants, and suitable preventive and curative medicine; and

f) the supply of adequate protective equipment and clothing that is adaptable for use by both women and men, and other appropriate precautions.

14. Safety requirements for tools, machines and equipment

14.1. General provisions

1. All tools, machines and equipment can be the source of diverse hazards and great attention should be paid to their design, manufacturing, planned use, maintenance and disposal.

2. To ensure that tools, machines and equipment are safe, key decisions have to be taken already at the concept/design and manufacturing stages. This code does not cover these decisions, as the steps to be taken by designers and manufacturers of machines are not undertaken at shipbuilding and ship repair facilities. It is, however, recommended that the guidance in the ILO code of practice on safety and health in the use of machinery (2013) (the "Machinery code") should be followed by designers and manufacturers of tools, machines and equipment for shipbuilding and ship repair, and taken into consideration by employers when choosing tools, machinery and equipment.

3. In accordance with the provisions of the Guarding of Machinery Convention, 1963 (No. 119), and the Guarding of Machinery Recommendation, 1963 (No. 118), all tools, machines and equipment used in shipbuilding and ship repair, including hand tools, both manual and power-driven, should:

a) comply with safety and health requirements as prescribed in international or national standards and recommendations, wherever these are available;

b) be of good design and construction, taking into account, as far as possible, safety and health and ergonomic principles;

c) be maintained in good working order;

d) inspected before each use;

e) be used only for work for which they have been designed and in line with the manufacturer's instructions, unless it has been assessed by a competent person who has concluded that such use is safe;

f) be used or operated only by workers who have been authorized and given specific training; and

g) be provided with protective guards, shields or other devices, as required by national laws or regulations.

4. Employers, manufacturers or agents should provide comprehensive and clear instructions and information on all aspects of operator/user maintenance and the safe use of tools, machines and equipment. These should include any safety features, requirements for PPE, as well as the need for training.

5. No worker using tools, machines or equipment should make inoperative the guards provided, nor should such guards be made inoperative on any machinery to be used by any worker.

6. Equipment should be so designed as to allow easy and safe maintenance and minor repair at the worksite. Workers who operate equipment should be trained to do day-to-day maintenance on machines and tools. Only competent persons should carry out repairs on machines and tools.

7. Machines and equipment should be so constructed and installed as to avoid hazardous points between moving and stationary parts or objects. If this is not the case, all dangerous moving parts, such as reciprocating components, revolving shafts, gearing or belt drives, should be enclosed or adequately guarded in accordance with national laws and regulations.

8. Workers operating tools, machines and equipment should be provided with appropriate PPE.

9. Employers should develop a system for identification and tag out of defective tools to ensure they are not used.

14.2. Hand tools

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.

2. When not in use, and while being carried or transported, sharp tools should be kept in sheaths, shields, chests or other suitable containers.

3. When used at heights, tools should be secured to workers to prevent them from being dropped during transportation or when the workers lose their grip, and to ensure they are not left behind after work.

4. Only non-sparking tools should be used near or in the presence of flammable or explosive dusts or vapours.

5. Employers should not issue or permit the use of unsafe tools.

14.3. Power-driven tools

14.3.1. Pneumatic tools

1. Operating triggers on portable pneumatic tools should be:

a) so placed as to minimize the risk of the accidental starting of the machine; and

b) arranged to close the air inlet valve automatically when the pressure of the operator's hand is removed.

2. Hose and hose connections for the supply of compressed air to portable pneumatic tools should be:

a) designed for the pressure and service for which they are intended;

b) fastened securely to the permanent pipe outlet and to the tool; and

c) designed so that they cannot be released while the hose is under pressure.

3. Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel.

4. Tools should not be shot out of pneumatic hammers, but be removed by hand.

5. When cutting rivets with pneumatic cutters:

a) the tools should be provided with a cage guard or other suitable device to catch the rivet heads; or

b) the workers should be provided with suitable head, hearing and eye protection.

6. Pneumatic tools should be disconnected from the source of power and the pressure in the hose lines released before any adjustments or repairs are made.

7. Air supply lines should:

a) be adequately protected from damage by traffic or other movement; and

b) over such surfaces as those of ladders, steps, scaffolds and walkways, they should not be laid in such a manner as to create a tripping hazard.

8. Portable pneumatic tools should not be hoisted or lowered by the air line.

9. Reciprocating pneumatic equipment should have the plungers, dies and tools removed when they are not in use.

10. Compressed air should not be used for cleaning clothing or parts of the body, or be directed at the body.

11. Hoses should be inspected visually before each use and removed if damaged.

14.3.2. Hydraulic tools

1. Hydraulic tools should be stored in dry conditions and the hoses should be kept in hanging position.

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.

3. The safe operating pressure recommended by the manufacturer for hoses, valves, pipes, filters, and other fittings must not be exceeded.

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.

5. The maintenance of hydraulic tools should be based on the work cycles of the equipment, in accordance with the instructions of the manufacturer.

14.3.3. Cartridge-operated tools

1. When using cartridge-operated tools, a warning sign should be displayed in the working area.

2. 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.

3. The recoil of a cartridge-operated tool should not be capable of injuring the user.

4. The noise of the detonation should not be such as to damage hearing.

5. A cartridge-operated tool, before each 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) the moving parts work easily; and

d) the barrel is unobstructed.

6. At intervals recommended by the manufacturer, the tool should be completely dismantled and inspected by a competent person for wear of the safety devices.

7. Cartridge-operated tools should be repaired only by the manufacturer or by competent persons.

8. Cartridges should not be stored or cartridge-operated tools used:

a) in a place or environment where they could explode accidentally; or

b) in an explosive atmosphere.

9. When not required for use, inspection or other purpose, cartridge-operated tools should be kept 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) stores the cartridge separate from the tools.

10. No cartridge-operated tool should be stored or transported loaded, or left loaded when not in use.

11. Cartridge-operated tools should be accompanied by instructions for their maintenance and use and should only be operated by persons trained in their safe use.

12. The employer should keep a registry of cartridges.

14.3.4. Electrical tools

1. Portable electrical tools should, as far as possible, be operated by rechargeable batteries in order to avoid cables lying on the floor, or should use reduced voltage to avoid the risk of a lethal shock.

2. All electrical tools should:

a) be earthed/grounded as per the manufacturer's specifications, unless they are "all-insulated", "double-insulated" or battery powered tools which do not require an earth; earthing should be incorporated in metallic cases, and as a safeguard against damaged cables where wires enter the tool; and

b) be inspected and maintained on a regular basis by a competent person, and complete records kept.

3. Electrical equipment for use in places where a potentially explosive atmosphere is likely to occur should be constructed so as not to be liable to ignite that atmosphere. Other electrical equipment should be pressurized or otherwise explosion-protected to a standard appropriate for use in that atmosphere.

14.3.5. Stored energy

1. The shipbuilding and ship repair industry uses a variety of machinery which contains stored energy, for example, pressure energy in pneumatic and hydraulic systems, electrical energy in capacitive elements or batteries, or mechanical energy in components under strain. The unexpected release of these energies can lead to very serious injury to workers in the vicinity. Of particular concern are maintenance activities which typically involve workers being in close proximity to machinery with stored energy (unless isolated or dissipated) and undertaking activities which are likely to compromise the containment of that energy.

2. A particular hazard is presented by hydraulic and other gas or steam systems which typically operate under very high pressures. Workers in close proximity to these systems may suffer hydraulic fluid injection injuries which, in addition to the physical damage caused, can result in necrosis of surrounding tissue due to the common components of hydraulic fluids.

3. An initial and ongoing risk assessment should be conducted to identify machinery and its components containing stored energy which, if accidentally released, can result in injury to workers.

