Australian Government
Australian Radiation Protection and Nuclear Safety Agency

RADIATION PROTECTION STANDARD

Occupational Exposure to Ultraviolet Radiation

RADIATION PROTECTION SERIES No. 12

Radiation Protection Series

The *Radiation Protection Series* is published by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to promote practices that protect human health and the environment from the possible harmful effects of radiation. ARPANSA is assisted in this task by its Radiation Health and Safety Advisory Council, which reviews the publication program for the *Series* and endorses documents at the Radiation Protection Standards level, and by its Radiation Health Committee, which oversees the preparation of draft documents and recommends publication.

There are four categories of publication in the ***Series***:

Radiation Protection Standards set fundamental requirements for safety. They are prescriptive in style and may be referenced by regulatory instruments in State, Territory or Commonwealth jurisdictions. They may contain key procedural requirements regarded as essential for best international practice in radiation protection, and fundamental quantitative requirements, such as exposure limits.

Codes of Practice are also prescriptive in style and may be referenced by regulations or conditions of licence. They contain practice-specific requirements that must be satisfied to ensure an acceptable level of safety in dealings involving exposure to radiation. Requirements are expressed in 'must' statements.

Recommendations provide guidance on fundamental principles for radiation protection. They are written in an explanatory and non-regulatory style and describe the basic concepts and objectives of best international practice. Where there are related **Radiation Protection Standards** and **Codes of Practice,** they are based on the fundamental principles in the **Recommendations**.

Safety Guides provide practice-specific guidance on achieving the requirements set out in **Radiation Protection Standards** and **Codes of Practice**. They are non-prescriptive in style, but may recommend good practices. Guidance is expressed in 'should' statements, indicating that the measures recommended, or equivalent alternatives, are normally necessary in order to comply with the requirements of the **Radiation Protection Standards** and **Codes of Practice**.

In many cases, for practical convenience, prescriptive and guidance documents which are related to each other may be published together. A **Code of Practice** and a corresponding **Safety Guide** may be published within a single set of covers.

All publications in the ***Radiation Protection Series*** are informed by public comment during drafting, and **Radiation Protection Standards** and **Codes of Practice**, which may serve a regulatory function, are subject to a process of regulatory review. Further information on these consultation processes may be obtained by contacting ARPANSA.

Australian Government
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Radiation Protection Standard

Occupational Exposure to Ultraviolet Radiation

Radiation Protection Series Publication No. 12

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This publication was approved by the Radiation Health Committee on 29-30 March 2006, and the Radiation Health & Safety Advisory Council, at its meeting on 8 December 2006, advised the CEO to adopt the Standard.

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The mission of ARPANSA is to provide the scientific expertise and infrastructure necessary to support the objective of the ARPANS Act — to protect the health and safety of people, and to protect the environment, from the harmful effects of radiation.

Published by the Chief Executive Officer of ARPANSA in December 2006

Foreword

This document was drafted after a review of the ultraviolet (UVR) guidelines issued by the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA) and its successor the International Committee on Non-Ionizing Radiation Protection (ICNIRP), which recently reassessed the original UVR exposure limits. First drafts of the document were circulated to the Radiation Health Committee for comment and discussed by the full committee at their meetings during 2000.

This publication replaces the previous standard issued by the National Health and Medical Research Council as Radiation Health Series No. 29 *Occupational standard for exposure to ultraviolet radiation (1989).*

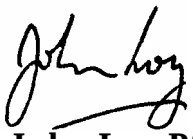
This Radiation Protection Standard limits the occupational exposure to ultraviolet radiation for artificial sources in the workplace, considered to be a controlled environment and provides guidance on minimising a worker's exposure to uncontrollable sources of UVR, such as the sun. While mandatory application of the limits for exposure to solar ultraviolet radiation to outdoor workers is difficult in practice, it is important to limit UVR exposures by using engineering and administrative controls as well as personal protection. The UVR exposure limits are set to levels where it is believed that nearly all workers may be repeatedly exposed without adverse effect.

The Standard was developed by a working group of the Radiation Health Committee after a comprehensive review of existing international standards and guidelines and their associated scientific literature. The document was reviewed by the Radiation Health Committee and then circulated for public comment from June–August 2003.

After review of comments and further cost-benefit analysis, a revised draft was released for a second round of public comment from August-October 2005.

The comments received were reviewed by the working group, and the final Standard was adopted by the Radiation Health Committee at its meeting of 29-30 March 2006, subject to completion of the final regulatory impact statement. The final RIS was cleared on 30 November 2006 by the Office of Best Practice Regulation. The Radiation Health and Safety Advisory Council advised the CEO to adopt the Standard on 8 December 2006.

The Standard will be reviewed from time to time to ensure that it continues to provide the highest standards of protection.



