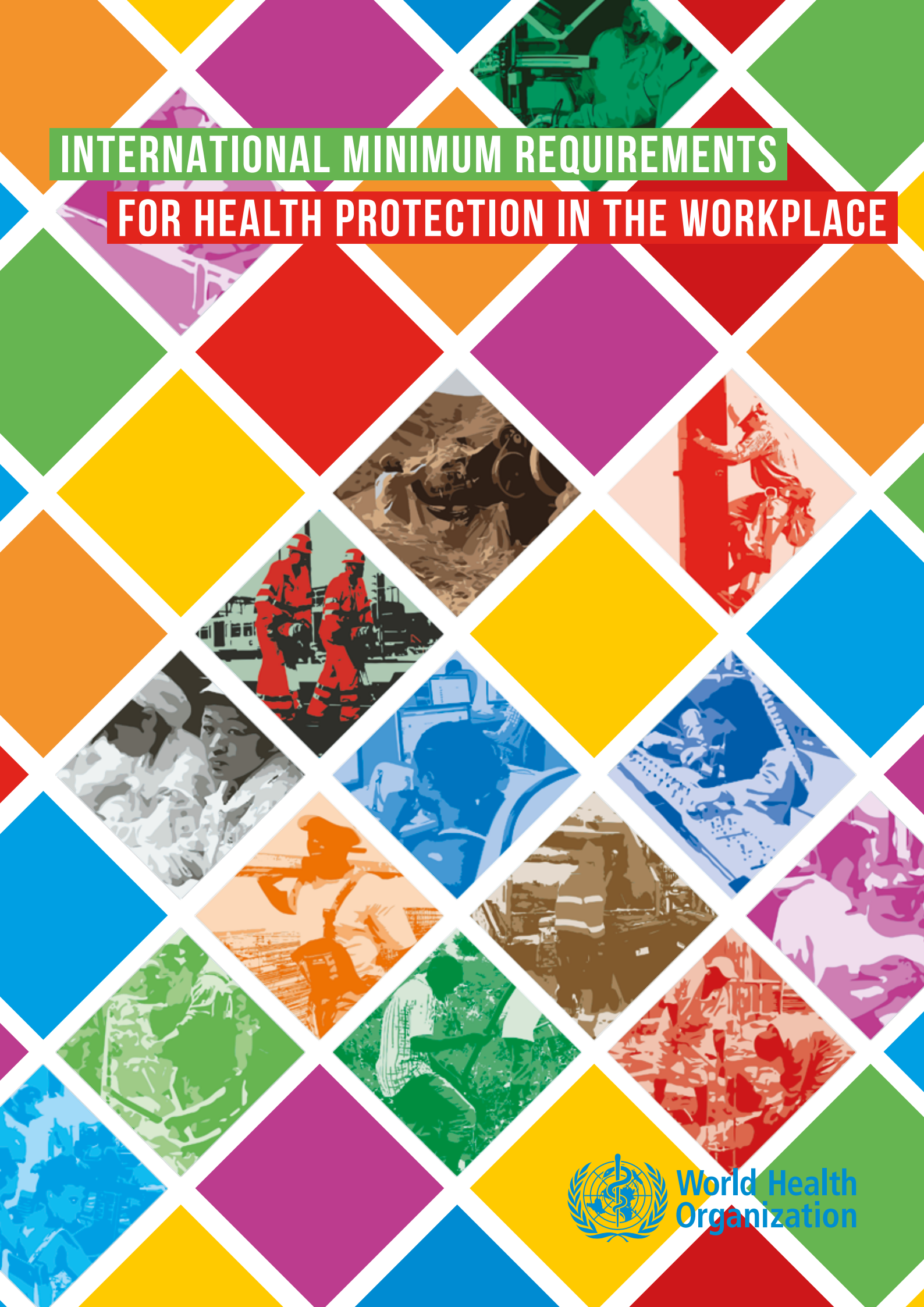
INTERNATIONAL MINIMUM REQUIREMENTS FOR HEALTH PROTECTION IN THE WORKPLACE



World Health Organization

INTERNATIONAL MINIMUM REQUIREMENTS FOR HEALTH PROTECTION IN THE WORKPLACE

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1. INTRODUCTION

A core function of the World Health Organization (WHO) is to set health-based norms and standards and to promote their implementation. WHO has adopted internationally recognized methods for guideline development to ensure a clear, transparent and unbiased process for comprehensive and objective assessment of the available evidence and international consensus on recommendations to meet global public health needs.[1]

The 60th World Health Assembly in 2007 requested that WHO should develop a set of minimum requirements for health protection, applicable to all workplaces in big and small enterprises whether in formal or informal work settings. Such standards are voluntary and are there to guide governments in developing their own national regulations and norms.

WHO regularly receives requests from its Member States to provide information and to advise on setting up national health standards for workplaces. Compliance with a basic set of internationally agreed standards for health protection can support workers' health, particularly in small enterprises and informal settings that are outside the scope of official occupational safety and health inspection and administration.

WHO has already developed several public health standards and guidelines applicable to work settings, such as indoor air quality guidelines,[2] radiation protection standards,[3] international chemical safety cards,[4] and a guide for water safety in public buildings.[5] Other guidance documents are currently being developed including on occupational exposure to nanoparticles, electromagnetic fields, UV and optical radiation and occupational risks in housing.

This report provides an analysis of the current spectrum of global, regional and national norms including conventions, standards, directives, regulations, guides, and codes directly relating to protecting health in the workplace. It identifies gaps in what is currently available and makes recommendations for improvements. Consideration has been given to exposure to hazardous substances, noise and vibration, radiation, musculoskeletal and psychosocial risks, as well as general workplace and welfare issues such as lighting, thermal comfort, drinking water and sanitation, first aid and health surveillance.

The work was carried out under the supervision and guidance of the WHO Global Occupational Health Programme.

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[1] WHO Handbook for guideline development. Second edition 2015. Geneva: World Health Organization, accessed 24 October 2017).

[2] WHO guidelines for indoor air quality: selected pollutants. Copenhagen: WHO Regional Office for Europe; 2010, accessed 24 October 2017).

[3] Radiation protection and safety of radiation sources: International Basic Safety Standards. In: WHO Executive Board, 131th Session, 22 May 2012, report by the Secretariat, Document EB131/11. Geneva: World Health Organization; 2012, accessed 24 October 2017).

[4] ICSC Database, International chemical safety cards. Geneva: International Labour Organization, accessed 24 October 2017).

[5] Water safety in buildings. Geneva: World Health Organization; 2011, accessed 24 October 2017).

2. METHODOLOGY

This report includes standards, conventions, recommendations, directives, regulations, codes and guides (collectively known as 'norms'). They were developed and established by consensus-building processes involving experts from various countries and issued by an international body. They include requirements for identifying health hazards and controlling risks in the workplace, or they provide guidance and instruction on related topics. Some may be binding, such as ratified conventions and European directives, while others such as recommendations, codes or guides encourage voluntary compliance. In exceptional cases, national regulations, standards or guides have been listed. These were included when considered to be internationally important because they provided an example of a standard type that might be needed globally.

Norms were found by typing relevant English keywords into general search engines and the online search engines of specific standard-setting organizations such as the International Organization for Standardization (ISO), the International Labour Organization (ILO) and WHO. Using English keywords may have limited the number of results from non-Anglophone regions, although it can be assumed that most globally-applied standardization documents will also be available in English.

A complete list of the organizations searched is given in **Table 1** and the role of the leading institutions and their approach to standard setting is summarized in **Table 2**.

The title of each norm found was entered into a database[6] and categorized according to:

- the hazard or risk factor that it covered;
- its type, e.g. convention, standard, directive, etc.;
- whether it applied at a global, regional or national level;
- whether it targeted health protection of workers or technical support.

For each norm, a record was made of the source (the publisher), the website where it could be downloaded or purchased and its date of publication.

The research focused on hazards impacting on workers' health and were grouped into the following categories:

- chemical substances
- biological agents
- noise and vibration
- radiation
- musculoskeletal risk factors
- psychosocial risk factors
- work environment
- general.

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[6] Using the database FileMaker Pro.

First aid was included in the work environment category because it is grouped in this way in the ILO Convention on Hygiene when considering topics such as heating and lighting.

The general category included norms that covered health and safety overall, health surveillance, norms specific to certain industries, and norms that related to employment protection such as maternity rights, night work and minimum age.

An example of the database screen for one record is shown in **Figure 1**.