4. Workers who may work in close proximity to machinery containing stored energy should be identified and made aware of the potential hazards of the unexpected release of that energy. This especially applies to workers involved in maintenance activities, and the arrival and departure of a ship when it is being winched into the dry dock or during manoeuvres, with cables and ropes under tension.

5. Only authorized and competent workers should work on equipment with stored energy.

6. Where there are specific hazards, such as electricity, pressure differentials, poor air quality or radiation, these should be identified and controlled so that workers and others in the workplace are not endangered. This should include confirmation that:

a) electrical, gas and liquid connections have been isolated and any excess pressure in the systems concerned has been discharged;

b) suitable guarding or enclosure of equipment or components that can unexpectedly release energy;

c) any unexpected movement of machinery is prevented;

d) suspended loads have been secured;

e) scaffolding, work platforms and ladders used for the work have an adequate stability and carrying capacity;

f) tanks or confined spaces are serviced, inspected or cleaned, measures have been taken to control the danger from lack of oxygen, toxic gases or other hazardous substances, and that appropriate emergency procedures are in place;

g) access to the danger area is restricted to essential personnel and a safety zone is established;

h) appropriate PPE and protective clothing are supplied and used; and

i) equipment or components that contain or store energy, including pressure vessels, actuators and pipes, should be maintained and inspected in accordance with manufacturers' recommendations and relevant laws.

7. To isolate or dissipate potentially damaging energy sources, the following action should be taken:

a) machinery should be fitted with a means to disconnect and isolate it from all energy sources. Such isolators should be

clearly identified. They should be capable of being locked in the "off" position if reconnection could endanger workers. This is especially important where a worker is unable to check that the energy is still cut off due to the inaccessibility of the area;

b) identify and implement specific procedures for the control of hazardous energy. These procedures should include preparation for shut-down, lock-out or tag-out, a permit-to-work system and verification of isolation, as part of a formal risk management system;

c) after the energy is cut off it should be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to workers;

d) certain circuits may remain connected to their energy sources in order, for example, to hold parts, to protect information, and to light interiors. In this case, special steps should be taken to ensure worker safety;

e) where there is a potential for fluid release, the pipeline should be blanked off; and

f) steps to safely re-energize and reinstate equipment to operational status.

8. The lock and tag should only be removed by those persons who installed them or by authorized personnel only after it is verified that this may be done without creating a hazard to the workers.

14.4. Tools for plate-cutting, flame-cutting and other hot work

1. Workers should be:

a) competent and familiar with the equipment to be used, which should be inspected by a competent person before use; and

b) given careful instructions if special precautions need to be taken.

2. Harmful fumes may be produced and oxygen depleted during operations. Special care should be taken during operations, in particular, in enclosed places and confined spaces in accordance with the provisions of section 7.9.

3. Before any operation begins, inspections and tests should be carried out by a competent person to ensure that there are no combustible solids, liquids or gases at, or in, any compartments adjacent to the work area which might be ignited by heat or sparks from the work.

4. All surfaces upon which hot work is to be conducted should be free of oil, grease or any flammable or combustible material.

5. All openings through which sparks might fall should be closed where practical or covered by appropriate protective materials.

6. Cargo tanks, fuel tanks, cargo holds or other tanks or spaces (including cargo pumps and pipelines) that have contained flammable substances should be certified by a competent person as being free of flammable gases before any work commences.

7. Adequate ventilation or protection against fumes should be in place.

8. All operations should be properly supervised and a fire watch maintained, both in the operational area and all adjacent areas, including spaces on the other side of affected bulkheads. Because of the possibility of delayed fires, the fire watch should be maintained for a suitable period of time after the work has been completed.

9. An adequate quantity of appropriate fire extinguishers should be kept at hand.

10. Clean and approved PPE should be worn by the worker and other persons involved in the work process. The worker should normally wear:

a) a welding helmet and suitable eye shield;

b) leather working gloves;

c) a leather apron when appropriate; and

d) other appropriate PPE.

14.5. Abrasive wheels

1. Floor stands for abrasive wheels should be:

a) rigidly constructed;

b) sufficiently heavy for the wheels, discs, etc. used; and

c) securely mounted on substantial foundations so as to withstand vibration.

2. Abrasive devices should be equipped with protection hoods or other suitable devices to prevent injury to persons if the wheel or belt breaks.

3. Stationary abrasive wheels and portable abrasive wheels, whenever practicable, should be equipped with exhaust systems that will effectively remove the dust and dirt particles produced in grinding.

4. Work rests on abrasive wheels should be substantially constructed, rigidly supported and readily adjustable, shaped to fit the contour of the wheel, and securely fixed in position as close as practicable to the wheel.

5. Portable abrasive wheels used for external grinding should be provided with protection hoods, and abrasive wheels

used for internal grinding should be provided with adequate protection flanges.

6. Abrasive wheels should be inspected before they are mounted to ascertain whether they are cracked or otherwise damaged.

7. Every abrasive wheel should be properly mounted.

8. The maximum safe speed of operation should be marked on every abrasive wheel. Abrasive wheels should not be run at a speed exceeding the maximum safe speed indicated on them.

9. Dry grinding or brushing should not be done on surfaces coated with harmful paint unless local exhaust ventilation is provided or respiratory protective equipment is used.

10. Workers employed on abrasive wheels should be provided with protection for the head and eyes against flying particles or splashes and protection against respiratory and hearing hazards.

14.6. Gas cylinders

14.6.1. General requirements

1. Cylinders for compressed or liquefied gases should be:

a) properly constructed with sound material;

b) fitted with appropriate safety devices in accordance with national laws and regulations or other nationally and internationally recognized instruments;

c) inspected and tested by a competent person as prescribed; and

d) stored, transported, handled and used in conformity with the prescribed safety measures.

2. If cylinders charged with liquefied gases are heated, this should not be done with an open flame.

14.6.2. Storage

1. Cylinders should be properly secured and kept upright, but must be capable of quick release. Oxygen and fuel gas cylinders (such as acetylene) should be kept in suitable, separate, well-ventilated compartments that are not subject to extremes of temperature. The space should have no electrical fittings or other sources of ignition. "No smoking" signs should be displayed at the entrance and within the space. Prohibition of smoking should be enforced.

2. Inside buildings, oxygen cylinders should not be stored near acetylene cylinders or near cylinders filled with other fuel gases.

3. Cylinders should be kept at a safe distance from:

a) electrical conductors, such as third rails, trolley wires and grounding conductors; and

b) all operations which produce flames, sparks or molten metal, or cause excessive heating of the cylinders.

4. Valve protection caps should always be in place when cylinders are not in use or not connected for use.

5. Loaded and empty gas cylinders should be kept in separate places. Empty gas cylinders should be marked to show that they are empty.

6. No tools or other objects should be placed on the top of a gas cylinder.

14.6.3. Moving and handling

1. Cylinders should not be knocked, dropped or rolled in handling, or otherwise subjected to violent shocks, especially at low temperatures.

2. Cylinders should be moved by tilting and rolling them on their bottom edges.

3. When cylinders are transported by vehicle, they should be secured in position.

4. The devices for holding the cylinders should be such that the cylinders can be rapidly removed in case of fire.

5. When in use, cylinders should be held in place by a truck, chain or other effective means.

6. When cylinders are hoisted, they should be secured on a cradle, slingboard or pallet. They should not be hoisted by means of magnets or choker slings.

7. Valve protection caps should not be used for lifting cylinders from one vertical position to another. Bars should not be used under valves or valve protection caps to pry cylinders loose when frozen. Warm, not boiling, water should be used to thaw cylinders loose.

8. Unless cylinders are firmly secured on a special carrier intended for this purpose, regulators should be removed and valve protection caps put in place before cylinders are moved.

9. All cylinders, particularly acetylene cylinders, should be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are actually being hoisted or carried.

