L.N. 250 of 2010

OCCUPATIONAL HEALTH AND SAFETY AUTHORITY ACT
(CAP. 424)

Work Place (Minimum Health and Safety Requirements for the Protection of Workers from Risks resulting from Exposure to Artificial Optical Radiation) Regulations, 2010

IN exercise of the powers conferred by article 12 of the Occupational Health and Safety Authority Act, the Minister for Health, the Elderly and Community Care, in consultation with the Occupational Health and Safety Authority, has made the following regulations:

Title, scope and applicability.

1. (1) The title of these regulations is the Work Place (Minimum Health and Safety Requirements for the Protection of Workers from Risks resulting from Exposure to Artificial Optical Radiation) Regulations, 2010.

(2) The scope of these regulations is to lay down minimum requirements for the protection of workers from risks to their health and safety arising or likely to arise from exposure to artificial optical radiation during their work. These regulations refer to the risk to the health and safety of workers due to adverse effects caused by exposure to artificial optical radiation to the eyes and to the skin. These regulations shall implement Directive 2006/25/EC of the European Parliament and of the Council.

(3) These regulations shall apply fully to all workers without prejudice to more stringent and,or more specific provisions contained in any other law or regulation on the protection of workers from the risks related to exposure to artificial optical radiation.

Interpretation.

2. In these regulations, unless the context otherwise requires:

"the Act" means the Occupational Health And Safety Authority Act;

"the Authority" means the Occupational Health and Safety Authority established by article 8 of the Act;

"exposure limit values" means the limits on exposure to optical radiation which are based directly on established health effects and biological considerations. Compliance with these limits will ensure that workers exposed to artificial

sources of optical radiation are protected against all known adverse health effects;

"irradiance (E) or power density" means the radiant power incident per unit area upon a surface expressed in watts per square metre (W m^{-2});

"laser (light amplification by stimulated emission of radiation)" means any device which can be made to produce or amplify electromagnetic radiation in the optical radiation wavelength range primarily by the process of controlled stimulated emission;

"laser radiation" means optical radiation from a laser;

"level" means the combination of irradiance, radiant exposure and radiance to which a worker is exposed;

"the Minister" means the Minister responsible for occupational health and safety;

"non-coherent radiation" means any optical radiation other than laser radiation;

"optical radiation" means any electromagnetic radiation in the wavelength range between 100 nm and 1 mm. The spectrum of optical radiation is divided into ultraviolet radiation, visible radiation and infrared radiation:

(i) ultraviolet radiation: optical radiation of wavelength range between 100 nm and 400 nm. The ultraviolet region is divided into UVA (315-400 nm), UVB (280-315 nm) and UVC (100-280 nm);

(ii) visible radiation: optical radiation of wavelength range between 380 nm and 780 nm;

(iii) infrared radiation: optical radiation of wavelength range between 780 nm and 1 mm. The infrared region is divided into IRA (780 - 1400 nm), IRB (1400 - 3000 nm) and IRC (3000 nm - 1 mm);

"radiance (L)" means the radiant flux or power output per unit solid angle per unit area, expressed in watts per square metre per steradian (W m^{-2} sr^{-1});

"radiant exposure (H)" means the time integral of the irradiance, expressed in joules per square metre (J m^{-2}).

Exposure limit values.

3. (1) The occupational exposure limit values for non-coherent radiation, other than that emitted by natural sources of optical radiation, are as set out in Schedule I.

(2) The occupational exposure limit values for laser radiation are as set out in Schedule II.

Determination of exposure and assessment of risks.

4. (1) The employer shall assess and, if necessary, measure and,or calculate the levels of exposure to optical radiation to which workers are likely to be exposed so that the measures needed to restrict exposure to the applicable limits can be identified and put into effect. The methodology applied in assessment, measurement and,or calculations shall follow the standards of the International Electrotechnical Commission (IEC) in respect of laser radiation and the recommendations of the International Commission on Illumination (CIE) and the European Committee for Standardisation (CEN) in respect of non-coherent radiation. In exposure situations which are not covered by these standards and recommendations, and until appropriate EU standards or recommendations become available, assessment, measurement and,or calculations shall be carried out using available national or international science-based guidelines. In both exposure situations, the assessment may take account of data provided by the manufacturers of the equipment when it is covered by relevant Community Directives.