FIGURE 1. DATABASE SCREEN

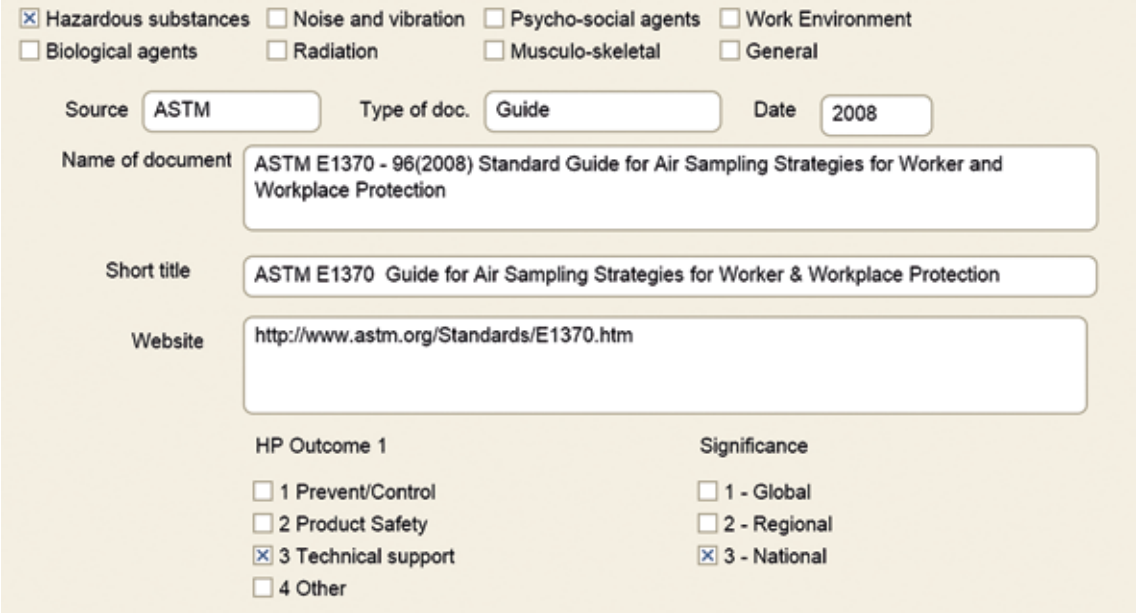

TABLE 1. LIST OF ORGANIZATIONS SEARCHED

Abbreviation	Organization
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org/
AFNOR	French Standards Association http://www.afnor.org/en
AFSSET	French Agency for Food, Environmental and Occupational Health & Safety http://www.afssa.fr/galaxieEN.html
ANSI	American National Standards Institute http://www.ansi.org/
ASEAN	Association of Southeast Asian Nations http://www.asean.org/
ASSE	American Society of Safety Engineers http://www.asse.org/
ASTM	American Society for Testing and Materials (now ASTM International) http://www.astm.org/

Abbreviation	Organization
ATSDR	Agency for Toxic Substances and Diseases Registry (United States of America, USA) http://www.atsdr.cdc.gov/
BC-GSEU	British Columbia Government and Service Employees Union http://www.bcgeu.ca/
BC-PSA	British Columbia Public Service Agency http://www2.gov.bc.ca/
BNQ	Bureau de Normalisation du Québec, Canada http://www.bnq.qc.ca/en/
BSI	British Standards Institution http://www.bsigroup.com/
CAMA	Corporate Alliance on Malaria in Africa http://www.gbchealth.org/our-work/collective-actions/cama/
CAS	Chemical Abstracts Service (USA) https://www.cas.org/
CDC	Centers for Disease Control and Prevention (USA) http://www.cdc.gov/
CEEP	European Centre of Employers and Enterprises providing Public services http://www.ceep.eu/
CEN	European Committee for Standardization http://www.cen.eu/cen/products/en/pages/default.aspx
CENELEC	European Committee for Electrotechnical Standardization https://www.cenelec.eu/
CIS	International Occupational Safety and Health Information Centre (ILO) http://www.ilo.org/safework/cis/lang—en/index.htm
CMA	Croatian Medical Association http://hlz.mef.hr/
CSA	Canadian Standards Association Group http://www.csagroup.org/us/en/home
CSOH	Croatian Society of Occupational Health
EBRC	European Bank for Rehabilitation and Cooperation
EBRD	European Bank for Reconstruction and Development http://www.ebrd.com/pages/homepage.shtml
ETSI	European Telecommunications Standards Institute http://www.etsi.org/
ETUC	European Trade Union Confederation http://www.etuc.org/
EU	European Union http://eur-lex.europa.eu/en/index.htm
EU–OSHA	European Agency for Safety and Health at Work https://osha.europa.eu/en?set_language=en
FAO	Food and Agriculture Organization of the United Nations http://www.fao.org/home/en/

Abbreviation	Organization
FIOH	Finnish Institute of Occupational Health http://www.ttl.fi/en/Pages/default.aspx
GRI	Global Reporting Initiative https://www.globalreporting.org/Pages/default.aspx
HSE	Health and Safety Executive (United Kingdom of Great Britain and Northern Ireland) http://www.hse.gov.uk/index.htm
IAC	Immunization Action Coalition http://www.immunize.org/
IAEA	International Atomic Energy Agency http://www.iaea.org/
ICNIRP	International Commission on Non-Ionizing Radiation Protection http://www.icnirp.org/
ICOH	International Commission on Occupational Health http://www.icohweb.org/site_new/ico_homepage.asp
ICRP	International Commission on Radiological Protection http://www.icrp.org/
ICRU	International Commission on Radiation Units and Measurement http://www.icru.org/reports
IEA	International Ergonomics Association http://www.iea.cc/
IEC	International Electrotechnical Commission http://www.iec.ch/
IFC	International Finance Corporation http://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/home
IFRC	International Federation of Red Cross and Red Crescent Societies http://www.ifrc.org/
ILO	International Labour Organization http://www.ilo.org/global/lang—en/index.htm
ILS	International Leptospirosis Society http://www.med.monash.edu.au/microbiology/staff/adler/ils.html
INC	International Council of Nurses http://www.icn.ch/
IOHA	International Occupational Hygiene Association www.ioha.net/activities.html
IPCS	International Programme on Chemical Safety http://www.who.int/ipcs/en/
ISO	International Organization for Standardization http://www.iso.org/iso/home/store/catalogue_ics.htm
JSOH	Japan Society for Occupational Health http://www.paho.org/hq/

Abbreviation	Organization
MHCC	Mental Health Commission of Canada http://www.mentalhealthcommission.ca/
NEA	Nuclear Energy Agency https://www.oecd-nea.org/
NIOSH	National Institute for Occupational Safety and Health (USA) http://www.cdc.gov/niosh/
OECD	Organisation for Economic Co-operation and Development http://www.oecd.org/
OSHA	Occupational Safety and Health Administration of the USA https://www.osha.gov/index.html
PAHO	Pan American Health Organization http://www.paho.org/hq/
PSI	Public Services International http://www.world-psi.org/
QF	Qatar Foundation http://www.qf.org.qa/
SAN	Sustainable Agriculture Network http://sanstandards.org/sitio/
SCOEL	Scientific Committee on Occupational Exposure Limits http://ec.europa.eu/social/main.jsp?catId=148&intPageId=684&langId=en
SWA	Safe Work Australia www.safeworkaustralia.gov.au/sites/SWA
UEAPME	Union Européenne de l'Artisanat et des Petites et Moyennes Entreprises http://www.ueapme.com/
UN	United Nations www.un.org/en/
UNEP	United Nations Environment Programme http://www.unep.org/
VDI	Verein Deutscher Ingenieure http://www.vdi.eu/
WB	The World Bank http://www.worldbank.org/
WEF	World Economic Forum http://www.weforum.org/
WENRA	Western European Nuclear Regulators Association http://www.wenra.org/archives/consultation-revised-wenra-safety-reference-levels/
WHO	World Health Organization http://www.who.int/en/

TABLE 2. MAIN INSTITUTIONS' APPROACH TO DEVELOPING NORMS FOR WORKPLACE HEALTH PROTECTION

Organization	Type of document	Approach
European Union and its Committee for Standardization (CEN)	Regulations Directives Recommendations Standards	The EU publishes regulations, directives and recommendations. Regulations and directives are legally binding on Member States. They define the essential requirements that ensure a high level of protection for health, safety, the consumer or the the environment. The task of drawing up harmonized standards to meet the essential requirements established by the directives, is entrusted to the European standardization organizations (CEN, CENELEC and ETSI). CEN has signed the Vienna Agreement with the International Organization for Standardization (ISO), enabling European and international standards to be developed in parallel. About 30% of the European Standards in the CEN collection are identical to ISO standards. These EN ISO standards have the dual benefit of automatic and identical implementation in all CEN member countries, and have global applicability.[7]
International Labour Organization (ILO)	Conventions Recommendations Codes	International labour standards are legal instruments drawn up by the ILO's constituents (governments, employers and workers). They are either conventions, which are legally-binding international treaties that may be ratified by Member States, or recommendations, which serve as non-binding guidelines.[8] Codes are another form of ILO guidance document.
International Standards Organization (ISO)	International standards	ISO standards respond to market needs. They are developed by international experts organized into technical committees. These include experts from the relevant industry, consumer associations, academia, nongovernmental organizations (NGOs) and government. Each standard is developed using a consensus-based approach.[9]
World Health Organization (WHO)	Different types of guidelines	WHO has adopted an internationally recognized approach to standards and guideline development that includes review of evidence, external consultations and peer reviews.[10]
WHO and ILO with the cooperation of the European Commission.	International Chemical Safety Cards (ICSC)[11]	The ICSC are data sheets intended to provide essential safety and health information on chemicals in a clear and concise way. The primary aim of the cards is to promote the safe use of chemicals in the workplace. The main target users are workers and those responsible for occupational safety and health.