14.7. Lifting appliances and gear

14.7.1. General requirements

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; and

b) in accordance with the requirements laid down in national laws and regulations or other nationally and internationally recognized instruments.

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.

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 and a guarantee of conformity with national laws and regulations or other nationally and internationally recognized instruments 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.

4. Documentation (as appropriate) relating to lifting appliances should include:

a) a driver's instruction manual;

b) an erection manual;

c) a maintenance manual;

d) a spare parts manual;

e) the manufacturer's certification of fitness for use;

f) a certificate of test and thorough examination after initial erection;

g) the manufacturer's certificates for wire ropes installed on cranes; and

h) periodic examination and maintenance records.

5. Controls of lifting appliances should conform to ISO 7752-1:2010 Cranes – Control layout and characteristics – Part 1: General principles, and ensure that the operator has ample room for operation when at the controls. They should:

a) be so positioned that the operator has an unrestricted view of the operation or any person authorized to give the operator signals;

b) be marked with their purpose and method of operation;

c) return to the neutral position when released; and

d) be equipped with a dead man's handle to prevent unattended movement.

6. 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 or other nationally and internationally recognized instruments.

7. 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.

8. Lifting appliances where the safe working load varies with the radius of operation should display a chart, showing the radius and the corresponding safe working load, in accordance with nationally or internationally recognized instruments. 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.

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

10. 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 signals or other adequate means.

11. A safe distance, as prescribed by national laws and regulations, or other nationally and internationally recognized instruments should be provided between moving parts or loads of lifting appliances and:

a) fixed objects in the surrounding environment; and

b) electrical conductors.

12. 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.

13. Power-operated lifting appliances should be fitted with a safe working load limiter. This should operate when the load that is being raised or lowered exceeds the safe working load by a predetermined amount. The limiter should only prevent motions that would increase the overload.

14. Every power-operated lifting appliance should be provided with an efficient brake or brakes capable of arresting a

load while it is being lowered. The brakes should normally be applied automatically when:

a) the motion control lever is returned to its neutral position;

b) an emergency stop is operated;

c) there is a power supply failure;

d) when overspeed is detected; or

e) in the case of electrically operated brakes, there is a failure of one phase or a significant drop in voltage or frequency of the power supply.

15. In accordance with the Occupational Safety and Health (Dock Work) Convention, 1979 (No. 152), and as prescribed by national laws and regulations or other nationally and internationally recognized instruments, every lifting appliance and every item of loose gear should be examined and tested by a competent person:

a) before being used for the first time;

b) after erection on a site;

c) subsequently at prescribed intervals; and

d) after any substantial alteration or repair to load-bearing parts.

16. Only tested appliances, gear and equipment can be used for lifting. Inspection and testing of all lifting appliances should be carried out by a competent person. A record of load tests must be included in the equipment record giving details of the tests, including verification of the test loads used, and be signed and dated by the person conducting the test.

17. The results of tests and examinations should be recorded. After completion of the thorough examination, the competent person should prepare a report which:

a) identifies the item examined, the date of the thorough examination, its safe working load(s) and any defects found;

b) specifies any parts to be repaired or replaced;

c) includes a statement that the item is, or is not, safe for continued use;

d) gives the date by which the next test and thorough examination of the lifting appliance should be carried out; and

e) gives the name and qualifications of the competent person.

18. A register of the lifting appliances and items of loose gear should be kept in a form prescribed by the competent authority.

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

a) is 18 years of age or older according to the Minimum Age Convention, 1973 (No. 138), and the Worst Forms of Child Labour Convention, 1999 (No. 182);

b) is medically fit; and

c) has received appropriate training in accordance with nationally or internationally recognized instruments and is properly qualified.

20. 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.

21. No person should be raised, lowered or carried by a lifting appliance unless it is constructed, installed, certified 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; or

b) for which the lifting appliance can safely be used.

22. All lifting appliance operators and users of loose gear should be carefully selected, trained and tested to ensure that they are competent. Operators should be trained and certified to operate each make and model of lifting appliance that they are called upon to use.

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

24. For further information, refer to 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.

14.7.2. Cranes

1. 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.

2. The operator's cab should be ergonomically designed to provide the operator with a safe and comfortable working environment, as well as having a means to control the internal temperature, such as air conditioning, if this is found necessary through an ergonomic assessment of the implications. The cab and its fittings should be constructed of fire-resistant material and conform to internationally recognized instruments. In particular, it should have:

a) an unrestricted view of the area of operation;
b) adequate protection from the elements;
c) windows that can be readily and safely cleaned inside and out;
d) a windscreen designed or equipped to ensure the operator has a full view of the load and is protected against UV radiation;
e) a comfortable seat that enables the operator to look in the required direction;
f) a sliding or inward-opening door readily openable from inside and outside if the cabin is elevated;
g) means of emergency escape;
h) suitable fire extinguishers; and
i) a secure means of access such as a fixed ladder with a safety cage.

3. The operator's cab should be designed to limit noise and vibration to within nationally permitted levels.

4. Radio controlled overhead cranes must be operated by a qualified worker who has been trained to operate the equipment. Certificates of trained workers should be kept by the employer, and a list of qualified workers should be kept in the charging compartment of the radio control devices. Radio controlled overhead cranes should be inspected daily, including the operation of brakes, automatic stopping distance, hook latch and radio controls.

5. Cranes should have a load limiter in accordance with subsection 14.7.1, paragraph 13.

6. Mobile cranes may travel with a suspended load only if the crane manufacturer has specified the load rating and provided clear instructions for this operation.

7. Rail-mounted cranes should be so designed that in the event of the breakage of a wheel, the failure of an axle or derailment, the crane will not overturn or collapse.

8. Rail-mounted cranes should be equipped with blinking yellow warning lights when moving and devices to clear the rails of dunnage and similar material automatically as the crane moves.

9. The wheels of rail-mounted cranes should be provided with guards to prevent danger to feet.

10. The rails should be of adequate section and bearing capacity, firm and level with an even rail surface and electrically bonded and earthed. Shock absorbing buffers should be provided on rail mounted cranes and on rail end stops.

11. Anemometers should be fitted in the most exposed position of large rail-mounted cranes to provide warning of wind conditions requiring them to be taken out of service.

14.7.3. Forklifts

1. Forklifts which are powered by internal combustion engines carry flammable fuel, produce exhaust emissions with toxic components and can create noise nuisance. The driver, as well as unauthorized riders or those working close by, are at risk of rollovers. The risk of being run over is high in areas of poor vision, especially when reversing.

2. Forklifts should be equipped with a rollover protection structure and, where applicable, seat belt to prevent injuries in case of rollover. All forklift operators should be trained in their safe use, in particular rollover prevention, and be required to follow safe work practices. They should observe all signs and clearance heights in relation to the height of the load or mast.

3. The "one seat, one rider" rule should be enforced without exception. Another worker may be lifted by the forklift only if a securely attached work platform, cage or other protective equipment is used to prevent falls.

4. All forklift operators should be alert to the presence of co-workers and bystanders and ensure that they are kept at a safe distance or separated by a barrier. Forklifts with an enclosed cab should be fitted with one or two rear-view mirrors. Traffic ways, walkways and work areas should be separated by yellow lines painted on the floor. Forklifts should be conspicuously painted or marked and fitted with a flashing or rotating yellow beacon, a horn and audible reverse signal or alarm.

5. Forklifts operating inside warehouses should preferably be equipped with electric motors. In workshops, electric pallet stackers or "walkie stackers" are preferable to even the smallest forklifts.