(2) The assessment, measurement and,or calculations referred to in sub-regulation (1) shall be planned and carried out by competent persons at suitable intervals taking particular account of regulation 9 concerning protective and preventive services and measures and regulation 13 concerning consultation and participation of the workers of the General Provisions for Health and Safety at Work Places Regulations, 2003. The data obtained from the assessment, including those obtained from the measurement and,or calculation of the level of exposure referred to in sub-regulation (1) shall be preserved in a suitable form so as to permit consultation at a later stage.

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(3) The employer shall give particular attention, when carrying out the risk assessment, to the following:

(a) the level, wavelength range and duration of exposure to artificial sources of optical radiation;

(b) the exposure limit values referred to in regulation 3 of these regulations;

(c) any effects concerning the health and safety of workers belonging to particularly sensitive risk groups;

(d) any possible effects on workers' health and safety resulting from workplace interactions between optical radiation and photosensitising chemical substances;

(e) any indirect effects such as temporary blinding, explosion or fire;

(f) the existence of replacement equipment designed to reduce the levels of exposure to artificial optical radiation;

(g) appropriate information obtained from health surveillance, including published information, as far as possible;

(h) multiple sources of exposure to artificial optical radiation;

(i) a classification applied to a laser as defined in accordance with the relevant IEC standard and, in relation to any artificial source likely to cause damage similar to that of a laser of class 3B or 4, any similar classification;

(j) information provided by the manufacturers of optical radiation sources and associated work equipment in accordance with the relevant Community Directives.

(4) The employer shall be in possession of an assessment of the risk in accordance with regulation 10 of the General Provisions for Health and Safety at Work Places Regulations, 2003 and shall identify those measures which must be taken in accordance with regulations 5 and 6 of these regulations. The risk assessment shall be recorded on a suitable medium, and it may include a justification by the employer that the nature and extent of the risks related to optical radiation make a further detailed risk assessment unnecessary. The risk assessment shall be updated on a regular basis, particularly if there have been significant changes which could render it out-of-date, or if the results of health surveillance show it to be necessary.

(5) A medium is considered to be suitable, as required by the preceding paragraph, if it allows records and the information contained therein to be stored in a way which is readily accessible for future reference and which meets the following conditions:

(a) it is possible for any corrections or other amendments, and the contents of the records prior to such corrections or amendments, to be easily ascertained; and

(b) it is not possible for the records otherwise to be manipulated or altered.

Reduction of risks resulting from exposure to artificial optical radiation.

5. (1) Every employer shall take measures to eliminate or reduce to a minimum the risks arising from exposure to artificial optical radiation, taking account of technical progress and of the availability of measures to control the risk at source.

(2) Where the risk assessment carried out in accordance with regulation 4(1) for workers exposed to artificial sources of optical radiation indicates any possibility that the exposure limit values may be exceeded, the employer shall devise and implement an action plan comprising technical and,or organisational measures designed to prevent the exposure exceeding the limit values, taking into account in particular:

(a) other working methods that reduce the risk from optical radiation;

(b) the choice of equipment emitting less optical radiation taking account of the work to be done;

(c) technical measures to reduce the emission of optical radiation including, where necessary, the use of interlocks, shielding or similar health protection mechanisms;

(d) appropriate maintenance programmes for work equipment, workplaces and workstation systems;

(e) the design and layout of workplaces and workstations;

(f) limitation of the duration and level of the exposure;

(g) the availability of appropriate personal protective equipment;

(h) the instructions of the manufacturer of the equipment where it is covered by relevant Community Directives.

(3) On the basis of the risk assessment carried out in accordance with regulation 4, workplaces where workers could be exposed to levels of optical radiation from artificial sources exceeding the exposure limit values shall be indicated by appropriate signs in accordance with the Workplace (Provision of Health and, or Safety Signs) Regulations, 2002. The areas in question shall be identified, and access to them limited where this

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is technically possible and where there is a risk that the exposure limit values could be exceeded.