[7] European directives on safety and health at work [website]. Bilbao, Spain: EU-OSHA. (https://osha.europa.eu/en/legislation/directives/directives-intro); Developing European Standards [website]. EU CEN. (https://www.cen.eu/work/ENdev/Pages/default.aspx, accessed 24 October 2017).

[8] ILO Conventions and recommendations [website]. Geneva: ILO. (http://www.ilo.org/global/standards/introduction-to-international-labour-standards/conventions-and-recommendations/lang--en/index.htm, accessed 24 October 2017).

[9] How we develop standards [ISO website]. Geneva: ISO. (http://www.iso.org/iso/home/standards_development.htm, accessed 24 October 2017).

[10] WHO Handbook for guideline development. Second edition 2015. Geneva: World Health Organization, accessed 24 October 2017).

[11] International chemical safety cards. Geneva: ILO, accessed 24 October 2017.

3. CHEMICAL SUBSTANCES

This chapter covers norms relating to chemical substance exposure, inhalable dusts, asbestos, lead and welding fume (summarized in **Table 3**). Some of these norms are industry specific but the majority are relevant to all workplaces. The main points from the review are summarized as follows.

3.1 PROTECTING WORKERS FROM CHEMICAL SUBSTANCES

ILO Convention 170 issued in 1990 on the use of chemicals, requires the adoption of a coherent policy on safety in the use of chemicals at work. This policy should cover the production, handling, storage, transport and disposal of chemicals. It highlights the responsibilities of suppliers and exporting states, as well as the responsibilities of the users. It draws attention to the need for employers to comply with occupational standards, and calls for such standards to be adopted at national level.

Similar requirements for the protection of workers are given in European Directive 98/24/EC. This directive also provides for the drawing up of indicative and binding occupational exposure limit values as well as for biological limit values at community level.

The ILO and the EU have also issued conventions and directives on asbestos (ILO C162 and Directive 2009/148/EC). However, the ILO does not have a specific convention to protect workers from exposure to lead, whereas at the regional level, lead is covered in EU Directive 98/24/EC.

3.1.1 Occupational exposure limits

In 1980 the ILO published a code on exposure to airborne substances harmful to health. This covers what factors should be considered when adopting exposure limits, how they should be used and the importance of keeping them up to date. For example the code states that:

> *When a country adopts exposure limits established in another country, account should be taken of possible differences with regard to climate, altitude, pollution of the living and general environment, conditions of work and physical effort, eating habits and health of the population, anthropometric data, distribution of workers by age and sex, and the general level of protection against occupational hazards; these differences may affect the absorption, metabolism, elimination and biological effects of hazardous substances in the body's system.*

The American Conference of Governmental Industrial Hygienists' (ACGIH) Guide is an important document listing exposure limits. ACGIH is a member-based organization that advances occupational and environmental health. Its annual publication on threshold limit values (TLVs) and biological exposure indices (BEIs) is available for sale in Canada, the United States and many other countries.

In Directive 2000/39/EC, the EU has published a list of 63 Indicative Occupational Exposure Limits (IOELs). These limits are not binding but must be used by Member States when deciding which

limit to adopt. The scientific basis for IOELs established by the European Commission is published by the Scientific Committee on Occupational Exposure Limits (SCOEL).[12]

The substance-specific information required by European Regulation 1907 of 2006 on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) also includes occupational exposure limits in the form of derived no-effect levels (DNELs). Under REACH there is a requirement for health-based DNELs to be established for occupational (and non-occupational) exposure to chemicals produced or imported into Europe in annual quantities above 10 tonnes.[13]

The Japanese Society for Occupational Health (JSOH) published a recommendation for occupational exposure limits in 2013. This list has been included for comparison with ACGIH and EU recommendations.

For asbestos, in its 1986 Convention the ILO prohibits the use of certain types but calls for exposure limits for other types, to be determined by the competent authority of national governments. The EU Directive 2009/148/EC specifies both a binding exposure limit and the method of assessment that should be used. Occupational exposure should not exceed 0.1 fibres per cm3 as an 8 hour time weighted average (TWA).

For lead, binding exposure and biological limits are given in Annex I and Annex II of EU Directive 98/24/EC. These are 0.15 mg/m3 per 8 hour TWA and 70 µg lead/100 ml blood. The blood-lead standards quoted are for all workers and indicate when suspension from lead work is required. Lower limits may be recommended and used at a national level, with still lower limits for young persons and women. For example, it is understood that the ACGIH recommend a limit of 30 µg/100 ml,[14] which is the same limit used for women of reproductive capacity in the United Kingdom.[15]

3.2 GAPS IDENTIFIED IN CHEMICAL SUBSTANCES' NORMS

Further guidance is required on practical measures to assess and manage exposure to hazardous substances, including a generic assessment form.

The ACGIH produces a comprehensive list of occupational exposure limits (OELs), which is reviewed annually. The list is a priced publication and the current version is only available in English. It is understood that earlier editions are available in Greek, Italian, Spanish and Portuguese. The ILO and WHO publish a series of international chemical safety cards that can be accessed free of charge in 10 languages. These contain TLV exposure limits referenced to an ACGIH publication, the German maximum workplace concentration (MAK) limit and the EU limit. These cards are a useful source of reference provided they are regularly updated. In general, more access to OEL information is required together with guidance on interpreting the limits and monitoring exposure. Priced ISO measurement standards are available for some air contaminants, but more guidance is required on simple methods to estimate exposure using inexpensive equipment.

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[12] Health and safety at work – Scientific Committee on Occupational Exposure Limits. Brussels: European Commission, accessed 24 October 2017.

[13] Tools and publications. Bilbao, Spain: EU OSHA, accessed 24 October 2017).

[14] Dr LJ Bhagia communication with the authors (2014).

[15] The control of lead at work regulations 2002, No. 2676. Surrey, UK: UK National Archives, accessed 24 October 2017.

Standards have been published for ventilation in buildings, for dust control in specific industries, and for dust control from specific substances i.e. silica. However, there is no global standard or code on the design, use and testing of local exhaust ventilation.

TABLE 3. NORMS FOR CHEMICAL SUBSTANCES

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1971	C136 – Benzene Convention, 1971 (No. 136)
Global	Convention	ILO	1976	Occupational Cancer Convention, 1974 (No. 139)
Global	Convention	ILO	1977	C148 Working Environment (Air Pollution, Noise and Vibration)
Global	Convention	ILO	1986	C162 – Asbestos Convention, 1986 (No. 162)
Global	Convention	ILO	1993	C170 – Chemicals Convention, 1990 (No. 170)
Global	Code	ILO	1974	Dust in mining, tunnelling and quarrying
Global	Code	ILO	1980	Exposure to airborne substances harmful to health
Global	Code	ILO	1984	Safety in the use of asbestos
Global	Code	ILO	2001	Safety in the use of synthetic vitreous fibre insulation wools
Global	Code	ILO	2001	Ambient factors in the workplace
Global	Standard	ISO	2008	ISO/TR 12885:2008 Nanotechnologies – H&S practices
Global	Guide	ILO	1991	Safety and health in the use of agrochemicals
Global	Guide	ILO	1997	Dust control in the working environment (silicosis)
Global	Guide	WHO	2010	WHO guidelines for indoor air quality: selected pollutants
Global	Guide	ACGIH	2014	2014 TLVs and BEIs
Regional	Directive	EU	1998	Council Directive 98/24/EC Protection of workers from lead.
Regional	Directive	EU	1998	Directive 98/24/EC Protection of workers from chemical agents
Regional	Directive	EU	2000	Directive 2000/39/EC list of indicative OELs (for 63 agents).
Regional	Directive	EU	2009	Directive 2009/148/EC Protection of workers from asbestos
National	Code	SWA	2011	How to manage and control asbestos in the workplace
National	Code	SWA	2011	How to safely remove asbestos
National	Code	SWA	2011	Spray painting and powder coating
National	Code	SWA	2012	Managing risks of hazardous chemicals in the workplace
National	Code	SWA	2012	Welding processes

Area	Type	Source	Date	Sort title
National	Standard	HSE	2005	EH40/2005 Workplace exposure limits
National	Standard	SWA	2012	Control of inorganic lead at work & safe use of lead
National	Guide	JSOH	2013	Recommendation of occupational exposure limits
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	1995	ISO 7708:1995 Particle size fraction definitions for health-related sampling
Global	Standard	ISO	2000	ISO 16017-1:2000 Workplace sampling for volatile organic compounds
Global	Guide	ATSDR	2014	Toxic substances portal
Global	Guide	WHO ILO	2014	International Chemical Safety Cards
Regional	Directive	EU	1998	CEN/TC 264 – air sampling methods

4. BIOLOGICAL AGENTS

Biological agents can be defined as:

> *Bacteria, virus, fungi and other micro-organisms or parts of them and their associated toxins, including those which have been genetically modified, cell cultures or endoparasites which are potentially hazardous to human health.*

Note: dusts of organic origin such as pollen, flour dust and wood dust are not considered to be biological agents and are therefore not covered by this definition.[16]

Workers can be exposed to biological agents through contact with infected individuals, infected animals, body fluids, exposure to contaminated water or air, and through a work activity that involves the use of human pathogens, for instance laboratory work involving infectious diseases.