6. Forklifts operating outside can operate on LPG or diesel fuel. Every forklift driven by an internal combustion engine should:

a) have an efficient exhaust system fitted with a silencer and a gas cleaner, where appropriate;

b) have an exhaust system designed in such a manner that engine exhaust is directed away from the operator's position. Materials used in the vicinity of exhaust systems should be non-flammable and not adversely affected by heat from the exhaust system;

c) carry an appropriate fire extinguisher; and

d) be manufactured or adapted to comply with applicable noise-level regulations.

7. Local exhaust ventilation may also be necessary in places where dust, gas, vapour, steam or fumes are formed.

8. Forklifts powered by LPG should be equipped with an LPG lock-off valve to prevent the flow of LPG when the forklift is turned off. All connections of gas hoses and pipes must be checked for leaks after a new LPG cylinder has been connected.

9. The forks of the forklift should be designed to prevent their accidental unhooking or unintentional lateral displacement when in use. The forks of forklifts are items of loose gear and should be tested and certified before being brought into use. Movement of the attachment and its parts must be mechanically limited at the extreme positions.

10. In the event of the failure of a single lifting/lowering part of the mechanism (such as a gearwheel, chainwheel or spindle), a locking mechanism should prevent the elevated load or operator's platform from dropping.

11. Any trapping, crushing or shearing points within reach of the operator in the normal operating position on the truck should be suitably guarded. There should be no sharp edges or angles creating a hazard in the area of the operator in the normal operating position or in the area of access and egress during normal operation and daily checks.

12. The operator's compartment should be covered by an overhead guard and provide good all-round visibility. For forklifts with a high lifting capacity, a closed-circuit camera or automatic setting of correct height should be provided. However, where available, cameras and proximity sensors should only be used to assist the driver.

13. The controls of the forklift should be adjustable to suit all operators. The steps should be equipped with a high

grip and self-cleaning surface. Seat belts or other appropriate restraints should be provided and worn, where necessary. These should preferably be of the inertia reel type and designed to take into account the working position of the driver or operator, which may differ from that of a normal road vehicle. Sound-proofed safety cabs should be fitted where the noise levels from the truck engine exceed exposure limits. For forklifts operating outside, the compartment should be weatherproof.

14. Forklifts should be maintained in a safe and efficient condition. They should be inspected daily by the driver, operator or other competent person, and the inspection should include checking that tyre pressure is sufficient to maintain stability.

15. When the operator leaves the seat of the forklift, the forks should be fully lowered to the floor, the parking brake applied, the engine stopped. At the end of the shift, forklifts should be parked in designated parking areas or in authorized areas for charging batteries, and the keys properly kept to prevent unauthorized access.

16. Driver seating should be ergonomically designed. PPE for forklift drivers includes protective shoes, reflective clothing and a helmet with safety goggles when moving outside the driver's compartment.

14.7.4. Equipment for lifting persons

1. All newly acquired aerial lifts should meet the design and construction requirements of relevant nationally and internationally recognized instruments. Every effort should be made to replace equipment that does not meet current standards. Modifications to lifts are not allowed without written approval from the manufacturer.

2. Prior to operation every day, each operator should conduct a worksite and machine inspection, including applicable function tests of controls and safety devices. The purpose of these checks is to detect and abate hazards.

3. Most lifts are designed for operation on relatively flat surfaces with a minimal slope (less than 5 per cent). Operation on surfaces that exceed the manufacturer's maximum rated slope is not allowed.

4. The maximum load specified by the manufacturer must not be exceeded. This includes the weight of the person and all tools/supplies/equipment, etc. on the platform at any one time.

5. Minimum safe distances, in accordance with nationally and internationally recognized instruments, are to be maintained while working in an aerial lift.

6. Guard rails typically provide adequate protection for lifts that are stationary and where the platform rises straight up from its base. A certified fall protection system should be used when operating all boom type lifts.

7. When welding while on an aerial lift, the platform or any part of the machine must not be used for grounding.

8. When using electrical tools while on an aerial lift, only tools that are double insulated or have a grounding plug should be used.

9. In order to avoid collision hazards:

a) overhead cranes that are located within working distance of the lift should be locked out;

b) before lowering a platform, it should be ascertained that persons or objects are not present. A warning of the intent to descend (audible alarm, voice commands, etc.) should be given. Teammates on the ground must be warned before the platform is lowered;

c) warning barricades should be placed at a safe perimeter around the lift for both pedestrian and vehicular traffic;

d) the swing range should be taken into account in order to avoid objects within the range of motion of the machine;

e) when moving a lift, extreme caution and slow and deliberate motions should be used, particularly on slippery decks or when the route contains corners, blind spots and other visual obstructions; and

f) for drivable boom lifts, boom controls (not drive controls) should be used for the final positioning of the platform close to objects.

10. To avoid injury from pinch or shear points:

a) hands, arms and other body parts must be kept within the confines of the platform and guard rail while working on the platform. Hands and fingers must be kept away from moving parts while on the ground;

b) loose clothing that could be caught in chains, pulleys, lifts, etc. should be avoided; and

c) before conducting maintenance and repairs, the lift must be de-energized.

11. The lift should be secured and the key removed while it is stored to avoid improper use by unauthorized persons.

14.7.5. Maintenance

1. All lifting appliances and loose gear should be maintained in good working order, and in efficient condition and good repair.

2. Maintenance, including lubrication, should be carried out on a regular scheduled basis, in accordance with the manufacturer's recommendations and operational experience.

3. Replacement components should conform to the manufacturer's manual or be of an equivalent standard.

4. Repairs to the structure of a lifting appliance should follow the correct procedure specified by the manufacturer. Excessive heat can change the properties of steel.

5. Corrective maintenance should also be carried out when necessary.

6. An accurate record of all routine and corrective maintenance should be kept.

14.7.6. Ropes, chains and accessories

1. All ropes, chains and accessories should:

a) be of sound material, good construction and adequate strength, and the use of plant fibre ropes for the lifting of any material should be prohibited;

b) before being placed in service, be thoroughly tested by competent persons;

c) conform to any national technical standards that may be applicable; and

d) be maintained in good working order.

2. Only tested and labelled equipment can be used for lifting. A safe working load must be marked on every lifting appliance. All lifting appliances with a safe working load should be inspected periodically. The status of inspection should be clearly marked, for instance by use of a colour code. Care should be taken that any paint or coatings do not conceal any inspection points.

14.7.6.1. Chains

1. A load must 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.

2. A thorough inspection of all chains in use must be made at least every three months. Each chain must bear an indication of the month in which it was thoroughly inspected. The thorough inspection must include inspection for wear, defective welds, deformation and increase in length or stretch.

3. All repairs to chains must 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 must be proof tested to the proof test load recommended by the manufacturer.

4. Chain slings must be removed from service when, due to stretch, the increase in length of a measured section exceeds 5 per cent.

14.7.6.2. Hooks

1. The manufacturer's recommendations should be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available should be tested to twice the intended safe working load before they are initially put into use.

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

3. 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.

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

5. Hooks should be inspected periodically to ensure that they have not been bent by overloading. Bent or sprung hooks must not be re-used.

14.7.6.3. Wire ropes

1. Wire ropes should be of adequate strength for the frequency and type of intended use and selected in accordance with ISO 16625:2013 Cranes and hoists – Selection of wire ropes, drums and sheaves.

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

3. Hoisting ropes should be in one length without any joins. 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. It may also be necessary to fit larger sheaves if the connection needs to pass over them.

4. 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.

5. The safe working load should be marked on every wire rope.

6. 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; and
f) an excessive number of broken wires.

14.7.6.4. Synthetic fibre ropes

1. Fibre rope and synthetic web slings are used primarily for lifting machinery units and piping equipment. They are also the best choice for use for valuable loads, highly finished parts, fragile components and delicate equipment.

2. Fibre rope deteriorates upon contact with acids and caustics. Fibre rope slings should not therefore be used with such substances, unless the manufacturer recommends them for that use.