(4) Workers shall not be exposed above the exposure limit values. In any event, if, despite the measures taken by the employer to comply with these regulations in respect of artificial sources of optical radiation, the exposure limit values are exceeded, the employer shall take immediate action to reduce exposure below the exposure limit values. The employer shall identify the reasons why the exposure limit values have been exceeded, and shall adapt the protection and prevention measures accordingly in order to prevent them being exceeded again. The employer shall adapt the measures referred to in this regulation to the requirements of workers belonging to particularly sensitive risk groups.

Information and training for workers.

6. (1) Without prejudice to the provisions of regulations 12 and 14 of the General Provisions for Health and Safety at Work Places Regulations, 2003 the employer shall ensure that workers who are exposed to risks from artificial optical radiation at work and,or their representatives, receive any necessary information and training relating to the outcome of the risk assessment provided for in regulation 4 of these regulations, concerning in particular:

(a) measures taken to implement these regulations;

(b) the exposure limit values and the associated potential risks;

(c) the results of the assessment, measurement and,or calculations of the levels of exposure to artificial optical radiation carried out in accordance with regulation 4 of these regulations together with an explanation of their significance and potential risks;

(d) how to detect adverse health effects of exposure and how to report them;

(e) the circumstances in which workers are entitled to health surveillance;

(f) safe working practices to minimise risks from exposure;

(g) proper use of appropriate personal protective equipment.

Consultation and participation of workers.

7. Consultation and participation of workers and,or their representatives on the matters covered by these regulations and

the schedules hereto, including the assessment, measurement and,or calculations of the levels of exposure to artificial optical radiation experienced at work, shall take place in accordance with the General Provisions for Health and Safety at Work places Regulations, 2003.

Health surveillance.

8. (1) With the objectives of the prevention and timely detection of any adverse health effects, as well as the prevention of any long-term health risks and any risk of chronic diseases, resulting from exposure to optical radiation, an employer shall make arrangements for carrying out appropriate health surveillance of workers who are exposed to artificial optical radiation and such health records shall be made available to the Authority.

(2) An employer shall ensure that health surveillance is carried out by a doctor or other person which is deemed by the Health Authorities to be competent to carry out health surveillance in accordance with this regulation.

(3) An employer shall ensure that for each worker who undergoes health surveillance in accordance with regulation 8 (1), individual health records are made and kept up-to-date.

(4) (a) Health records shall contain a summary of the results of the health surveillance carried out, and shall be kept in a suitable form so as to permit any consultation in a confidential manner at a later date.

(b) Copies of the appropriate records shall be supplied to the Authority on request; individual workers shall, at their request, have access to their own personal health records.

(c) The employer shall take appropriate measures to ensure that the doctor or the competent person as is referred to in sub-regulation (2) of this regulation has access to the results of the risk assessment referred to in regulation 4 where such results may be relevant to the health surveillance.

(5) In any event, where exposure above the limit values is detected, a medical examination shall be made available by the employer to any worker concerned. This medical examination shall also be carried out where, as a result of health surveillance, a worker is found to have an identifiable disease or adverse health effect which is considered by a doctor or competent person to be the result of exposure to artificial optical radiation at work. In both cases, when limit values are exceeded or adverse health effects, including diseases, are identified:

(a) the worker shall be informed by the doctor or other suitably competent person of the result which relates to him personally, and shall, in particular, receive information and advice regarding any health surveillance which he should undergo following the end of exposure;

(b) the employer shall be informed of any significant findings from the health surveillance, taking into account any medical confidentiality;

(c) the employer shall:

(i) review the risk assessment carried out pursuant to regulation 4,

(ii) review the measures provided for to eliminate or reduce risks pursuant to regulation 5,

(iii) take into account the advice of the competent person or the Authority in implementing any measure required to eliminate or reduce risk in accordance with regulation 5, and

(iv) arrange continued health surveillance and provide for a review of the health status of any other worker who has been similarly exposed. In such cases, the doctor or competent person or the Authority may propose that exposed persons undergo an adequate medical examination.

Onus of proof.

9. In any proceedings for an offence under these regulations consisting of failure to comply with a duty or requirement to do something, or to do something so far as is reasonably practicable, it shall be for the accused to prove, as the case may be, that it was not practicable or not reasonably practicable to do more than was in fact done to satisfy the duty or requirement, or there was no better practicable means than was in fact used to satisfy the duty or requirement.