Table 4 shows norms relating to biological agents and the key points are summarized as follows.

4.1 PROTECTING WORKERS FROM BIOLOGICAL AGENTS

The range of documents outlining the requirements for assessment and control of biological agents is diverse and fragmented. Several guidance documents exist on specific diseases, such as a joint guideline from WHO and the International Leptospirosis Society (ILS) on leptospirosis. Other pathogens that are covered include the human immunodeficiency virus (HIV), malaria parasites, tuberculosis and anthrax bacteria.

There are also broader documents for the classification of biological agents by hazards and standardized protection measures for the different levels of risk. However, no international standard was found providing an overview for worker exposure to biological agents. The regional European Directive 2000/54/EC on biological agents at work may serve as a blueprint for such a minimum standard. It classifies biological agents into risk groups and defines the minimum requirements for eliminating and controlling these risks. Its annexes cover medical surveillance, biohazard signs and vaccinations among others. Another example, which may be especially relevant to developing countries, is a Canadian guidance document developed in British Columbia in 2007. This provides instructions on how to deal with the risk of infectious disease transmission in the workplace.

In the last decade the international community has developed a comprehensive approach to the prevention and management of HIV transmission in the workplace. ILO's HIV and AIDS Recommendation No. 200 in 2010 states that:

- HIV and AIDS should be recognized and treated as a workplace issue;
- prevention of all means of HIV transmission should be a fundamental priority;
- the workplace should play a role in facilitating access to treatment;

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[16] Source EN 1540: 2011 definition 2.1.1 from browsing platform: ISO 13137:2013 Workplace atmospheres – Pumps for personal sampling of chemical and biological agents – Requirements and test methods

- there should be no discrimination against or stigmatization of workers, in particular jobseekers and job applicants, and no workers should be required to undertake an HIV test or disclose their HIV status.

Other guidelines consider post-exposure prophylaxis (PEP) to HIV at work (WHO/ILO, 2007) and provide guidance on how to improve access to HIV and tuberculosis (TB) prevention, treatment, care and support services (WHO/ILO/UNAIDS Guidelines, 2010). The latter document focuses on health workers and is a model of how to effectively manage HIV and TB in the workplace.

Several guidelines provide directions on TB control. The most recent from 2013 was jointly developed by WHO, ILO and UNAIDS updating the 2003 guidelines on workplace HIV control. The United States Occupational Safety and Health Administration (OSHA) standard from 2001 gives examples of how to manage various aspects of TB control in the workplace, including case-finding, case management and case notification. A 2009 WHO guideline advises on TB control in health-care settings.

No international norms were found on control of exposure to malaria during working hours in endemic countries. International 2009 guidelines are available from the Corporate Alliance on Malaria in Africa (CAMA) and the World Economic Forum (WEF), 2006, which sets out the most important features of malaria control in workplaces.

Several WHO documents provide guidance on control of pathogens in health-care settings. A 2008 guideline gives recommendations regarding care for patients with suspected or confirmed Filovirus haemorrhagic fever; a 2009 document deals with H1N1 and other influenza-like illnesses and a guideline from 2014 covers epidemic- and pandemic-prone acute respiratory infections.

4.2 GAPS IDENTIFIED IN BIOLOGICAL AGENTS' NORMS

Guidance is available to protect workers from exposure to HIV, TB, malaria, anthrax and leptospirosis as well as other pathogens occurring in health-care settings. However, there is no ILO Convention for biological agents, or global guidance that covers all biological agents. Therefore we recommend that a comprehensive international guidance is required. This standard should also consider aspects of pandemic preparedness outside health-care institutions, with particular consideration given to (re)emerging diseases – like SARS (severe acute respiratory syndrome) and viral haemorrhagic fevers – and their impact on the workplace at local and international level.

Products used to disinfect and control biological hazards are regulated in the EU under the Biocidal Products Regulation and it is recommended that the requirements of this legislation be adopted internationally. Similarly, the EU regional standard for sharps' safety should be made an international standard.

TABLE 4. NORMS FOR BIOLOGICAL AGENTS

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Guide	WHO ILO	1971	Guidelines for workplace TB control activities
Global	Guide	WHO ILS	1976	Human leptospirosis: guidance for diagnosis, surveillance and control
Global	Guide	WHO	1977	Preventing needle-stick injuries among health care workers: a WHO-ICN collaboration
Global	Guide	WHO ILO	1986	Joint ILO-WHO guidelines for health services and HIV/AIDS
Global	Guide	WEF	1993	Guidelines for employer-based malaria control programmes
Global	Guide	WHO	1974	Interim infection control recommendations for care of patients with suspected or confirmed filovirus (Ebola, Marburg) haemorrhagic fever
Global	Guide	WHO	1980	Guidelines for the surveillance and control of anthrax in humans and animals
Global	Guide	WHO	1984	Policy on TB infection control in health-care facilities, congregate settings and households
Global	Guide	WHO	2001	Infection prevention and control in health care for confirmed or suspected cases of pandemic (H1N1) 2009 and influenza-like illnesses
Global	Guide	CAMA	2001	Implementing an integrated malaria control program
Global	Guide	WHO IL0 UNAIDS	2008	Joint WHO-ILO-UNAIDS guidelines for improving health workers' access to HIV and TB prevention, treatment, care and support
Global	Guide	ILO	1991	HIV and AIDS Recommendation, 2010 (No. 200)
Global	Guide	WHO ILO UNAIDS	1997	TB/HIV prevention, diagnosis, treatment and care in the workplace
Global	Guide	WHO IL0	2010	Joint WHO/ILO guidelines on post-exposure prophylaxis (PEP) to prevent HIV infection
Global	Guide	WHO	2014	Infection prevention and control of epidemic- and pandemic-prone acute respiratory infections in health care
Regional	Directive	EU	1998	European Directive 2000/54/EC – biological agents at work

Area	Type	Source	Date	Sort title
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	1998	ISO 11731 -1 Water quality – detection and enumeration of Legionella
Global	Standard	ISO	2004	ISO 11731-2 Water quality: detection and enumeration of Legionella
Global	Guide	WHO	2009	Recommended classification of pesticides
Regional	Standard	EN	2000	EN 13098 Workplace measurement of airborne micro-organisms and endotoxins
Regional	Standard	EN	2003	EN 14031 Workplace atmospheres – Determination of airborne endotoxins
Regional	Standard	EN	2003	EN 14042:2003 Procedures for the assessment of exposure to chemical & biological agents
National	Standard	OSHA	2001	1904.11 Recording criteria for work-related tuberculosis cases

5. NOISE AND VIBRATION

A summary of norms on noise and vibration is given in **Table 5**.

5.1 PROTECTING WORKERS FROM NOISE AND VIBRATION

Noise and vibration is included in the 1977 ILO Convention No. 148 on the working environment. In addition, the ILO has published Recommendation 156 and two relevant codes. The code on noise and vibration, first published in 1971 and revised in 1984, recommends a noise warning limit at 85 decibels (dB) (A) and a danger limit at 90 dB (A) as equivalent continuous sound levels for 8 hours. Limits for impulse noise are also given. No exposure limits are given for vibration but reference is made to the relevant ISO standard.

There are two important EU directives, one relating to noise exposure (2003/10/EC) and the other to whole-body and hand-arm vibration (2002/44/EC). Both these directives specify exposure limits. For noise this is 87 dB (A) averaged over 8 hours, and for vibration 5 m/s2 for hand-arm vibration and 1.15 m/s2 for whole-body.

5.2 TECHNICAL SUPPORT FOR NOISE AND VIBRATION

For technical support on measurement and evaluation techniques for noise and vibration, see the ISO standards series 4869, 2631, 4869, 5349, 9612 and 1999.

5.3 GAPS IDENTIFIED IN NOISE AND VIBRATION NORMS

Workplace protection on noise and vibration is well covered by international standards. However, more guidance is needed on how to assess noise and simple methods of noise control. Noise is measured in decibels (dB), which is a log scale and employers need to understand the practical implications of this. For example, a difference of 3 dB equates to a doubling or halving of noise exposure, for instance: 90 db + 90 dB = 93dB.