3. Inspection of fibre rope slings is carried out by examining the surface for cuts, gouges or worn surface areas, dry, brittle, scorched or discoloured fibres, or melted fibres. Where defects are observed, the rope must be discarded. Fibre rope slings cannot be repaired. The interior of fibre ropes should be inspected. It should be clean. A build-up of powder on the inside of a fibre rope indicates excessive internal wear.

14.7.6.5. Safe operation of lifting gear

1. Lifting hooks, clamps, wires, lines, shackles, lugs, lever-pullers and chain-blocks must be controlled visually by the operator before lifting.

2. Workers must ensure that all lifting gear:

a) has 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 based, and the number of legs if more than one;

b) is not loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

c) is not used without the affixed and legible identification markings, as required.

14.7.6.6. Shackles

1. The diameter of the body and pin of a shackle are indicated, as well as its safe working load, which must be taken into consideration at all times. Shackle pins are always larger than the body of the shackle. Shackles are usually manufactured from two types of steel, grade T (800 N per mm^2) and grade M (400 N per mm^2).

2. When pairs of shackles are selected for a job, both should have the same safe working load. Size may be misleading, as grade T shackles are approximately twice the strength of grade M shackles.

3. 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.

4. "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.

5. 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.

6. 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 with seizing wire to keep them from coming undone.

14.8. The use of robots and modern technology

1. Accidents involving robots could include:

a) the arm of the robot causes the accident through an unpredicted movement caused by component or software malfunctions;

b) a workers' limb or other body part can be trapped between a robot's arm and other peripheral equipment;

c) a gripper mechanism or an accessory of the robot's mechanical parts fails; and

d) the power supplies to the robot are uncontrolled.

2. Particularly hazardous situations are likely to occur:

a) if workers enter into the operating envelope of the robot;

b) when workers are in close proximity to the robot system for programming, teaching, trouble shooting, maintenance or repair purposes.

3. The employer should conduct a risk assessment for all new and used robots and ancillary equipment prior to the introduction of robot systems, and in case the robot has been moved or modified. The risk assessment should determine the controls and safety features necessary to achieve and maintain a safe work environment for workers.

4. The employer should train and instruct workers in the safe operation and maintenance of the robot system and ancillary equipment. Competent persons with the required technical skills should be available at the shipbuilding and ship repair facility to oversee the installation, deployment, maintenance and repair of robot applications, and the implementation of all related control strategies.

5. All robots should comply with nationally and internationally recognized instruments and be provided with the technical information as to their design and use. They should be designed:

a) to prevent exposure of workers to components, gears, drive belts or linkages;

b) so that loss of electrical power, voltage surges, or changes in oil or air pressure do not impair the safe operation of the system;

c) so that hazards caused by breaking, loosening, or releasing stored energy are minimized;

d) to prevent unauthorized or unintended modification of operating parameters; and

e) with layers of protection and redundancy built into safety systems.

6. All robots should be installed safely in accordance with the manufacturer's instructions and relevant nationally and internationally recognized instruments.

7. Each robot should have customized safety control features, depending on the particular hazards and risks of the robot.

8. Common safety features to prevent unauthorized access into the operating envelope of the robot include:

a) interlocked perimeter guards around the operating envelope of the robot with safety sensors that ensure doors are closed;

b) flashing lights, signs, whistles or horn to indicate the robot application is in use;

c) safety light curtains, laser scanners, pressure-sensitive safety mats or other presence sensing devices to stop the robot in case of unauthorized access;

d) two-hand operating controls; and

e) emergency stop devices.

9. Robots should be maintained and repaired only by the manufacturer or by a competent person. Lockout and tag-out standards should be followed. When motion of the robot system is required for maintenance, it should occur in manual mode at a speed that is less than full machine speed.

10. These abovementioned safety features and control measures should be inspected at regular intervals.

15. Competence, education and training

15.1. General

1. In this section and in the context of shipbuilding and ship repair, the word "training" shall be taken to mean either "education" or "training" or both as appropriate.

2. The necessary OSH competence requirements should be defined by the employer based on the provisions of national laws or regulations or, in the absence thereof, in consultation with worker representatives. Appropriate training arrangements should be established and maintained to ensure that all workers are competent to perform the safety and health aspects of their present or planned duties and responsibilities.

3. The employer should have, or should have access to, sufficient OSH competence to identify and eliminate or control work-related hazards and risks, and to implement the OSH management system. Specific training needs can be identified from the initial and ongoing hazard identification, risk assessment, control and evaluation processes.

4. Training programmes should:

a) cover all workers at the shipbuilding and ship repair facility, including contractors and subcontractors, as appropriate;

b) be conducted by competent persons;

c) provide, in a manner and language understood by workers, effective and timely initial practical and theoretical training before commencement of duties and refresher trainings at appropriate intervals, or further to significant changes in risk levels for workers or in their functions;

d) include participants' feedback and evaluation of their comprehension and retention of the training with a view to the continuous improvement of the training;

e) be reviewed periodically by the safety and health committee, where it exists, or by the employer in consultation with workers or their representatives, and modified as necessary; and

f) be documented.

5. The form and the content of training should be devised and implemented in consultation with workers or their representatives. Training should be in accordance with the needs identified and include:

a) pertinent aspects of OSH legislation, codes of practice and instructions on the prevention of accidents and disease and 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 hygiene practices;

c) the correct and effective use of prevention, control and protection measures, especially engineering controls, and the worker's own responsibility for using such measures properly;

d) operating procedures while working at high-hazard work spaces;

e) correct methods for the handling of substances, the operation of processes and equipment, and for storage, transport and waste disposal;

f) ergonomically correct methods for the handling of materials and tools;

g) assessments, reviews and exposure measurements, and the rights and duties of workers in this regard;

h) the role of health surveillance, the rights and duties of workers in this regard, and access to information;

i) instructions on PPE as may be necessary, its significance, correct use and limitations, and in particular on factors which may show inadequacy or malfunction of the equipment, and the measures which may be required for the workers to protect themselves;

j) hazard warning signs and symbols for hazardous ambient factors which may occur;

k) procedures to be followed in an emergency, emergency measures, rescue, firefighting and fire prevention, and first aid;

l) appropriate hygiene practices to prevent, for example, the transmission of hazardous substances off site; and

m) cleaning, maintenance, storage and waste disposal, to the extent that these may cause exposure for the workers concerned.

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

7. Employers should ensure that training and information requirements and procedures are kept under review, as part of the assessment review and documentation.

8. Before commencing work, on-site pre-work briefings should be completed which cover the scope of work, work method, identification of key hazards and risk assessment. Such

briefings should be given to all workers on site, including contractors, subcontractors and other third parties. All relevant safety permits should be completed before work is commenced and the worksites should be supervised and examined to the same standards that exist for the shipbuilding and ship repair operation.

15.2. Qualification of managers and supervisors

1. Managers and supervisors should be in possession of an appropriate qualification and training, or have gained sufficient knowledge, skills and experience to qualify on the basis of competence, to ensure that they are able to:

a) plan and organize safe shipbuilding and ship repair operations, including identification of hazards, assessments of risks and the implementation of preventive measures;

b) establish, implement and maintain an OSH management system;

c) monitor the status of safety and health in those operations for which they are responsible; and

d) take remedial action in the event of non-compliance with requirements.

2. Managers should receive technical and other training to allow them to fulfil their responsibilities for OSH.

15.3. Qualification and training for workers

1. Workers should be assigned and only perform work for which they have the required level of skills, knowledge and training.