Offences.

10. (1) Any breach by any person of any provision of these regulations shall be deemed an offence.

(2) Any person who knowingly or recklessly interferes with the performance of a duty or obligation by a person under these regulations shall be guilty of an offence.

SCHEDULE I

Non-coherent optical radiation

The biophysically relevant exposure values to optical radiation can be determined with the formulae below. The formulae to be used depend on the range of radiation emitted by the source and the results should be compared with the corresponding exposure limit values indicated in Table 1.1. More than one exposure value and corresponding exposure limit can be relevant for a given source of optical radiation.

Numbering (a) to (o) refers to corresponding rows of Table 1.1.

(a) $H_{eff} = \int_0^t \int_{\lambda=180\ nm}^{\lambda=400\ nm} E_\lambda(\lambda,t) \cdot S(\lambda) \cdot d\lambda \cdot dt$ (H_{eff} is only relevant in the range 180 to 400 nm)

(b) $H_{UVA} = \int_0^t \int_{\lambda=315\ nm}^{\lambda=400\ nm} E_\lambda(\lambda,t) \cdot d\lambda \cdot dt$ (H_{UVA} is only relevant in the range 315 to 400 nm)

(c), (d) $L_B = \int_{\lambda=300\ nm}^{\lambda=700\ nm} L_\lambda(\lambda) \cdot B(\lambda) \cdot d\lambda$ (L_B is only relevant in the range 300 to 700 nm)

(e), (f) $E_B = \int_{\lambda=300\ nm}^{\lambda=700\ nm} E_\lambda(\lambda) \cdot B(\lambda) \cdot d\lambda$ (E_B is only relevant in the range 300 to 700 nm)

(g) to (l) $L_R = \int_{\lambda_1}^{\lambda_2} L_\lambda(\lambda) \cdot R(\lambda) \cdot d\lambda$ (See Table 1.1 for appropriate values of λ_1 and λ_2)

(m), (n) $E_{IR} = \int_{\lambda=780\ nm}^{\lambda=3000\ nm} E_\lambda(\lambda) \cdot d\lambda$ (E_{IR} is only relevant in the range 780 to 3 000 nm)

(o) $H_{skin} = \int_0^t \int_{\lambda=380\ nm}^{\lambda=3000\ nm} E_\lambda(\lambda,t) \cdot d\lambda \cdot dt$ (H_{skin} is only relevant in the range 380 to 3 000 nm)

For the purposes of these regulations the formulae above can be replaced by the following expressions and the use of discrete values as set out in the following tables:

(a) $E_{eff} = \sum_{\lambda=180\ nm}^{\lambda=400\ nm} E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$ and $H_{eff} = E_{eff} \cdot \Delta t$

(b) $E_{UVA} = \sum_{\lambda=315\ nm}^{\lambda=400\ nm} E_\lambda \cdot \Delta\lambda$ and $H_{UVA} = E_{UVA} \cdot \Delta t$

(c), (d) $L_B = \sum_{\lambda=300\ nm}^{\lambda=700\ nm} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$

(e), (f) $E_B = \sum_{\lambda=300\ nm}^{\lambda=700\ nm} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$

(g) to (l) $L_R = \sum_{\lambda_1}^{\lambda_2} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$ (See Table 1.1 for appropriate values of λ_1 and λ_2)

(m), (n) $E_{IR} = \sum_{\lambda=780\ nm}^{\lambda=3000\ nm} E_\lambda \cdot \Delta\lambda$

(o) $E_{skin} = \sum_{\lambda = 380\,nm}^{\lambda = 3\,000\,nm} E_{\lambda} \cdot \Delta\lambda$ and $H_{skin} = E_{skin} \cdot \Delta t$

Notes:

$E\lambda(\lambda,t)$, $E\lambda$ *spectral irradiance or spectral power density:* the radiant power incident per unit area upon a surface, expressed in watts per square metre per nanometre [W m^{-2} nm^{-1}]; values of $E\lambda(\lambda, t)$ and E_{λ} come from measurements or may be provided by the manufacturer of the equipment;

E_{eff} *effective irradiance (UV range)*: calculated irradiance within the UV wavelength range 180 to 400 nm spectrally weighted by $S(\lambda)$, expressed in watts per square metre [W m^{-2}];