John Loy PSM
CEO of ARPANSA

14 December 2006

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Contents

Foreword i

1. Introduction 1

1.1 CITATION 1
1.2 BACKGROUND 1
1.3 PURPOSE 2
1.4 SCOPE 2
1.5 STRUCTURE 3
1.6 INTERPRETATION 3

2. Duties and Responsibilities 4

2.1 EMPLOYERS' DUTIES 4
2.2 EMPLOYEES' DUTIES 4

3. Protection from occupational exposure to UVR sources 5

3.1 MANAGING RISK IN OCCUPATIONAL UVR EXPOSURE 5
3.2 PROVISION OF INFORMATION TO EMPLOYEES 7
3.3 POST INCIDENT EXPOSURE MANAGEMENT 7
3.4 ADDITIONAL REQUIREMENTS FOR OCCUPATIONAL EXPOSURE TO ARTIFICIAL SOURCES OF UVR 8
3.5 ADDITIONAL REQUIREMENTS FOR OCCUPATIONAL EXPOSURE TO SOLAR UVR 8

Schedule 1 Exposure Limits (EL) for UVR from Artificial Sources 9

References 13

Glossary 15

Annex 1 Rationale for Limiting Exposure to UVR 17

Annex 2 Health effects of UVR 18

Annex 3 Limiting Excessive Exposure to Ultraviolet Radiation (UVR) in the Workplace 21

Annex 4 ARPANSA Radiation Protection Series Publications 27

Annex 5 Radiation Protection and Regulatory Authorities 29

Contributors to Drafting and Review 31

Index 32

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1. Introduction

1.1 CITATION

This Radiation Protection Standard may be cited as the *Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation (2006).*

1.2 BACKGROUND

Australians are predominantly a fair skinned population and enjoy an outdoor lifestyle and each year there are approximately 380 000 new cases of skin cancer diagnosed in Australia. Although some types of skin cancers are relatively easy to treat if detected early, there are over 1300 fatal cases of skin cancer each year. Avoidance of sun exposure, wearing clothing with good body coverage, a broad brimmed hat, wrap around sunglasses and sunscreen are all major factors in preventing UVR exposure and skin cancer.

Exposure to solar ultraviolet radiation is the predominant cause of skin cancer in populations of European origin, particularly when the sun is highest in the sky, such as in summer during the middle of the day. Limiting UVR exposures at these times has the greatest potential for reducing skin cancer incidence (IARC 1992, Hill, Elwood & English 2004). The best approach to implementing successful strategies in reducing skin cancer will be to encourage sun protection policies and practices that reduce sun exposure in both occupational and recreational activities (IARC 1992, Hill, Elwood & English 2004). An exposure standard that encourages UVR exposures to be less than that required to obtain observable biological effects is a key to reducing occupational exposures.

UVR exposure also places our eyes at risk of photokeratitis, photoconjunctivitis and cataracts. Prolonged exposure to UVR can have serious consequences for the eyes. Wearing wrap around sunglasses and a broad brimmed hat can prevent most of the UVR from reaching the eyes.

UVR can be produced by various artificial sources but for most people the sun is the predominant source of exposure to UVR. For outdoor workers without adequate protection or control measures the levels of solar UVR exposure may exceed the exposure limits set out in this Standard. Many workers, in particular those exposed to solar UVR, may not be using adequate protection against UVR.

This Standard is based on the recommendations of the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC 1989), which were a modification to their original guidelines proposed in 1985 (IRPA/INIRC 1985). These IRPA/INIRC guidelines were reviewed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) at the annual meeting in 1996 and again in 2004. ICNIRP concluded that recent data did not suggest that the exposure limit (EL) values needed to be amended (ICNIRP 2004). This standard replaces the National Health and Medical Research Council's Radiation Health Series No 29 (RHS 29), *Occupational standard for exposure to ultraviolet radiation,* 1989.

1.3 PURPOSE

This Radiation Protection Standard sets out to protect workers by:

(a) limiting the occupational exposure to ultraviolet radiation for artificial sources in the workplace, considered to be a controlled environment; and

(b) setting requirements for minimising a person's exposure to uncontrollable sources of UVR, such as the sun. While mandatory application of the limits for exposure to solar ultraviolet radiation to outdoor workers is difficult in practice, it is important to limit UVR exposures by using engineering and administrative controls as well as personal protection**.**

This Standard sets common essential requirements for the control of exposure to ultraviolet radiation, including the specification of employer's duties and employee's duties. It also provides practical strategies for protection of workers from ultraviolet radiation.

1.4 SCOPE

This Standard covers exposure to ultraviolet radiation incurred as part of a worker's occupation and includes both solar UVR and artificial sources of UVR. The document covers exposures to incoherent sources of UVR in the spectral region between 180 and 400 nm.

The Standard establishes threshold exposure levels for occupational exposure of the eye or the skin during an 8 hour working day. The Standard does not apply to UVR exposures of patients as a part of medical treatment or for elective cosmetic purposes. These threshold levels are intended as upper limits for non-therapeutic and non-cosmetic exposure and should be considered as absolute limits for ocular exposure but occasional exposure of conditioned skin above these levels may not result in adverse effects. However, photosensitizers may lower the threshold for UVR damage (see Annex 2).

The exposure limits of Schedule 1 apply to artificial sources of UVR in the workplace, a controlled environment, but do not apply to ultraviolet lasers. Exposures to lasers are covered by laser standards (AS/NZS 2211 'Safety of laser products'). The values should be used as guides in the control of exposure to both pulsed and continuous sources of UVR where the exposure duration is not less than 0.1 µsec.

Given the variability in exposures to solar UVR due to highly variable ambient solar UVR levels as well as behavioural effects and different exposure geometry, application of the exposure limits of Schedule 1 is not practical and limiting UVR exposures to as low as possible is the most effective approach. The exposure limits of Schedule 1 are typically exceeded within 5 to 10 minutes in summer by solar radiation for 2 to 3 hours either side of noon at 0º to 40º latitude (see Annex 3).