TABLE 5. NORMS FOR NOISE AND VIBRATION

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1977	C148 Working Environment (Air Pollution, Noise and Vibration)
Global	Code	ILO	1971	Protection of workers against noise and vibration
Global	Code	ILO	2001	Ambient factors in the workplace
Global	Standard	ISO	1997	ISO 11690-2: Recommended practice for the design of low-noise workplaces containing machinery
Global	Guide	ILO	1977	R156 - Working Environment (Air Pollution, Noise and Vibration) Recommendation
Regional	Directive	EU	2002	2002/44/EC exposure of workers to the risks arising from physical agents (vibration)
Regional	Directive	EU	2003	2003/10/EC exposure of workers to the risks arising from physical agents (noise)
National	Guide	BSI	1996	PD 6585-2:1996 CR 1030-2:1995 Hand-arm vibration. Guidelines for vibration hazards reduction: management measures at the workplace
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	1995	EN ISO 4869-4: Measurement of sound for level-dependent sound-restoration ear muffs
Global	Standard	ISO	1997	ISO 2631 Evaluation of human exposure to whole body vibration
Global	Standard	ISO	2000	EN ISO 4869-2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn
Global	Standard	ISO	2001	ISO 5349 Measurement and evaluation of human exposure to hand-transmitted vibration
Global	Standard	ISO	2009	ISO 9612 Determination of noise exposure, engineering method
Global	Standard	ISO	2013	ISO 1999: Estimation of noise-induced hearing loss

6. RADIATION

6.1 PROTECTING WORKERS FROM RADIATION

ILO Convention No. 115 on the protection of workers from ionizing radiation has been available since 1960 and is still applicable. However, there is no specific convention for non-ionizing radiation. Some aspects are covered in ILO codes and guides, for example: on the use of lasers (1993); the protection of workers from power frequency, electric and magnetic fields (1994); visual display units (1994); and safety when using radio-frequency dielectric heaters and sealers (1998). The ILO List of Occupational Diseases (revised in 2010) includes diseases caused by ionizing radiations and by optical (ultraviolet, visible light, infrared) radiations including laser.

The WHO Environmental Health Criteria monographs on static fields (2006), extremely low-frequency fields (2007) and radio-frequency fields (expected in 2019) are co-published with ILO and the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

WHO provided guidance on exposure to radon in buildings in 2009. WHO has also been actively involved in the revision of the international radiation basic safety standards (so-called "International BSS"), co-sponsored by WHO and seven other international organizations. This covers all sources of radiation exposure that workers, the public and patients might experience.

The International Commission on Radiological Protection has been publishing recommendations on protection from ionizing radiation since 1928. Virtually all international standards and national regulations addressing radiological protection are based on the Commission's recommendations. The latest edition was published in 2007.

There are three important European directives on: the protection of patients, workers and the public from ionizing radiation (Council Directive 2013/59/ Euratom, so-called "Euratom BSS"); the protection of workers exposed to electromagnetic fields (2013/35/EU); and the protection of workers exposed to artificial optical radiation (2006/25/EC).

Both the International BSS and the Euratom BSS establish dose limits for workers occupationally exposed to ionizing radiation. The effective dose is limited to 20 mSv per year averaged over a period of five consecutive years (i.e. 100 mSv in 5 years) and must not exceed 50 mSv in any single year. The OELs for apprentices aged 16–18 years are 6 mSv per year. People below 16 years of age are not allowed to be exposed to ionizing radiation at work. The directive on artificial optical radiation also defines exposure limits and formulae for calculating them. However, these would be difficult for most organizations to apply unless they had access to an expert in this field.

Table 6 covers norms to protect workers from harmful exposure to ionizing and non-ionizing radiation. The main points are summarized as follows.

6.2 TECHNICAL SUPPORT FOR RADIATION

Technical support standards have been published by ISO covering different methods of dose assessment and vocabulary used in radiological protection (Series 20553, 27048, 20785, 12749,

16637). Safety guides and technical documents related to occupational radiation protection have been published by the International Atomic Energy Agency (IAEA Safety Standards Series).

6.3 GAPS IDENTIFIED IN RADIATION NORMS

There are sufficient norms in place for ionizing radiation protection but there are no international standards for non-ionizing radiation. Guidance is therefore required to protect workers from all types of non-ionizing radiation, including exposure to the sun.

TABLE 6. NORMS FOR RADIOLOGICAL HAZARDS

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1960	Radiation Protection Convention, (No. 115)
Global	Code	ILO	1994	Protection of workers from power frequency electric and magnetic fields: a practical guide
Global	Code	ILO	1996	Safety standards for protection against ionizing radiation and radiation sources
Global	Code	ILO	2001	Ambient factors in the workplace
Global	Standard	IAEA	2002	Preparedness and response for a nuclear or radiological emergency
Global	Standard	IAEA	2014	Radiation protection and safety of radiation sources: international basic safety standards jointly sponsored by EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP, WHO
Global	Guide	ILO	1993	No. 68 The use of lasers in the workplace
Global	Guide	ILO	1994	No. 70 VDU radiation protection guidance
Global	Guide	ILO	1998	No. 71 Safety in the use of radio-frequency dielectric heaters and sealers
Global	Guide	WHO	2006	Static fields. Environmental Health Criteria 232
Global	Guide	WHO	2007	Extremely low frequency fields. Environmental Health Criteria 238
Global	Guide	ICNIRP ILO WHO	2007	Protecting workers from ultraviolet radiation
Global	Guide	ICRP	2007	Recommendations of the International Commission on Radiological Protection
Global	Guide	ILO	2010	ILO List of Occupational Diseases
Regional	Directive	EU	2006	2006/25/EC: The minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation)

Area	Type	Source	Date	Sort title
Regional	Directive	EU	2013	2013/35/EU: The minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)
Regional	Directive	EU	2014	2013/59/Euratom: Basic safety standards for protection against the dangers arising from exposure to ionising radiation
Regional	Guide	WENRA	2013	http://www.wenra.org/archives/consultation-revised-wenra-safety-reference-levels/
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	2006	ISO 20553: Monitoring of workers occupationally exposed to a risk of internal contamination with radioactive material
Global	Standard	ISO	2011	ISO 27048:2011: Dose assessment for the monitoring of workers for internal radiation exposure
Global	Standard	ISO	2013	ISO 20785-3: Dosimetry for exposures to cosmic radiation in civilian aircraft.
Global	Standard	ISO	2013	ISO 12749-2:2013: Vocabulary – Part 2: Radiological protection
Global	Standard	ISO	2014	ISO 16637: Monitoring and internal dosimetry for staff exposed to medical radionuclides as unsealed sources (under development)
Global	Guide	IAEA	1999	Occupational Radiation Protection. Safety Guide RS-G 1.1. Jointly sponsored by IAEA and ILO

7. ERGONOMIC RISK FACTORS

The discipline of workplace ergonomics emphasizes the interaction between workers and other elements of the working system including tasks, mental workload, equipment, workspace and environment, and aims to prevent work-related musculoskeletal disorders (WMSD) and other problems. **Table 7** lists norms relating to workplace ergonomics and musculoskeletal risk factors such as manual handling and the use of visual display terminals (VDTs). The main points are summarized as follows.

7.1 PROTECTING WORKERS FROM MUSCULOSKELETAL RISK FACTORS

The 1967 ILO Maxiumum Weight Convention No. 127 aims to protect workers from lifting heavy loads that are likely to cause injury. Other norms cover ergonomics associated with task design and the man–machine interface. ISO standard 26800 (2011) provides an overview of ergonomics to enhance the health, well-being and satisfaction of those using equipment or carrying out tasks.

ISO standard 6385 provides a framework for analysing a work system. The ISO series 11228 specifies weight limits and other parameters for manual handling, lifting and carrying. An ISO technical report published in 2013 defines requirements regarding patient handling in the health-care sector and is considered a preliminary norm. The ISO standard series 9241 covers office work on VDTs extensively. A similar standard on work station design involving machinery other than VDTs is available as an EU CEN standard. Two European directives from 1990 define minimum requirements regarding exposure to physical hazards and also cover WMSD, manual loads and work on VDTs.

In 2010 two professional bodies, the International Commission on Occupational Health (ICOH) and the International Ergonomics Association (IEA) published a guide on ergonomics for occupational health practice in industrially-developing countries. In the same year, ILO in collaboration with IEA published a document on general ergonomics giving advice on practical and easy-to-implement solutions for resource-limited settings. WHO has published a booklet on preventing musculoskeletal disorders in the workplace as part of its protecting workers' health series (2010). Safe Work Australia developed a guide in 2011 on how to manage the risk of musculoskeletal disorders arising from hazardous manual tasks in the workplace.

7.2 TECHNICAL SUPPORT FOR MUSCULOSKELETAL RISK FACTORS

ISO has published a technical specification for the improvement of local muscular workloads and is working on a technical application document to inform and guide the implementation of the standard series 11228 on manual handling. ISO standard 11226 gives directions on the evaluation of static working postures.

7.3 GAPS IDENTIFIED IN MUSCULOSKELETAL RISK FACTOR NORMS

Work-related musculoskeletal diseases are a major burden to health systems in developed countries.[17] WMSDs are also very common in low-income countries but prevention, diagnosis and treatment are still insufficient – these countries are characterized by low levels of automation and suboptimal working conditions. Ergonomic principles are not sufficiently recognized and applied.[18] On a global level, standards on ergonomic principles as well as guidelines for developing countries relating to prevention of musculoskeletal diseases are available but their implementation lags behind.

The ILO Convention only covers lifting heavy loads and there is a need to broaden its scope to include other forms of manual handling, such as pushing and pulling or work on VDTs, as well as general ergonomics and the well-researched interaction between psychosocial risk factors and development of WMSD.[19] Simple readily-available guidance is then required to put the requirements into practice.