2. Employers should ensure that all workers, including contractors, subcontractors and their workers, are:

a) sufficiently educated and trained in the tasks they are assigned to and possess the relevant skills certificates;

b) suitably instructed in the hazards connected with their work and environment, as well as trained in the precautions necessary to avoid accidents and injuries to health;

c) made aware of the relevant laws, regulations, requirements, codes of practice, instructions and advice relating to prevention of accidents and diseases;

d) informed of their individual and collective responsibility for safety and health; and

e) sufficiently instructed in the correct use and effects of PPE and its appropriate care, and have training made available to them, as appropriate.

15.4. Qualifications of contractors, subcontractors and other third parties

1. Contracts for services should contain standard clauses requiring contractors to employ only workers and subcontractors who possess relevant skills, and to comply with nationally and internationally recognized instruments and establishment OSH requirements.

2. The OSH management systems of contractors and subcontractors and their OSH record should carry similar weight to other performance factors when considering the choice of contractors and subcontractors.

16. Personal protective equipment and protective clothing

16.1. General provisions

1. In accordance with section 3.4, paragraph 3, only where adequate protection against exposure to hazardous ambient factors through the elimination of hazards/risks, their control at source, minimization by the design of safe work systems and collective measures cannot be ensured and all other measures are either impracticable or could not secure safe and healthy working conditions, suitable PPE and protective clothing should be provided and maintained by the employer.

2. The minimum requirements for mandatory PPE on the shipbuilding and ship repair facility should be established and communicated.

3. PPE and protective clothing should comply with technical standards set by the competent authority, or recognized by national or international bodies, taking ergonomic principles into account, and be provided, as prescribed by national laws and regulations:

a) having regard to the type of work, the gender of the worker and based on a risk assessment;

b) without cost to the workers; and

c) in consultation with workers and their representatives.

4. 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 and protective clothing; and

b) arrange that PPE and protective clothing are properly stored, maintained, cleaned, examined, replaced and, if necessary for health reasons, disinfected or sterilized at suitable intervals, in accordance with nationally and internationally recognized instruments or guidance set or otherwise recognized by the competent authority.

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

6. Employers should provide workers with appropriate instructions and means to enable them to use, maintain and store PPE and protective clothing properly.

7. Workers should be required to:

a) make proper use of and take good care of PPE and protective clothing provided for their use;

b) use the provided PPE and protective clothing throughout the time they are exposed to the risk that requires its use; and

c) examine PPE periodically to ensure that it is in good condition and is replaced or repaired, as necessary, by the employer, at no cost to the user.

8. PPE should be ergonomically designed and, as far as practicable, should not restrict the user's mobility or field of vision, hearing or other sensory functions.

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

10. Before reissuing the clothing or equipment, employers should provide for the laundering, cleaning, disinfecting and examination of protective clothing or equipment which has been used and may be contaminated by materials that are hazardous to health.

11. In providing PPE and protective clothing, employers should take into account that:

a) proper maintenance and use of PPE, including appropriate behaviour of the user, are essential in providing the protection for which it is designed;

b) PPE itself may produce uncomfortable, unhealthy or unsafe working conditions;

c) only the user is protected, while others coming into the environment continue to be exposed;

d) PPE can provide a false sense of security, in particular when it is not properly used or has lost its effectiveness as a result of improper storage or maintenance; and

e) PPE may introduce additional hazards to the workforce.

12. PPE should meet the requirements of Chapters 7–14 with respect to each hazard identified at the facility, for example heat and cold stress, noise exposure, hazardous substances and vibration.

16.2. Clothing

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

2. The clothing supplied should meet the following requirements:

a) waterproof clothing and head coverings when working in adverse weather conditions;

b) distinguishing clothing or reflective devices or otherwise conspicuously visible material when there is regular exposure to danger from moving vehicles; and

c) the ability of the material from which the clothing is made to resist penetration by chemicals, minimize heat stress, release dust, resist catching fire and not discharge static electricity, as far as technologically possible.

16.3. Head protection

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 times while in the shipbuilding and ship repair facility. It may be necessary to carry different types of helmets for particular activities.

2. In general, the shell of a helmet should be of one-piece construction, with an adjustable cradle inside to support the helmet on the wearer's head and, where appropriate, particularly for persons working overhead, a chinstrap 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.

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

4. If splits or cracks appear, or if a helmet shows signs of ageing or deterioration of the harness, the helmet should be discarded.

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

6. In addition to safety, consideration should also be given to the physiological aspects of 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.

16.4. Face and eye protection

1. Clear or coloured goggles, a screen, a face shield or other suitable device should be worn when there is likely exposure to eye or face injury from airborne dust or flying particles, dangerous substances, harmful heat, light or other radiation, and in particular during welding, flame-cutting, grinding or other hazardous work.

2. Face and eye protectors are available in a wide variety of designs. Careful consideration should be given to the characteristics of the respective hazard to ensure the selection of the appropriate protector. Ordinary prescription (corrective) goggles, unless manufactured to a safety standard, do not afford protection. Goggles designed to be worn over ordinary prescription glasses should be selected according to the hazards to be protected against.

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

16.5. Hand and foot protection

1. Hands and feet should be protected against physical, chemical and other hazards. Protective gloves or gauntlets, appropriate barrier creams and suitable protective clothing to protect hands or the whole body, 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.

2. Gloves give protection from the particular hazard of the work being carried out and should be appropriate to that type of work.

3. Footwear of an appropriate type should be employed in workplaces where there is the likelihood of exposure to adverse conditions or of injury from falling or crushing objects, hot or hazardous substances, sharp-edged tools or nails and slippery wet surfaces.

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

5. Appropriate safety footwear, such as shoes and boots, should have firm, slip-resistant soles and reinforced toecaps and should be worn properly at all times. Sandals and similar footwear should not be worn when working.

6. Hand and foot protection should be available in appropriate sizes for those who are required to wear them.

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

16.6. Respiratory protective equipment

1. Respiratory protective equipment, suitable for the particular environment, should be used when workers cannot be protected against airborne dust, fumes, vapours or gases by ventilation or other means. Workers should be trained in the proper selection of filters, where appropriate.

2. Appropriate respiratory protective equipment should be provided for work in conditions where there is a risk of oxygen deficiency or exposure to poisonous, dangerous or irritating fumes, dust or gases.

3. The selection of correct equipment is essential and should be done in collaboration with those who need to wear the equipment. Since there is a wide variety of equipment available, advice should be sought from competent persons on the appropriate equipment for particular purposes. Different sizes and models should be available to accommodate a broad range of facial types.

4. Workers should be trained in the use and care of equipment so that they are able to inspect the respirator immediately prior to each use to ensure that it is in proper working condition. The face piece incorporated in respirators and breathing apparatus must be fitted correctly to prevent leakage. Beards and whiskers are likely to interfere with the face seal, as may the wearing of goggles, unless adequately designed for the purpose.

5. Respirators should be properly stored. Damage may occur if they are not protected from physical and chemical agents, such as vibration, sunlight, heat, extreme cold, excessive moisture or damaging chemicals.

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

7. Workers should be medically evaluated for their ability to wear a respirator safely before they are required to do so.

8. When negative pressure respiratory equipment is required on a regular basis, it should not be used without a proper documented fit test.

16.7. Hearing protection

1. Workers who by the nature of their duties are exposed to high levels of noise 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.

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. Earmuffs reduce the capacity to locate sound sources and prevent warning signals from being heard. This is especially true for workers with considerable hearing loss.

3. No model 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.

4. Hearing protectors only work well if they are well maintained. Good maintenance consists of cleaning, changing replaceable parts such as cushions, and overall monitoring of the state of the hearing protector.

16.8. Protectors against radioactive contamination

1. Respirators, overalls, head coverings, gloves, tight-fitting boiler suits, impermeable footwear and aprons appropriate to the risks of radioactive contamination should be worn in areas where unsealed radioactive sources are prepared or used.