1.5 STRUCTURE

This Radiation Protection Standard is structured as follows:

- Section 2 specifies duties and responsibilities of employers and employees;
- Section 3 sets out a risk management approach to reducing exposure to UVR in the workplace;
- Schedule 1 provides the limits for occupational exposure to UVR;
- the meanings of terms used in the Standard are defined in the Glossary;
- Annexes to the Standard provide information that will assist users of the Standard:
  - Annex 1 provides the rationale for the limits;
  - Annex 2 provides a description of the health effects of UVR;
  - Annex 3 provides guidance on limiting exposure to UVR in the workplace;
  - Annex 4 lists other publications in the Radiation Protection Series;
  - Annex 5 lists the authorities from which advice on protection from UVR is available, and the Regulatory Authorities for occupational exposure to UVR.

1.6 INTERPRETATION

This Standard is based on the principles described in the '*Guidelines on limits of exposure to ultraviolet radiation of wavelengths between 180 nm and 400 nm (incoherent optical radiation)*' (ICNIRP 2004). Terms used in this Standard have the meaning given in the Glossary. In addition, the words 'must' and 'should' have a special meaning. 'Must' indicates that the requirement to which it refers is considered to be mandatory. 'Should' indicates a recommendation – that is, a requirement that is to be applied as far as is practicable in the interests of reducing risk.

2. Duties and Responsibilities

2.1 EMPLOYERS' DUTIES

Where there are sources of ultraviolet radiation present in the workplace, an employer must ensure that a program of ultraviolet radiation protection is devised and implemented. In fulfilling this requirement, the employer must:

(a) provide information on the potential health hazard and risk management requirements to and appropriate induction and on-going training for employees who may be exposed to ultraviolet radiation in their work and maintain a records of the training;

(b) ensure that a plan for the control of exposure to ultraviolet radiation is developed, approved, implemented and regularly reviewed, and that the workforce is consulted in the planning and review process (examples of such a plan and the minimum elements required to be in the plan are given on the ARPANSA web site www.arpansa.gov.au);

(c) ensure that all necessary resources for implementing the plan for the control of exposure are provided, at the employer's expense, including personal protective equipment;

(d) endeavour to ensure that exposure to ultraviolet radiation in the workplace is kept to a minimum;

(e) when an employee reports a matter which may compromise ultraviolet radiation protection, ensure that appropriate action is taken to investigate and, if necessary, rectify the problem;

(f) inform the appropriate authority without delay of the occurrence of an incident and, as soon as practicable, of its cause and consequences and of the steps taken to remedy the situation and to prevent a recurrence.

2.2 EMPLOYEES' DUTIES

Employees who may be exposed to ultraviolet radiation in the workplace must, to the extent that they are capable, comply with all reasonable measures to control and assess exposure to ultraviolet radiation in the workplace, including:

(a) following the ultraviolet radiation protection practices specified in the plan for the control of exposure to ultraviolet radiation;

(b) participating in training related to ultraviolet radiation protection, as required;

(c) making proper use of the training received to ensure their own health and safety and that of other persons;

(d) making proper use of protective equipment provided by the employer;

(e) reporting to the employer, any matter of which they are aware which may compromise ultraviolet radiation protection.

3. Protection from Occupational Exposure to UVR Sources

3.1 MANAGING RISK IN OCCUPATIONAL UVR EXPOSURE

The following people must ensure that the hazards associated with exposure to ultraviolet radiation are managed: employers; operators of ultraviolet radiation sources; people in control of workplaces; designers, manufacturers, contractors, labour hire personnel and suppliers of ultraviolet radiation sources; self-employed persons.

The persons listed above are to ensure that the hazards associated with exposure to ultraviolet radiation and ultraviolet radiation sources are managed by a risk management process as listed below in 3.1.2.

3.1.1 Workplace Policy

A risk management process for ultraviolet radiation exposure must be implemented and should be clearly documented in a written workplace policy that expresses the commitment of all parties. This policy must identify the risks, specify the procedures that must be implemented to control and manage them, and identify those responsible for that implementation.

3.1.2 Risk Management Process

The risk management process must include:

(a) Identification of the hazards. This step should include identification of the sources of ultraviolet radiation;

(b) Assessment of the risk. This step includes estimation of exposure levels, comparison to the relevant limits and consideration of both the likelihood and severity of the consequence(s) of the hazard;

(c) Choice (including reasons why) of the most appropriate control measures to prevent or minimise the level of risk. The control/s chosen must not cause other hazards;

(d) Implementation of the chosen control measures. This step must include maintenance requirements to ensure the ongoing effectiveness of the control/s and training on the control measures for workers potentially exposed to ultraviolet radiation;

(e) Monitoring and reviewing the effectiveness of the control measures. The monitoring and review process must assess whether the chosen controls have been implemented as planned, that the control measures are effective and that the control measures have not introduced new hazards or worsened existing hazards.