H *radiant exposure*: the time integral of the irradiance, expressed in joules per square metre [J m^{-2}];

H_{eff} *effective radiant exposure*: radiant exposure spectrally weighted by $S(\lambda)$, expressed in joules per square metre [J m^{-2}];

E_{UVA} *total irradiance (UVA)*: calculated irradiance within the UVA wavelength range 315 to 400 nm, expressed in watts per square metre [W m^{-2}];

H_{UVA} *radiant exposure*: the time and wavelength integral or sum of the irradiance within the UVA wavelength range 315 to 400 nm, expressed in joules per square metre [J m^{-2}];

$S(\lambda)$ *spectral weighting* taking into account the wavelength dependence of the health effects of UV radiation on eye and skin, (Table 1.2) [dimensionless];

t, Δt *time, duration of the exposure*, expressed in seconds [s];

λ *wavelength*, expressed in nanometres [nm];

$\Delta\lambda$ *bandwidth*, expressed in nanometres [nm], of the calculation or measurement intervals;

$L\lambda(\lambda)$, L_{λ} *spectral radiance of the source* expressed in watts per square metre per steradian per nanometre [W m^{-2} sr^{-1} nm^{-1}];

$R(\lambda)$ *spectral weighting* taking into account the wavelength dependence of the thermal injury caused to the eye by visible and IRA radiation (Table 1.3) [dimensionless];

L_R *effective radiance (thermal injury)*: calculated radiance spectrally weighted by $R(\lambda)$ expressed in watts per square metre per steradian [W m^{-2} sr^{-1}];

$B(\lambda)$ *spectral weighting* taking into account the wavelength dependence of the photochemical injury caused to the eye by blue light radiation (Table 1.3) [dimensionless];

L_B *effective radiance (blue light)*: calculated radiance spectrally weighted by $B(\lambda)$, expressed in watts per square metre per steradian [W m^{-2} sr^{-1}];

E_B *effective irradiance (blue light)*: calculated irradiance spectrally weighted by $B(\lambda)$ expressed in watts per square metre [W m^{-2}];

E_{IR} *total irradiance (thermal injury)*: calculated irradiance within the infrared wavelength range 780 nm to 3 000 nm expressed in watts per square metre [W m^{-2}];

E_{skin} *total irradiance (visible, IRA and IRB)*: calculated irradiance within the visible and infrared wavelength range 380 nm to 3 000 nm, expressed in watts per square metre [W m^{-2}];

H_{skin} *radiant exposure*: the time and wavelength integral or sum of the irradiance within the visible and infrared wavelength range 380 to 3 000 nm, expressed in joules per square metre (J m^{-2});

α *angular subtense*: the angle subtended by an apparent source, as viewed at a point in space, expressed in milliradians (mrad). Apparent source is the real or virtual object that forms the smallest possible retinal image.

Table 1.1

Exposure limit values for non-coherent optical radiation

Index	Wavelength nm	Exposure limit value	Units	Comment	Part of the body	Hazard
a.	180-400 (UVA, UVB and UVC)	H_{eff} = 30 Daily value 8 hours	[J m^{-2}]		eye cornea conjunctiva lens skin	photokeratitis conjunctivitis cataractogenesis erythema elastosis skin cancer
b.	315-400 (UVA)	$H_{UVA} = 10^4$ Daily value 8 hours	[J m^{-2}]		eye lens	cataractogenesis
c.	300-700 (Blue light) *see note 1*	$L_B = \frac{10^6}{t}$ for t ≤ 10 000 s	L_B :[W m^{-2} sr^{-1}] t: [seconds]	for α ≥ 11 mrad	eye retina	photoretinitis
d.	300-700 (Blue light) *see note 1*	L_B = 100 for t > 10 000 s	[W m^{-2} sr^{-1}]			
e.	300-700 (Blue light) *see note 1*	$E_B = \frac{100}{t}$ for t ≤ 10 000 s	E_B: [W m^{-2}] t: [seconds]	for α < 11 mrad *see note 2*		
f.	300-700 (Blue light) *see note 1*	E_B = 0,01 t >10 000 s	[W m^{-2}]			