TABLE 7. NORMS ON WORKPLACE ERGONOMICS AND MUSCULOSKELETAL RISK FACTORS

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1960	C127 – Maximum weight convention
Global	Standard	ISO	1994	ISO 9241 Series: Ergonomics of human – system interaction
Global	Standard	ISO	1996	ISO 11228-1 Manual handling (MH) lifting and carrying
Global	Standard	ISO	2001	ISO 6385 Ergonomic principles in the design of work systems
Global	Standard	ISO	2002	ISO 11228-2 MH pushing and pulling
Global	Standard	ISO	2014	ISO 11228-3 MH of low loads at high frequency
Global	Standard	ISO	1993	ISO 11226 Ergonomics – Evaluation of static working postures (reviewed and confirmed in 2011)
Global	Standard	ISO	1994	ISO 26800 Ergonomics general principles and concepts
Global	Standard	ISO	1998	ISO/TR 12296 Manual handling of people in the healthcare sector
Global	Guide	ILO IEA	2006	Ergonomic checkpoints

[17] Eumusc.net [website].Musculoskeletal health in Europe – Report v 5.0. 2012. (http://www.eumusc.net, accessed 25 February 2014).

[18] Torres Y et al. (2009). Preventing work-related musculoskeletal disorders in Cuba, an industrially developing country. Work. 2011;38:301–306.

[19] The role of work stress and psychological factors in the development of musculoskeletal disorders. The Stress and MSD study. Surrey: Robens Center for Health Ergonomics for the Health and Safety Executive; 2004.

Area	Type	Source	Date	Sort title
Global	Guide	ICOH IEA	2007	Ergonomics guidelines for industrially developing countries
Global	Guide	WHO	2007	Protecting Workers' Health Series No. 5 Preventing musculoskeletal disorders in the workplace
Regional	Directive	EU	2007	H&S requirements for work with display screen equipment
Regional	Directive	EU	2010	H&S requirements for the manual handling of loads
Regional	Standard	EN	2006	EN 1005-2 Manual handling of machinery and component parts of machinery
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	2000	ISO 11226: Ergonomics – Evaluation of static working postures
Global	Standard	ISO	2014	ISO/TS 20646 Ergonomic guidelines for local muscular workloads
Global	Guide	ISO	2014	ISO/DTR 12295 Ergonomics – Application document for international standards on manual handling

8. PSYCHOSOCIAL RISK FACTORS

Psychosocial risk factors are defined by Cox and Griffiths[20] as

> *… those aspects of work design and the organization and management of work, and their social and environment contexts, which have the potential for causing psychological, social and physical harm.*

Occupational stress is one outcome of psychosocial risk factors. **Table 8** lists norms relating to this category and the main points are summarized as follows.

8.1 PROTECTING WORKERS FROM PSYCHOSOCIAL RISK FACTORS

The ISO 10075 series of standards covers psychosocial risks under the heading of ergonomic principles related to mental workload. Terms and definitions are defined in Part 1, for instance mental stress and mental strain which are an integral part of the so-called stress-strain concept.[21] Design principles are given in Part 2, and methods of measuring and assessing mental workload in Part 3. The series refers to the mental workload associated with both thinking and manual tasks.

The 2013 Canadian Standard provides a comprehensive example. It uses the term 'psychological health' and refers to British guidance documents BSI PAS 1010, on management of psychosocial risk factors, and HSG 218 on managing the causes of work-related stress.

[20] Cox T and Griffiths A. The assessment of psychosocial hazards at work. In: Shabracq MJ, Winnubst JAM and Cooper CL (eds), Handbook of Work and Health Psychology. Chichester: Wiley & Sons; 1995. (Reported in the Management of psychosocial risks at work report (2012) commissioned by the European Agency for Safety and Health at Work).

[21] Böckelmann I, Seibt R (2011). Methods for the indication of predominant mental workload and strain at work – possibilities for the corporate practice, in: Z für Arbeitswissenschaften (65) 2011/3, accessed 24 October 2017.

9. TECHNICAL SUPPORT FOR PSYCHOSOCIAL RISK FACTORS

ILO published a guide in 2012 on preventing stress at work including a number of checklists for making assessments. WHO has developed guidance on work organization and stress (2004), psychological harassment (2003) and stress at work in developing countries (2007). The European Social Partners (ESP), which combine employer and worker representations, have published framework agreements on work-related stress (2004) and harassment and violence at work (2007) and guidelines were developed that facilitate the implementation of these framework agreements (PRIMA-EF 2008). In collaboration with ILO, Public Services International (PSI) and the International Council of Nurses (ICN) also developed guidelines for workplace violence in 2003 applying specifically to health sector workplaces.

9.1 GAPS IDENTIFIED IN PSYCHOSOCIAL RISK FACTOR NORMS

The various norms use different terms such as mental workload, work-related stress, psychological health and psychosocial risk factors. A comparison needs to be made between each of these norms to assess to what extent they are similar and if common terms, such as those given in ISO 10075.1, can be used.

To date, research on work-related stress and mental illness in developing countries is still scarce. Existing studies indicate that there is a lack of awareness of work-related stress and a shortage of resources to deal with it.[22] Nonetheless, psychosocial risk factors at work are seen as an important factor that should be addressed.[23] International standards, such as the ISO 10075 series, may require review and adaptation to future research findings on the psychosocial risk situation in developing countries. Existing norms should be broadened to include violence, bullying and harassment, and occupational stress. One example in this respect is the European framework for psychosocial risk management. New approaches such as the psychosocial safety climate model as an indicator for psychosocial risk factors, should be considered for inclusion.[24]

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[22] Raising awareness of stress at work in developing countries – A modern hazard in a traditional working environment. Geneva: World Health Organization; 2007, accessed 24 October 2017).

[23] Kortum E, Leka S, Cox T. Psychosocial risks and work-related stress in developing countries: health impact, priorities, barriers and solutions. International Journal of Occupational Medicine and Environmental Health. 2010;23(3):225–238. https://doi.org/10.2478/v10001-010-0024-5

[24] Personal communication from Prof. Maureen Dollard, 31 March 2014.

TABLE 8. NORMS FOR PSYCHOSOCIAL RISK FACTORS

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Standard	ISO	1991	ISO 10075-1: Ergonomic principles related to mental work-load: Terms & Definitions
Global	Standard	ISO	1996	ISO 10075-2: Ergonomic principles related to mental workload: Design principles
Global	Standard	ISO	2004	ISO 10075-3: Ergonomic principles related to mental workload: Measuring and assessing
Global	Guide	WHO ILO PSI ICN	2002	Framework guidelines for addressing workplace violence in the health sector
Global	Guide	WHO	2003	Psychological harassment at work
Global	Guide	WHO	2004	Work organization and stress
Global	Guide	WHO	2007	Raising awareness of stress at work in developing countries
Global	Guide	WHO	2008	PRIMA-EF – Guidance on the European framework for psychosocial risk management
Global	Guide	ILO	2012	Stress prevention at work checkpoints
Regional	Code	EU ESP	2004	Framework agreement on work-related stress
Regional	Code	EU	2007	Framework agreement on harassment and violence at work
National	Standard	MHCC	2013	Psychological health and safety in the workplace
National	Guide	HSE	2007	HSG 218 Managing the causes of work-related stress
National	Guide	BSI	2011	PAS 1010 Guidance on the management of psychosocial risks in the workplace
FOCUS: TECHNICAL SUPPORT				
None				

10. WORK ENVIRONMENT

Work environment factors include air quality, temperature, provision of drinking water, lighting, general ventilation, tobacco smoke control, welfare facilities such as toilets and changing rooms, and first aid provision. Norms relating to the work environment are listed in **Table 9** and the main points are summarized as follows.

10.1 PROTECTING WORKERS FROM A POOR WORK ENVIRONMENT

The ILO sets out the requirements for a healthy working environment in its Hygiene Convention C120 and in Recommendation No. 102 on welfare facilities. The convention requires good housekeeping and careful design of premises, sufficient air and light, safe drinking water, facilities to rest, wash, change and dry clothes, protection from noise and vibration and first aid provision. This convention applies to commercial establishments and offices but not to industry in general.

In 2009 the International Finance Corporation (IFC) and the European Bank for Rehabilitation and Cooperation defined international guidelines on worker accommodation in projects they were supporting financially. The 2013 mandatory standards of migrant workers' welfare by the Qatar Foundation (QF) provide a similar example. These norms cover welfare facilities and also general employment conditions of migrant workers.

There are several ISO standards that relate to the physical working environment. ISO 6385 relates to general ergonomic aspects such as work space. A central requirement is that workers should be allowed to influence their work environment. Social, cultural and ethnic factors are recognized as influences on the acceptability of a work environment. ISO series 8995 sets requirements for proper lighting of indoor and outdoor workplaces. ISO standards 11399, 15265, 15743 and 12894 cover different aspects of the thermal environment such as working in hot and cold environments.[25]

In its Framework Convention on Tobacco Control and associated guidelines of 2005 and 2007, WHO sets a standard for reducing exposure to tobacco smoke. The 2011 WHO guideline on safe drinking water outlines general requirements for the quality of potable water without referring explicitly to the work environment.