3.1.3 Control Prioritisation

Where there is potential for exposure above the limits, the hazard should be managed through application of a combination of appropriate control priorities as indicated below. The measures higher in the control priorities are usually more effective than those lower, and should be given greater consideration accordingly. In order of priority, the Control Priorities are:

(a) Elimination of the hazard. If this is not practical, exposure to the risk should be prevented or minimised by one or a combination of the following control measures;

(b) Substitution of a less hazardous (and more manageable) process or less hazardous plant;

(c) Engineering controls including redesign of equipment or work processes and/or isolation and containment of the hazard. Examples include: installing shielding or enclosing the source either in a container or in a dedicated room, fail-safe interlocks, built-in UVR detectors and alarms, elimination of reflected UVR and ventilation to remove any ozone produced;

(d) Introduction of administrative controls such as signage restricting access, hazard signs or warning lights. Procedures should ensure that equipment is switched off during any maintenance and service on the UVR source, particularly if safety shielding is removed. Administrative controls may be used in combination with higher level controls;

(e) Use of appropriate personal protective equipment (PPE)**.** All users of PPE must be provided with the appropriate PPE and trained and supervised in its use to ensure that they have a clear understanding of its correct usage and limitations and they must use it accordingly. In addition, the PPE must be maintained and replaced as specified by the manufacturer to ensure it is kept in good condition so that its effectiveness as a control is not compromised.

3.1.4 Training and Supervision

Workers who may be exposed to ultraviolet radiation must be trained in safe work practices regarding ultraviolet radiation and supervised when appropriate. They must also be trained about the controls in place to manage the potential ultraviolet radiation hazard. Management must maintain records of such staff training. There must be appropriate procedures in place, developed as part of a plan for the control of exposure to ultraviolet radiation, to ensure that the safe systems of work designed to prevent ultraviolet radiation exposure are utilised.

3.1.5 Assessment of UVR Levels

Advice on measurement or estimation of UVR exposures is covered in Annex 3.

3.2 PROVISION OF INFORMATION TO EMPLOYEES

Employees must be advised about the following:

(a) The known biological effects of overexposure to ultraviolet radiation. These are summarised in a number of publications by international agencies (IARC 1992, NRPB 2002, ICNIRP 2004).[1]

(b) The procedures to be followed in the event of any overexposure, including a contact point.

3.3 POST INCIDENT EXPOSURE MANAGEMENT

A plan for medical management of any case of severe overexposure must be developed in advance.

The following plan of action is suggested as appropriate in the event of ultraviolet radiation overexposure of the eye:

(a) first aid treatment should be obtained from the nearest first aider, doctor or hospital as required for burns or other injuries;

(b) employers should arrange for employees suspected or confirmed as overexposed to ultraviolet radiation is to be medically assessed as soon as possible after the overexposure;

(c) in the event that medical assessment of the eye is required then referral to an ophthalmologist is recommended;

(d) the employer must ensure the employee is fully advised and understands the nature of the overexposure incident and the nature and reasons for the post incident management of it;

(e) the overexposure or incident must be investigated to determine the level and extent of exposure to ultraviolet radiation. This information should be recorded as specified in (d) above. Appropriate corrective action or changes to procedures and plant or equipment need to be instituted as soon as is reasonably practicable, with regard to preventing future overexposures to any employees working in similar situations

(f) the overexposure or incident must be reported to the relevant authority if it causes the employee to be absent from work or results in a work-related illness.

[1] It is planned to produce an ARPANSA Safety Guide Statement of the health effects and general information in easy to understand plain language for distribution to outdoor workers and the general public.

3.4 Additional Requirements for Occupational Exposure to Artificial Sources of UVR

3.4.1 The exposure limits of Schedule 1 apply to artificial sources of UVR in the workplace, a controlled environment, but do not apply to ultraviolet lasers. The limits apply in the control of exposure to both pulsed and continuous sources of UVR where the exposure duration is not less than 0.1 μsec.

3.4.2 All the requirements outlined in Sections 3.1.2 and 3.1.3 must be employed for artificial sources of UVR.

3.4.3 The employer must ensure that no person is occupationally exposed to ultraviolet radiation from artificial sources at levels that exceed the occupational exposure limits specified in Schedule 1.

3.5 Additional Requirements for Occupational Exposure to Solar UVR

3.5.1 Under clear sky conditions solar UVR changes smoothly and predictably on both a daily and seasonal basis. Clouds can have a highly variable effect on the levels of solar UVR in comparison to clear sky conditions. This large natural variation in solar UVR levels coupled with different exposure situations as well as a person's behaviour can make accurate assessment of personal UVR exposure very difficult. For these reasons, mandatory application of the exposure limits of Schedule 1 is not practical. However, it is important that the exposures to solar UVR are kept to a minimum by using appropriate protective measures (see Annex 3). For an unprotected individual, the exposure limits of Schedule 1 are typically exceeded within 5 to 10 minutes in summer by solar radiation for 2 to 3 hours either side of noon at 0° to 40° latitude (see Annex 3).

3.5.2 For outdoor workers, all the requirements as outlined in Sections 3.1.2 and 3.1.3 must be employed. While it may not be possible to limit exposure of outdoor workers to below the exposure limits of Schedule 1, it is important that the exposures to solar UVR are kept to a minimum by using appropriate protective measures. The exposure limits of Schedule 1 are meant as guidelines for solar UVR exposures.

Schedule 1

EXPOSURE LIMITS (EL) FOR UVR FROM ARTIFICIAL SOURCES[2]

S1.1 The EL for occupational exposure to UVR incident upon the skin or eye where irradiance values are known and the exposure duration is controlled are as below. Note that S1.2 and S1.3 must both be satisfied independently.