16.9. Protection from falls

1. Fall protection equipment, attached to independent lifelines or suitable anchorages should be worn where

protection against falls cannot be provided by other appropriate means; and life vests and life preservers where there is a danger of falling into water. Workers should be provided with and trained in the use of appropriate fall protection equipment, such as harnesses and lifelines and, where necessary, shock-absorbing lanyards.

2. Appropriate and timely rescue should be provided when using fall-arrest equipment to prevent suspension trauma.

3. Workplaces and roadways in which there are fall hazards or which border on a danger zone should be equipped with devices which prevent workers from falling into or entering the danger zone.

17. Special protection

17.1. Employment and social insurance

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

a) ensure that every worker has an employment contract and is covered by a scheme for workers' compensation and social protection; and

b) provide coverage, 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 shipbuilding and ship repair facilities, irrespective of their employment status.

17.2. Working hours

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.

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; and

d) weekly rest.

17.3. Night work

1. In view of the hazardous nature of shipbuilding and ship repair, the consequences of fatigue on accidents frequency, severity and health should be considered.

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 working time, pay or similar benefits, and appropriate social services.

3. The employer should take the necessary measures to maintain the same level of protection against occupational hazards during night work, as by day, in particular avoiding, as far as possible, the isolation of workers.

4. Where night work is required, lighting and other safety and health conditions should be managed to ensure that risks do not exceed those in daytime operations.

17.4. Working alone

1. Working alone should be avoided. If it is necessary, the employer should take appropriate measures for the protection of workers working alone or in isolation.

17.5. Fatigue

1. Fatigue can be a contributing factor to dangerous occurrences or serious accidents because workers may not be

alert or able to quickly respond to changing circumstances. In addition, prolonged fatigue can lead to long-term health problems.

2. Fatigue results from a number of factors, including environmental conditions, such as excessive heat, cold or noise; physical or mental overexertion; and/or insufficient rest and sleep between activities (for example, from poor quality sleep). The inter-related causes of fatigue include:

a) time of day that work takes place;

b) length of time spent at work and in work-related duties;

c) type and duration of work tasks and the environment in which they are performed;

d) the ergonomic design of workstations and the environment in which work is performed;

e) quantity and quality of rest obtained prior to and after a work period;

f) activities outside work, such as family commitments or a second job; and

g) individual factors, such as sleep disorders.

3. Acute fatigue is caused by immediate episodes of sleep deprivation; for example, because of long periods of wakefulness from excessively long shifts or night shifts without adequate daytime rest. Ongoing sleep disruption can lead to sleep debt and chronic sleep deprivation, placing individuals in a state of increased risk to themselves and to others. It results in:

a) unpleasant muscular weariness;

b) tiredness in everyday activities; and

c) reduced coordination and alertness.

If sleep deprivation continues, work performance can deteriorate even further.

4. Fatigue can result from features of the work and the workplace and from features of a worker's life outside work. Levels of work-related fatigue are similar for different individuals performing the same tasks.

5. Work-related fatigue can and should be assessed and managed at an organizational level. The contribution of non-work-related factors varies considerably between individuals. Non-work-related fatigue is best managed at an individual level.

6. Work-related causes of fatigue include:

a) aspects of the tasks being undertaken (for example, greater workload within standard shifts);

b) roster design (for example, too many consecutive night shifts);

c) unplanned work, overtime, emergencies, breakdowns and call-outs;

d) features of the working environment (such as noise or temperature extremes); and

e) commuting times.

7. Non-work-related causes of fatigue include:

a) sleep disruption due to ill family members;

b) strenuous activities outside work, such as a second job;

c) sleep disorders;

d) inappropriate use of alcohol, prescription and illegal drugs; and

e) stress associated with financial difficulties or domestic responsibilities.

8. A fatigue risk assessment should be carried out and a written fatigue management programme drawn up for all

operations and in accordance with national laws if national laws prescribe. The fatigue management programme 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; or

c) do not have a minimum of two consecutive days off in any seven-day period.

Additional fatigue hazards identified during the risk assessment should be included in the plan.

9. The risk assessment and the fatigue management plan 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.

10. Daily and weekly working hours should be arranged so as to provide adequate periods of rest which, as prescribed by national laws or approved by inspectorates or collective agreements, where applicable, should include:

a) appropriate breaks during working hours, especially when the work is strenuous, dangerous or monotonous, to enable workers to recover their vigilance and physical fitness;

b) sufficient breaks for meals;

c) daily or nightly rest; and

d) weekly rest.

Extended workdays (above eight hours) should be contemplated only if:

a) the nature of the work and the workload permit; and

b) the shift system is designed to minimize the accumulation of fatigue.

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

17.6. Alcohol and drugs

1. Problems relating to alcohol and drug use may arise from personal, family or social factors, or from certain work situations, or from a combination of these elements. Such problems not only have an adverse effect on the health and well-being of workers, but may also cause difficulties at work, including a deterioration in job performance. As there are multiple causes of alcohol- and drug-related problems, there are consequently multiple approaches to prevention, assistance, treatment and rehabilitation.

2. Alcohol and other drug policies and programmes should promote the prevention, reduction and management of alcohol- and drug-related problems 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.

3. 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.

4. Workers who seek treatment and rehabilitation for alcohol- or drug-related problems 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.

5. It should be recognized that the employer has authority to discipline workers for employment-related misconduct associated with alcohol and drugs. However, counselling, treatment and rehabilitation should be preferred to disciplinary action.

6. Further information can be found in the ILO code of practice on management of alcohol- and drug-related issues in the workplace (1996) and *Alcohol and drug problems at work: The shift to prevention* (ILO, 2003).

17.7. HIV and AIDS

1. HIV and AIDS should be treated like any other chronic illness/condition in the workplace.

2. The ILO HIV and AIDS Recommendation, 2010 (No. 200), concerning HIV and AIDS and the world of work, and the ILO code of practice on HIV/AIDS and the world of work (2001) should be instrumental in helping to prevent the spread of the pandemic, mitigate its impact on workers and their families and provide social protection to help cope with the disease.

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 bloodborne pathogens, particularly with respect to emergency response. Universal precaution should be applied with respect to first aid and other medical procedures and to the handling of other potentially infected material.

4. There should be no disciplinary action nor 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.

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 reasonably adapted to their abilities, to find other work through training or to facilitate their return to work should be encouraged.

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, regardless of sexual orientation.

7. When there is a possibility of exposure to HIV at work, workers should receive education 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.

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

18. Welfare

18.1. General provisions

1. At, or within reasonable access of, every shipbuilding or repair location or premises, the following facilities should be provided for both women and men, kept clean and maintained:

a) sanitary and washing facilities or showers;

b) facilities for changing and for the storage and drying of clothing; and

c) accommodation for taking meals which can also be used as shelter during interruptions of work due to adverse weather conditions.

2. All workers should have access to an occupational medical service.

3. The scale of the above facilities, and their construction and installation, should comply with the requirements of the competent authority.

4. The welfare facilities should be provided with a view to avoiding the physical and psychological discomfort caused, in particular, by a crowded, unsafe, unhealthy and unstable living environment and a lack of privacy.

18.2. Drinking water

1. An adequate supply of wholesome drinking water of suitable temperature should be provided at, or within reasonable access of, every shipbuilding and ship repair facility.

2. The communal use of glasses or other drinking water receptacles should be prohibited.

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

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

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

18.3. Sanitary and washing facilities

1. Adequate sanitary and washing facilities, including hot and cold or warm running water, together with soap or other cleaning materials and towels or other drying equipment, should be provided by the employer to enable workers to meet a standard of personal hygiene consistent with the adequate control of exposure and the need to avoid the spread of materials hazardous to health.