First aid is covered in the 1964 ILO Hygiene Convention No. 120 and in a guideline on first aid and resuscitation published by the International Federation of Red Cross and Red Crescent Societies (IFRC) of 2011.

10.2 TECHNICAL SUPPORT FOR THE WORK ENVIRONMENT

ISO 8756 gives technical advice on data handling regarding temperature, humidity and air pressure to control air quality. Monitoring the impact of working in hot and cold environments is guided

[25] These regulations apply to all climatic conditions however influenced by climate change developments.

by several ISO standards. The most recent, ISO 28802, advises on assessment of environments using physical measurements and surveys of peoples' subjective responses.

10.3 GAPS IDENTIFIED IN WORK ENVIRONMENT NORMS

The ILO Hygiene Convention is the main reference regarding basic requirements in the work environment. However, a convention that covers all workplaces, rather than just commercial premises and offices, is required that includes minimum standards for overnight accommodation if this is provided by the employer.

A further gap concerns guidelines on providing safe drinking water. The ILO Hygiene Convention requires that wholesome drinking water be provided and that WHO should publish water quality standards. There are currently no specific guidelines addressing the provision of water supplies in the workplace.

More consideration should also be given to first aid in the workplace. Responsibilities, training requirements and content of first-aid kits could be standardized. This may prevent situations in which first aid staff are overburdened with tasks and responsibilities.

TABLE 9. NORMS FOR THE WORK ENVIRONMENT

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1964	Hygiene (Commerce and Offices) Convention, 1964 (No. 120)
Global	Convention	WHO	2005	WHO Framework Convention on Tobacco Control
Global	Standard	ISO	2000	ISO 11399 Ergonomics of the thermal environment – principles and application of relevant standards
Global	Standard	ISO	2001	ISO 8995-1: Lighting of work places indoor
Global	Standard	ISO	2001	ISO 12894: Medical supervision of individuals exposed to extreme hot or cold
Global	Standard	ISO	2004	ISO 6385 Ergonomic principles in the design of work systems
Global	Standard	ISO	2004	ISO 15265: RA strategy for the prevention of stress or discomfort in thermal working conditions
Global	Standard	ISO	2006	ISO 8995-3: Lighting requirements for safety and security of outdoor work places
Global	Standard	ISO	2008	ISO 15743 Cold workplaces – Risk assessment and management
Global	Standard	ISO	2012	ISO 28802 Ergonomics for the physical working environment – Assessment of environments by means of an environmental survey involving physical measurements of the environment and subjective responses to people

Area	Type	Source	Date	Sort title
Global	Guide	WHO	2007	Guidelines on protection from exposure to tobacco smoke
Global	Guide	IFC EBRC	2009	Workers accommodation: processes and standards
Global	Guide	WHO	2011	Guidelines for drinking-water quality, fourth edition
Global	Guide	WHO	2011	Water safety in buildings
Global	Guide	IFRC	2011	International first aid and resuscitation guidelines
Global	Recom-mendation	ILO	1956	R102 Welfare Facilities Recommendation
Regional	Standard	EN	2007	EN 12464-2: Lighting of work places – Part 2: Outdoor work places
Regional	Standard	EN	2011	EN 12464-1: Lighting of work places – Part 1: Indoor work places
National	Standard	QF	2013	Mandatory standards of migrant workers' welfare
FOCUS: TECHNICAL SUPPORT				
Global	Standard	ISO	1989	ISO 7243: Estimation of the heat stress on working man, based on the WBGT-index
Global	Standard	ISO	1994	ISO 8756 Air quality – Handling of temperature, pressure and humidity data
Global	Standard	ISO	1995	ISO 11399: Ergonomics of the thermal environment: relevant International Standards
Global	Standard	ISO	2001	ISO 10551: Assessment of the thermal environment using subjective judgement scales
Global	Standard	ISO	2004	ISO 9886: Ergonomics – evaluation of thermal strain by physiological measurements
Global	Standard	ISO	2004	ISO 8996: Ergonomics of the thermal environment – Determination of metabolic rate
Global	Standard	ISO	2004	ISO 7933: Determination of heat stress using calculation of the predicted heat strain
Global	Standard	ISO	2007	ISO 11079 Determination and interpretation of cold stress when using IREQ
Global	Standard	ISO	2012	ISO 28802: Ergonomics of the physical environment – Assessment
Regional	Standard	EN	1993	EN 27243: Hot environments – estimation of the heat stress based on the WBGT-index

11. GENERAL NORMS

Table 10 lists norms relating to general aspects of worker health protection. They cover general management of health and safety, health surveillance and health and safety in specific industries. Also included are ILO conventions on employment protection such as the minimum age, which has an indirect effect on worker's health by excluding individuals that may be more susceptible to harm. A summary of the key points follows.

11.1 GENERAL NORMS PROTECTING WORKERS

The ILO conventions 155 and 187 on occupational safety and health and the British standard BS OHSAS 18001 have guided companies in setting up workplace health and safety management systems. In 2016 a new norm, ISO/NP 45001, was developed based on BS OHSAS 18001 and aligned with revised versions of ISO 9001 (Quality Management) and ISO 14001 (Environmental Management). Standards and guidelines targeting corporate social responsibility supportive of workers' health protection are provided by ISO 26000 and the criteria of the Global Reporting Initiative (GRI). The World Bank Group and the IFC developed environmental, health and safety guidelines in 2007 for all projects in which they are both involved including a performance standard on labour and working conditions includes management of occupational safety and health.

With the 1985 occupational health services convention 161 and the labour inspection conventions 81 and 129, the ILO also supports governments in shaping their national workplace health and safety frameworks.

Additional ILO conventions and codes of practice regulate safety and health in specific sectors. Several guidance documents exist for professions and workplaces related to seafaring, such as fishing, dockwork, ports, shipbuilding and shipbreaking. For mining, codes of practice are available for coal and cast mines. In manufacturing and civil engineering, codes regulate health and safety in the iron and steel industries, in non-ferrous metal companies, construction and building.

In the service and medical sectors, guidance is given for hospitality, nursing and domestic work. For agriculture ILO Convention 184 covers safety and health and a comprehensive standard for farms seeking Rainforest Alliance Certification for their products was published in 2015 by the Sustainable Agriculture Network (SAN). The SAN standard incorporates the requirements of eight ILO conventions relating to fair working conditions, and requires the analysis, documentation and mitigation or elimination of occupational health risks. Specific issues relating to farming such as the use of pesticides, shade from the sun and restrictions for the employment of minors (children from 12 to 15 years of age) are included.

In 2007, the World Health Assembly adopted a global action plan on workers' health covering the period from 2008 to 2017, which aims to achieve improvements in protection and promotion of health at work, employment conditions and health systems. The Healthy Workplaces Model was

developed consecutively as a guiding framework to support the implementation of the global action plan with a particular focus on primary and secondary prevention.

In 1998 the ILO developed technical and ethical guidelines on workers' health surveillance. A recent national guideline from Croatia identifies surveillance procedures for workplaces where workers are at risk of developing occupational diseases and injuries. The ILO provides a list of occupational diseases based on a worldwide consensus on diseases caused by work, updated in 2010. The definition of the term 'work-related diseases' is still being discussed, with further guidelines targeting worker's individual health resources. For instance, ILO and WHO have published guidance documents on food at work, management of alcohol and drug-related issues and physical fitness.

11.2 GENERAL TECHNICAL SUPPORT NORMS

No technical norms are listed in **Table 10** for this category.

11.3 OTHER RELEVANT NORMS

Employment conditions strongly influence health protection in the work environment. International norms in this context are provided by several ILO conventions regulating working time, working hours per day and week, rest time, vacation, part-time work and night work. ILO conventions on social security are also associated with health as are several ILO conventions providing protection to vulnerable population groups including pregnant women, children, older people, the disabled and migrant workers.