S1.2 For the UV-A spectral region 315 to 400 nm, the total radiant exposure on the unprotected eye must not exceed 10 $kJ.m^{-2}$ within an 8 hour period and the total 8 hour radiant exposure incident on the unprotected skin must not exceed the values given in Table 1. Values for the relative spectral effectiveness are given up to 400 nm to expand the action spectrum into the UV-A for determining the EL for skin exposure.

S1.3 In addition, the ultraviolet radiant exposure in the actinic UV spectral region (UV-B and UV-C from 180 to 315 nm) incident upon the unprotected skin and unprotected eye(s) within an 8 hour period must not exceed the values given in Table 1.

S1.4 For broadband sources emitting a range of wavelengths in the ultraviolet region (ie most UVR sources), determination of the effective irradiance of such a broadband source is done by weighting all wavelengths present in the emission with their corresponding spectral effectiveness by using the following weighting formula:

$$E_{eff} = \sum E_\lambda . S_\lambda . \Delta\lambda$$

where:

E_{eff} = Effective irradiance in $W.m^{-2}$ ($J.s^{-1}.m^{-2}$) normalised to a monochromatic source at 270 nm

E_λ = Spectral irradiance in $W.m^{-2}.nm$

S_λ = Relative spectral effectiveness (unitless)

$\Delta\lambda$ = Bandwidth in nanometres of the calculated or measurement intervals

S1.5 Permissible exposure time in seconds for exposure to actinic UVR incident upon the unprotected skin or eye may be computed by dividing 30 $J.m^{-2}$ by E_{eff} in $W.m^{-2}$. The maximum exposure duration may also be determined using Table 2 of this Schedule which provides representative exposure durations corresponding to effective irradiances in $W.m^{-2}$ (and $\mu W.cm^{-2}$).

Note: When applying the EL to the skin for the case when there is continuous exposure for a period longer than 8 hours (such as a double shift for indoor workers) special care needs to be taken. This is because the EL is based on a normal 24 hours cycle of light and dark where cellular repair takes place mainly when the exposure is discontinued.

[2] These exposure limits are intended to be used as guidelines only for Solar UVR exposure.

Table 1: Ultraviolet radiation exposure limits and Relative Spectral Effectiveness

Wavelength[a] (nm)	Exposure Limit ($J.m^{-2}$)	Exposure Limit ($mJ.cm^{-2}$)	Relative Spectral Effectiveness S_λ
180	2 500	250	0.012
190	1 600	160	0.019
200	1 000	100	0.030
205	590	59	0.051
210	400	40	0.075
215	320	32	0.095
220	250	25	0.120
225	200	20	0.150
230	160	16	0.190
235	130	13	0.240
240	100	10	0.300
245	83	8.3	0.360
250	70	7.0	0.430
254[b]	60	6.0	0.500
255	58	5.8	0.520
260	46	4.6	0.650
265	37	3.7	0.810
270	30	3.0	1.000
275	31	3.1	0.960
280[b]	34	3.4	0.880
285	39	3.9	0.770
290	47	4.7	0.640
295	56	5.6	0.540
297[b]	65	6.5	0.460
300	100	10	0.300
303[b]	250	25	0.120
305	500	50	0.060
308	1 200	120	0.026
310	2 000	200	0.015
313[b]	5 000	500	0.006

Table 1: Ultraviolet radiation exposure limits and Relative Spectral Effectiveness (continued)

Wavelength[a] (nm)	Exposure Limit ($J.m^{-2}$)	Exposure Limit ($mJ.cm^{-2}$)	Relative Spectral Effectiveness S_λ
315	1.0×10^4	1.0×10^3	0.003
316	1.3×10^4	1.3×10^3	0.0024
317	1.5×10^4	1.5×10^3	0.0020
318	1.9×10^4	1.9×10^3	0.0016
319	2.5×10^4	2.5×10^3	0.0012
320	2.9×10^4	2.9×10^3	0.0010
322	4.5×10^4	4.5×10^3	0.00067
323	5.6×10^4	5.6×10^3	0.00054
325	6.0×10^4	6.0×10^3	0.00050
328	6.8×10^4	6.8×10^3	0.00044
330	7.3×10^4	7.3×10^3	0.00041
333	8.1×10^4	8.1×10^3	0.00037
335	8.8×10^4	8.8×10^3	0.00034
340	1.1×10^5	1.1×10^4	0.00028
345	1.3×10^5	1.3×10^4	0.00024
350	1.5×10^5	1.5×10^4	0.00020
355	1.9×10^5	1.9×10^4	0.00016
360	2.3×10^5	2.3×10^4	0.00013
365[b]	2.7×10^5	2.7×10^4	0.00011
370	3.2×10^5	3.2×10^4	0.000093
375	3.9×10^5	3.9×10^4	0.000077
380	4.7×10^5	4.7×10^4	0.000064
385	5.7×10^5	5.7×10^4	0.000053
390	6.8×10^5	6.8×10^4	0.000044
395	8.3×10^5	8.3×10^4	0.000036
400	1.0×10^6	1.0×10^5	0.000030

[a] Wavelengths chosen are representative; other values should be interpolated at intermediate wavelengths.

[b] Emission lines of a mercury discharge spectrum.