2. Sanitary and washing facilities should be conveniently accessible, but situated so that they are not themselves exposed to contamination from the workplace. The type of facilities should be related to the nature and degree of exposure. 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 sanitary and washing facilities or showers.

3. Suitable toilets should be provided by the employer with hand washing facilities and soap. Toilets, washing facilities and areas set aside for eating should be kept clean and in a hygienic condition by the employer.

4. Electric showers should be connected to an earthing system.

18.4. Facilities for changing and storing clothing

1. Separate facilities for changing and storing clothing should be provided for women and men workers at easily accessible places, and should include suitable facilities for:

a) drying wet clothes, which should not be used for any other purpose; and

b) changing clothing including, where necessary to avoid contamination, suitable lockers separating work from street clothing.

2. Facilities for storing personal clothing should be provided for each worker when protective clothing is used or when there is a risk of the contamination of personal clothing by hazardous materials.

3. 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.

4. Suitable arrangements should be made for disinfecting facilities for changing and storing clothing and lockers, in conformity with the requirements of the competent authority.

18.5. Facilities and shelters for food and drink

1. Facilities and shelters should be made available, at or within easy access of the worksite, for protection from inclement weather and for washing, taking meals and for drying and storing clothing.

2. In appropriate cases, adequate facilities for heating, warming, obtaining or preparing food and drink should be provided at, or near, a shipbuilding and ship repair facility.

3. In order to reduce the risk of ingesting materials hazardous to health, employers should prohibit eating, chewing,

drinking or smoking in work areas in which adequate control of exposure can only be achieved by workers wearing PPE to prevent exposure to materials hazardous to health and in any other area where such materials are likely to be present.

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

5. Food and drink facilities should not have a direct connection to sanitary facilities, but should be equipped with a hand basin and soap in addition to a supply of wholesome drinking water. These facilities should have washable non-slip floors.

18.6. Living accommodation

1. Suitable living accommodation should be made available for the workers at shipbuilding or ship repair facilities which are remote from their homes, where adequate transportation between the facility and their homes or other suitable living accommodation is not available.

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, as a minimum, for:

a) a separate bed for each worker;

b) a separate locker for keeping personal belongings;

c) separate accommodation of the sexes;

d) an adequate supply of potable water;

e) adequate sanitary and washing facilities;

f) adequate ventilation and, where appropriate, heating;

g) canteens; and

h) rest and recreation facilities.

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 its construction material, minimum size and layout of accommodation, cooking, washing, storage, water supply and sanitary facilities.

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.

Bibliography

The International Labour Conference (ILC) has adopted a large number of international labour Conventions and Recommendations directly concerned with OSH. The ILO has also developed many codes of practice, guidelines and technical publications applicable to shipbuilding and ship repair. They represent a body of definitions, principles, obligations, duties and rights, as well as technical guidance that reflects the consensual views of the ILO's tripartite constituents from its 187 member States on most aspects of OSH.

1. Relevant ILO Conventions and Recommendations

1.1. Fundamental ILO Conventions and accompanying Recommendations

Freedom of association

a) the Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87); and

b) the Right to Organise and Collective Bargaining Convention, 1949 (No. 98).

The elimination of forced labour

a) the Forced Labour Convention, 1930 (No. 29), and the Protocol of 2014; and

b) the Abolition of Forced Labour Convention, 1957 (No. 105).

The abolition of child labour

a) the Minimum Age Convention, 1973 (No. 138), and the Minimum Age Recommendation, 1973 (No. 146); and

b) the Worst Forms of Child Labour Convention, 1999 (No. 182), and the Worst Forms of Child Labour Recommendation, 1999 (No. 190).

The elimination of discrimination

a) the Discrimination (Employment and Occupation) Convention, 1958 (No. 111), and the Discrimination (Employment and Occupation) Recommendation, 1958 (No. 111); and

b) the Equal Remuneration Convention, 1951 (No. 100), and the Equal Remuneration Recommendation, 1951 (No. 90).

1.2. Conventions and Recommendations on occupational safety and health and working conditions

a) the Hours of Work (Industry) Convention, 1919 (No. 1);

b) the Weekly Rest (Industry) Convention, 1921 (No. 14);

c) the Forty-Hour Week Convention, 1935 (No. 47);

d) the Labour Inspection Convention, 1947 (No. 81), and the Labour Inspection Recommendation, 1947 (No. 81);

e) the Radiation Protection Convention (No. 115), and the Radiation Protection Recommendation, 1960 (No. 114);

f) the Reduction of Hours of Work Recommendation, 1962 (No. 116);

g) the Employment Injury Benefits Convention (No. 121), and the Employment Injury Benefits Recommendation, 1964 (No. 121);

h) the Holidays with Pay Convention (Revised), 1970 (No. 132);

i) the Workers' Representatives Convention (No. 135), and the Workers' Representatives Recommendation, 1971 (No. 143);

j) the Occupational Cancer Convention (No. 139), and the Occupational Cancer Recommendation, 1974 (No. 147);

k) the Working Environment (Air Pollution, Noise and Vibration) Convention (No. 148), and the Working Environment (Air Pollution, Noise and Vibration) Recommendation, 1977 (No. 156);

l) the Occupational Safety and Health (Dock Work) Convention, 1979 (No. 152), and the Occupational Safety and Health (Dock Work) Recommendation, 1979 (No. 160);

m) the Occupational Safety and Health Convention, 1981 (No. 155), and the Occupational Safety and Health Recommendation, 1981 (No. 164);

n) Protocol of 2002 (recording and notification of occupational accidents and diseases) to the Occupational Safety and Health Convention, 1981;

o) the Occupational Health Services Convention, 1985 (No. 161), and the Occupational Health Services Recommendation, 1985 (No. 171);

p) the Asbestos Convention, 1986 (No. 162), and the Asbestos Recommendation, 1986 (No. 172);

q) the Chemicals Convention, 1990 (No. 170), and the Chemicals Recommendation, 1990 (No. 177);

r) the Night Work Convention, 1990 (No. 171), and the Night Work Recommendation, 1990 (No. 178);

s) the Prevention of Major Industrial Accidents Convention, 1993 (No. 174), and the Prevention of Major Industrial Accidents Recommendation, 1993 (No. 181);

t) the Part-Time Work Convention, 1994 (No. 175);

u) the Maternity Protection Convention, 2000 (No. 183), and the Maternity Protection Recommendation, 2000 (No. 191);

v) the List of Occupational Diseases Recommendation, 2002 (No. 194), (as well as the ILO List of Occupational Diseases (revised 2010)); and

w) the Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187), and the Promotional Framework for Occupational Safety and Health Recommendation, 2006 (No. 197).

1.3. Other ILO Conventions and Recommendations

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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, 1985 (No. 161), and the Occupational Health Services Recommendation, 1985 (No. 171), and the ILO *Technical and ethical guidelines for workers' health surveillance,* Occupational Safety and Health Series, No. 72 (Geneva, 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 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 introduce 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*.

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 unwarranted 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 personal protective equipment;

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 occupational safety and health (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.

Safety and health in shipbuilding and ship repair

The shipbuilding and ship repair industry is of strategic importance to many member States of the ILO.

This revised code of practice, adopted by a Meeting of Experts in January 2018, reflects the development of modern ILO instruments on occupational safety and health (OSH) and the changes in the industry in the past 44 years since an earlier code was adopted.

The revised code promotes a preventative safety and health culture in which the right to a safe and healthy working environment is respected at all levels, where government, employers and workers actively participate in securing a safe and healthy working environment through a system of defined rights, responsibilities and duties, and where the principle of prevention is accorded the highest priority. It further promotes OSH management systems as well as cooperation between employers and workers and their representatives. The revised code contains comprehensive guidance on how to improve OSH in the industry and sets out how governments, shipowners, employers, workers and their representatives should work together in doing so.

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