TABLE 10. GENERAL NORMS FOR HEALTH PROTECTION

Area	Type	Source	Date	Sort title
FOCUS: WORKER HEALTH PROTECTION				
Global	Convention	ILO	1947	Labour Inspection Convention, 1947 (No. 81)
Global	Convention	ILO	1958	Plantations Convention, 1958 (No. 110)
Global	Convention	ILO	1969	Labour Inspection (Agriculture) Convention, 1969 (No. 129)
Global	Convention	ILO	1977	Nursing Personnel Convention, 1977 (No. 149)
Global	Convention	ILO	1979	Occupational Safety and Health (Dock Work) Convention, 1979 (No. 152)
Global	Convention	ILO	1981	Occupational Safety and Health Convention, 1981 (No. 155)
Global	Convention	ILO	1985	Labour Statistics Convention, 1985 (No. 160)
Global	Convention	ILO	1985	Occupational Health Services Convention, 1985 (No. 161)
Global	Convention	ILO	1987	Health Protection and Medical Care (Seafarers) Convention, 1987 (No. 164)
Global	Convention	ILO	1991	Working Conditions (Hotels and Restaurants) Convention, 1991 (No. 172)

Area	Type	Source	Date	Sort title
Global	Convention	ILO	2001	Safety and Health in Agriculture (No. 184)
Global	Convention	ILO	2002	P155 – Protocol of 2002 to the Occupational Safety and Health Convention, 1981
Global	Convention	ILO	2006	Promotional Framework for Occupational Safety and Health (No. 187)
Global	Convention	ILO	2007	Work in Fishing Convention, 2007 (No. 188)
Global	Convention	ILO	2011	C189 – Domestic Workers Convention
Global	Code	ILO	1974	Safety and health in shipbuilding and ship repairing
Global	Code	ILO	1974	Safety and health in building and civil engineering work
Global	Code	ILO	1977	Safety and health in dock work
Global	Code	ILO	1981	Safety and health in the construction of fixed offshore installations
Global	Code	ILO	1991	Safety and health in open cast mines
Global	Code	ILO	1998	Safety and health in forestry work
Global	Code	ILO	1998	Safety and health in construction
Global	Code	ILO	2001	Safety and health in the non-ferrous metals industries
Global	Code	ILO	2004	Safety and health in shipbreaking: Guidelines for Asian countries and Turkey
Global	Code	ILO	2004	Safety and health in ports
Global	Code	ILO	2006	Safety and health in underground coalmines
Global	Code	ILO	2006	Safety and health in the iron and steel industry
Global	Code	WHO	2011	Building Healthy and Equitable Workplaces
Global	Code	ILO	2011	Safety and health in agriculture
Global	Standard	ISO	2010	ISO 26000:2010 Guidance on social responsibility
Global	Standard (List)	ILO	2010	List of occupational diseases (revised 2010)
Global	Standard	WB/IFC	2012	Performance Standard 2-Rev-0.1 Labour and working conditions
Global	Standard	ISO	2016	ISO 45001 for an occupational health and safety management system
Global	Standard	SAN	2017	Sustainable Agriculture Standards
Global	Guide	ILO	1996	Management of alcohol and drug-related issues in the workplace
Global	Guide	ILO	1998	Technical and ethical guidelines for workers' health surveillance
Global	Guide	WHO HPA	1999	Guidelines on Improving the Physical Fitness of Employees
Global	Guide	ILO	2001	Guidelines on occupational safety and health management systems (ILO-OSH 2001)

Area	Type	Source	Date	Sort title
Global	Guide	ILO	2005	Food at work – Workplace solutions for malnutrition, obesity and chronic diseases
Global	Guide	WB/IFC	2007	Environmental, health and safety guidelines
Global	Guide	GRI	2013	Sustainability Reporting Guidelines, Version 4
Regional	Directive	EU	1989	89/656/EEC Use of Personal Protective Equipment (PPE)
Regional	Directive	EU	1989	89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work
National	Standard	BSI	2007	BS OHSAS 18001 Occupational Health and Safety Management
National	Guide	CSOH/ CMA	2012	Guidelines for health checks of the workforce
FOCUS: TECHNICAL SUPPORT				

FOCUS: OTHER STANDARDS THAT MAY INFLUENCE HEALTH PROTECTION AT WORK				
Global	Convention	ILO	1935	Forty-Hour Week Convention, (No. 47)
Global	Convention	ILO	1949	Migration for Employment Convention (Revised), (No. 97)
Global	Convention	ILO	1952	Social Security (Minimum Standards) Convention, (No. 102)
Global	Convention	ILO	1957	Weekly Rest (Commerce and Offices) Convention, (No. 106)
Global	Convention	ILO	1962	Equality of Treatment (Social Security) Convention, (No. 118)
Global	Convention	ILO	1970	Holidays with Pay Convention (Revised), 1970 (No. 132)
Global	Convention	ILO	1973	Minimum Age Convention (No. 138)
Global	Convention	ILO	1982	Termination of Employment Convention, (No. 158)
Global	Convention	ILO	1982	Maintenance of Social Security Rights Convention (No. 157)
Global	Convention	ILO	1983	Vocational Rehabilitation and Employment (Disabled Persons) Convention, (No. 159)
Global	Convention	ILO	1990	Night Work Convention (No. 171)
Global	Convention	ILO	1994	Part-Time Work Convention (No. 175)
Global	Convention	ILO	1999	Worst Forms of Child Labour Convention, 1999 (No. 182)
Global	Convention	ILO	2000	Maternity Protection Convention, (No. 183)
Global	Recom-mendation	ILO	1962	Reduction of Hours of Work Recommendation, (No. 116)
Global	Recom-mendation	ILO	1980	Older Workers Recommendation, (No. 162)

12. CONCLUSIONS AND RECOMMENDATIONS

12.1 CONCLUSIONS

This review shows that there are numerous international norms relating to protecting health at work, with some degree of duplication. However, when duplication was noted it was generally found that the approach to protection was similar. For example, ILO conventions and EU directives all advocated a degree of risk assessment, and for exposure monitoring 8 hour TWAs were used rather than ceiling limits. It was therefore concluded that there is good international cooperation on the development of norms.

Gaps were identified for all specific hazard categories investigated. In summary, the following additional norms or guidance documents would be valuable at an international level:

Chemical substances:

- Guidance on risk assessment and control of exposure. This should include examples of simple generic risk assessment forms, and information on monitoring methods using inexpensive equipment.
- A comprehensive list of occupational exposure limits (OELs) in various languages, free of charge.
- A standard or code on the design, use and testing of local exhaust ventilation.

Biological agents:

- A norm that covers workplace health protection from all biological agents.
- A norm that ensures only approved biocides are used at work.
- A norm ensuring that all health-care workplaces are equipped with safety-engineered sharps.

Noise and vibration:

- Guidance on assessing noise exposure and on practical inexpensive solutions for noise control at source.

Radiation:

- A norm on non-ionizing radiation.
- Basic guidance to protect against non-ionizing radiation at work.

Ergonomic risk factors:

- Broadening the scope of the ILO Convention on manual loads to include pushing, pulling and VDT work.
- Basic guidance on avoiding musculoskeletal injuries to put requirements outlined in the various documents in place.

Psychosocial risk factors:

- A norm that includes protection from violence, harassment and bullying.
- Review existing norms to see if they consider situations in resource-limited settings sufficiently.
- International agreement on terminology.

Work environment:

- Comprehensive norm for all workplaces, including minimum requirements for welfare, accommodation, first aid and safe drinking water.

General norms:

- A standard or code on managing health and safety specifically for small- and medium-sized enterprises and the informal sector.
- Guidance on how health protection and promotion initiatives in the workplace can achieve general health benefits for the individual and the wider community.

For some of the gaps, guidance documents at regional or national level were identified that can serve as blueprints for standard development.

The poor state of workers' health protection worldwide, especially in resource-limited settings, does not mirror the wide range of existing norms and guidance documents. There seems to be a gap between what is advocated by the norms and their implementation in practice. This gap may be lessened by better access to the guidance available through education and training, simple accessible documents, enhanced political will and improved occupational health services.

In certain aspects of health protection the relevant norms have to be purchased, as a result the cost incurred may restrict access in resource-limited settings. For example, this is the case for OELs and exposure monitoring methods.

Developing countries may require additional guidance to:

- educate the workforce on basic requirements for workplace health protection;
- give advisory support to small- and medium-sized enterprises (SMEs) and informal sector workers and employers;
- promote preventive action.

In this context, it will be important to expand and strengthen prevention, diagnosis, treatment and rehabilitation services in the workplace, especially in settings where occupational health structures need to be strengthened. Close collaboration with primary health-care services may enable them to supporter workers and advocate on their behalf for preventive action by companies.

There are a number of guidance documents available for specific industries, or on specific hazards, many published by ILO in more than one language. Although these documents are a useful source of information for occupational health and safety professionals they may be too detailed for employers and workers. Simple and much shorter guidance documents are required for a number of topics. These should contain diagrams and photographs where appropriate to reach a wide range of literacy levels.

Last but not least, encouragement will be essential once a voluntary international norm has become a mandatory national law or regulation. This can be given by comprehensive information, workplace health and safety support and inspection.

12.2 RECOMMENDATIONS

1. International cooperation on all norms should continue and be expanded to developing countries whenever possible.
2. Access to existing norms should be improved particularly for SME and informal sector workers in resource-limited settings.
3. International norms and guidance documents should be developed according to the gaps identified in this document.
4. Simple technical guidance for employers and workers should be made available on the following topics:
   a) assessing and managing exposure to hazardous substances, and the use of OELs;
   b) controlling exposure to biological agents;
   c) noise assessment and control (including simple control methods for controlling noise at source);
   d) controlling exposure to non-ionizing radiation including exposure to the sun;
   e) preventing work-related musculoskeletal disorders;
   f) managing psychosocial risk factors including violence, bullying and harassment leading to work-related stress;
   g) provision of a safe work environment, including protection from exposure to second hand tobacco smoke, and adequate welfare facilities;
   h) the management of health and safety in small organizations.
5. International standards should be constantly reviewed and updated, so that omissions and changes in scientific opinion can be incorporated into the standards in a timely fashion. Whenever possible, standards should be amalgamated to avoid duplication and those no longer current should be taken out of circulation.

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The following experts kindly provided professional reviews and thoughtful comments on the report.:

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