Table 2: Limiting UV exposure durations based on EL

Duration of Exposure Per Day	Effective Irradiance E_{eff} ($W.m^{-2}$)	Effective Irradiance E_{eff} ($\mu W.cm^{-2}$)
8 Hr	0.001	0.1
4 Hr	0.002	0.2
2 Hr	0.004	0.4
1 Hr	0.008	0.8
30 Min	0.017	1.7
15 Min	0.033	3.3
10 Min	0.05	5
5 Min	0.1	10
1 Min	0.5	50
30 Sec	1.0	100
10 Sec	3.0	300
1 Sec	30	3 000
0.5 Sec	60	6 000
0.1 Sec	300	30 000

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Glossary

Action spectra

A term often used for the spectral weighting functions which attempt to take the varying biological effects of different wavelengths of ultraviolet radiation into account.

Aphakic

A person no longer having a natural ocular lens, for example after cataract surgery.

Conditioned skin

Skin that has already been exposed to UVR and has develops some ability to cope with the damaging effects of UVR. Note, damage occurs while the skin is being conditioned.

Effective irradiance

The effect that a UVR irradiance will have on a biological system such as the skin or eyes. The spectral effectiveness of each of the component wavelengths comprising the incident UVR is weighted and added into the total to produce an effective irradiance. The units are $W.m^{-2}$.

Employee

A person who works for an employer within an operation.

Employer

An operator who or which engages people to work within an operation; the term employer includes a self employed person.

Erythema

Reddening of the skin due to exposure to UVR.

Incident

An event which causes, or has the potential to cause, abnormal exposure of employees or of members of the public and which requires investigation of its causes and consequences and may require corrective action within the programme for control of radiation, but which is not of a scale as to be classified as an accident.

Incoherent Radiation

Any optical radiation other than laser radiation

Irradiance

The rate of energy arriving at a surface per unit time and per unit area. The units are $W.m^{-2}$ and the wavelength range the intensity is integrated over is generally stated.

Relative spectral effectiveness

Similar to action spectra defined above. The biological effectiveness of different UVR wavelengths may vary significantly across the UVR spectrum. The relative spectral effectiveness is a measure of how effective each wavelength is at causing damage.

Spectral irradiance

The irradiance within a specific wavelength band. The units are $W.m^{-2}.nm^{-1}$.

UVR

Ultraviolet radiation of wavelengths between 100 to 400 nm.

UVA

UVR of wavelengths between 315 to 400 nm.

UVB

UVR of wavelengths between 280 to 315 nm.

UVC

UVR of wavelengths between 100 to 280 nm.

Annex 1

RATIONALE FOR LIMITING EXPOSURE TO UVR

The organs at risk from exposure to UVR are the skin and the eyes, since the penetration depth of UVR through biological tissue is very short. In 1985 IRPA produced guidelines with exposure limits that are derived from numerous scientific studies (both human and animal) of the acute effects of ultraviolet irradiation of skin and eyes. These exposure limits are set below the threshold limit value of 30 $J.m^{-2}$ effective for induction of observable effects and as such includes safety margins. While the guidelines relate primarily to acute effects of ultraviolet radiation exposure, they should also provide sufficient protection against chronic effects.

The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC) in 1989 updated the previous limits on ultraviolet radiation which it had published in Health Physics in 1985. These 1985 limits assumed a constant spectral effectiveness across the UVA region (315 to 400 nm). By 1989 research had shown that the spectral effectiveness in the UVA declined significantly as the wavelength approached the boundary with the visible portion of the spectrum at 400 nm and the limits were changed to take this into account. The National Health and Medical Research Council (NHMRC) adopted these 1989 IRPA limits for its occupational exposure standard (RHS 29).

At its 1996 annual meeting, ICNIRP concluded that, while significant clarification had occurred with respect to health risk assessment from exposure to UV, recent data had not provided results suggesting the exposure limit values of the 1989 guidelines need to be amended. This was also stated in an overview document of recent and future ICNIRP activities (Bernhardt & Matthes 1997) published in Radiation Protection Dosimetry. Thus the original ELs still apply as does the original IRPA/INIRC rationale for their development. The 2004 update of guidelines on limits of exposure to ultraviolet radiation (ICNIRP 2004) evaluated and reviewed recent research on biological effects of UVR exposure and made no significant changes in the exposure limit values.

The exposure limits of Schedule 1 apply for the use of artificial sources of UVR in the workplace, as in a controlled environment the UVR exposures can be limited. However, given the variability in exposures to solar UVR due to highly variable ambient solar UVR levels as well as behavioural effects and different exposure geometry, application of the exposure limits is not practical and limiting UVR exposures to as low as possible is the most effective approach.

Annex 2

HEALTH EFFECTS OF UVR

Background

Comprehensive reviews of UVR effects have been published (UNEP/WHO/ICNIRP 1994, NRPB 2002, ICNIRP 2004,) and the interested reader is referred to those documents. The following discussion is a brief summary of the health effects of UVR.

General biological effects

Photons of UVR are sufficient to break chemical bonds in the molecules which make up the skin and eyes, such as DNA, and are therefore capable of inducing significant biological damage. The magnitude of these biological effects varies markedly with wavelength. The most significant adverse effects of exposure to UVR have been reported at wavelengths below 315 nm. This standard has been limited to UVR of wavelengths greater than 180 nm, which are transmitted through air. In regards to solar radiation very little radiation below 290 nm reaches the earth's surface.

Acute Effects

The most common acute effect of UVR on the skin is erythema (or sunburn), which results in redness and blistering within 8 to 24 hours after exposure. The severity of the erythema depends upon the duration of the exposure and the intensity of UVR as well as the skin type of the subject. Advice on sunburn and its treatment is available at www.sunsmart.com.au.

UVR has also been shown to suppress the immune response in humans and thus may enhance the risk of infection and decrease the effectiveness of the body's defence mechanisms.

The acute effects of UVR on the eyes are photokeratitis and photoconjunctivitis, which generally last for short time periods (24 to 48 hours) before they are reversed by the body's repair processes. Other effects of UVR on the eye may be acute retinal injury to aphakics and possible lens damage to individuals exposed to photosensitizing agents.

Chronic Effects

Chronic exposure to solar radiation accelerates the skin aging process (or solar elastosis) and increases the risk of developing skin cancer, both melanoma and non-melanoma. Chronic effects on the eye are cataracts and the development of pterygium and squamous cell cancer of the conjunctiva.

A fuller and more detailed discussion of health effects of UVR can be found in the ICNIRP 1996 rationale and the UNEP/WHO/ICNIRP 1994 Environmental Health Criteria 160, which also has a chapter on UVR protective measures.

Photosensitizers

Some substances can increase the sensitivity of human skin to UVR. These substances or chemicals are called photosensitizers and they can occur naturally and may be found in working environments ranging from domestic to outdoor and

industrial workplaces. Photosensitizers may also be present in medications and workers need to be made aware that if they are exposed to UVR (most notably, UV-A) and are on certain medications they may suffer a phototoxic reaction.

Certain occupations may encounter specific photosensitizers. For example, dyes are encountered in the textile industry, photosensitizing plants are encountered in agriculture and some inks found in the printing industry may contain a photosensitizer (eg. amyldimethylaminobenzoate).

Table 3: List of Photosensitizers

Sources	Active Ingredients
Photosensitizers in the domestic work environment	
Bacteriostats in soaps	Halogenated salicyclanilides;
Wood preservative	
Vegetables	Psoralens in celery and parsnips
Photosensitizers and the outdoor work environment	
Garden and countryside	
Plants:	
Umbelliferae:	giant hogweed (*Heracleum mantegazzianum*)
	cow parsnip (*Heracleum sphondylium*)
	wild parsnip (*Pastinaca sativa*)
	tromso palm (*Heracleum laciniatum*)
Rutaceae:	common rue (*Ruta graveolens*)
	gas plant (*Dictamnus alba*)
	Bergamot orange (*Citrus bergamia*)
Moraceae:	fig (*Ficus carica*)
Furocoumarins:	psoralen, 8-methoxypsoralen, 5-methoxypsoralen, pimpinellin, sphondin, angelicin.
General	
Perfumes and cosmetics:	5-methoxypsoralen (Bergapten) in oil of Bergamot, musk ambrette, 6-ethylcoumarin.
Sunscreens:	p-aminobenzoic acid (PABA), ethoxyethyl-p-methoxycinnamate, isopropyldibenzoylmethane, butylmethoxydibenzoylmethane.
Disinfectants and Antiseptics:	Methylene blue, eosin and rose bengal
Tattoos:	cadmium sulphide.
Photosensitizers in the industrial working environment	
Anthraquinone based dyes:	Benzanthrone; Disperse Blue 35
Polycyclic hydrocarbons:	pitch, coal tar, wood preservatives, anthracene, fluoranthene
Drugs:	chlorpromazine, amiodarone,
Plants:	giant hogweed, psoralens
Printing ink:	amyl-o-dimethylaminobenzoic acid
Animal feed supplement:	quinoxaline-n-dioxide

Table 3: List of Photosensitizers (continued)

Sources	Active Ingredients
Major Photosensitizers administered for medical purposes	
Drugs	
Antibacterial:	tetracyclines, sulphonamides, nalidixic acid, 4-quinolones
Tranquilizer:	phenothiazines (chloromazine)
Antidepressant:	protryptiline
Diuretic:	chlorthiazides, frusemide
Antiarrhythmic:	amiodarone, methyldopa, quindine, propranolol
Anti-inflammatory:	ibuprofen, azapropazone, naproxen,
Antifungal:	grizeofulvin
Bacteriostat:	halogenated salycilanilides, bithionol, buclosamide
Topical antifungal:	fentichlor, hexachlorophene
Antimalaric:	quinine
Therapies	
Photochemotherapy:	8-methoxysporalen, 5-methoxysporalen, trimethylsporalen, khellin
Photodynamic therapy:	Photofrin II

Adapted from WHO/ICNIRP Draft Guide on '*Protecting Workers from Ultraviolet Radiation*'.

For further reading see NOHSC: 3012(1991) Guidance note for the Protection of Workers from the Ultraviolet Radiation in Sunlight. This is available on www.nohsc.gov.au/PDF/standards/GuidanceNotes/UVRadiationSunlight.pdf

Annex 3

LIMITING EXCESSIVE EXPOSURE TO ULTRAVIOLET RADIATION (UVR) IN THE WORKPLACE

This annex covers occupational exposure to ultraviolet radiation (UVR). Exposure to UVR from the sun occurs during both leisure and various work activities, and excessive exposure to UVR can lead to sunburn, skin and eye damage, immune suppression, premature skin aging and skin cancer. Skin cancers can affect people of all skin types and can also develop on people who do not have a history of severe sunburn. Cumulative exposure to UVR and severe sunburns increase the risk of developing skin cancer.

Employer's Obligations Concerning UVR Exposure

Under workplace health and safety legislation and radiation protection legislation, employers and self-employed persons have an obligation to ensure workplace health and safety. Such legislation usually provides that workplace health and safety can generally be managed by identifying hazards, assessing risks from the hazards, implementing control measures and monitoring and reviewing the effectiveness of the measures. This includes protecting employees and persons from exposure to levels of UVR that can cause adverse health effects or may exceed the exposure limits contained in this Standard. These limits do not apply to the use of UVR for medical and therapeutic purposes (eg. phototherapy) or for cosmetic purposes (eg. solaria), which are not covered by the standard.

Worker's Obligations Concerning UVR Exposure

Workers or any other person at a workplace have an obligation to comply with the instructions given for workplace health and safety by the employer. If the employer provides personal protective equipment (PPE) for protection against UVR and instructs the employee in its use, the worker has an obligation to use the PPE. The worker also has an obligation not to wilfully or recklessly interfere with or misuse anything provided for workplace health and safety and to not wilfully put anyone else or themselves at risk. As an employee these obligations can be met by following safe working procedures established by the employer. Employees should not intentionally expose themselves or others to levels of UVR that may exceed the exposure limits of this Standard. They should never operate equipment that emits UVR with the shielding or protective devices removed.

Solar UVR in the Workplace

For most outdoor workers the sun is the primary sources of UVR exposure. Construction workers, landscape gardeners, lifeguards and rural workers for example, have potentially high-risk workplaces and may receive much greater solar UVR exposures than indoor workers. This places them at greater risk.

Solar UVR can reach a worker on the ground from three sources:

- directly from the sun
- scattered from the open sky
- reflected from the environment.

This means that even if a person is shaded from the direct sun they can still receive substantial UVR exposure from the open sky and reflective ground surfaces. If a person is in the shade but can view blue sky they are still exposed to solar UVR from the sky. A highly reflective environment can also increase UVR levels and can reduce

the effect of protective measures. Some ground and building surfaces are quite reflective to UVR and can reflect UVR onto the skin and eyes and these include white paint, light coloured concrete and metallic surfaces (Sliney 1986).

Workers who spend a significant amount of time during the day in a motor vehicle can also receive high levels of solar UVR, however, laminated front windscreens and tinting of the side and rear windows can greatly reduce the amount of UVR entering the vehicle. Most automotive tints provide excellent protection against solar UVR.

The Occupational UVR Exposure Limits and Solar UVR

The exposure limit in this Standard for both general and occupational exposure to UVR incident upon the skin or eye is 30 Jm^{-2} in an 8 hour working day. These exposure limits are intended to be used as guidelines only for solar UVR exposure.

UVR levels are reported by the media as a Solar UV-Index (WHO 2002), which is a measure of the maximum daily UVR. The UV Index allows for cloud cover and other environmental factors and is used worldwide for reporting UVR levels. The UV Index provides the public with a numerical indication of the maximum potential solar UVR level during the day. The higher the number the higher the solar UVR hazard. Measurements of typical UV Index for most Australian Capital cities are available (Gies et al 2004).

The following table shows that the duration required to exceed the exposure limits varies with the intensity of solar UVR. During summer when the UV Index value may be 12 for a typical clear sky day around solar noon, the time it takes for an individual with unprotected fair skin to exceed the exposure limit Tmax is 7 minutes, while the time to achieve erythema (sunburn) is approximately 11 minutes (Gies and Wright 2003). Unprotected workers would therefore easily exceed the EL within the 8 hour limit.

Forecasts of the expected UV Index for the most locations in Australia are provided by the Bureau of Meteorology and information on the UV Index and the Sunsmart UV alert can be obtained from their websites daily in summer as well as local newspapers and radio.

Table 4: **A comparison between the WHO UV Index relating the sun's UVR intensity to the time taken to exceed the EL's of Schedule 1. The higher the UV Index the shorter the time to exceed the EL.**

UV Index	Tmax (mins)
3	26
4	20
6	13
8	10
10	8
12	7
14	6
16	4

Protective measures against solar UVR

The employer can provide protection of workers from exposure to solar UVR with a plan to control UVR exposures utilising a combination of administrative and workplace controls and the provision of personal protective equipment. Carrying out an exposure or UVR risk assessment (for an example see

www.sunsmart.com.au/downloads/workplace/workplace_sample_risk_assessment.pdf) will be an important element of a plan to control UVR exposures.

Administrative controls could consist of:

- scheduling
- education and training programs to familiarise the workers with the potential UVR hazards
- restriction of access to employees
- signs warning of UVR hazards.

Scheduling

Approximately two thirds of the daily UVR is received in the two hours before and after solar noon, when UVR levels are at their highest. If possible workers should avoid exposure to the sun during these times. Even on a cloudy day a worker may still receive high levels of solar UVR due to scattering and reflected UVR reaching the earth's surface.

Personal Behaviour and Training

Personal behaviour of workers is an important factor in limiting the exposure to solar UVR. If personal protection measures are not used or used inappropriately then workplace education programs may be required to educate the workers and improve the manner in which they perceive solar UVR protection.

Employees with photosensitivity reactions to UVR require additional protective measures.

Engineering or Workplace controls such as:

- shade provision
- elimination of reflected UVR.

Shade Provision

Shade structures can also provide protection from solar UVR, however, the level of personal protection depends on the rating of the material and the amount of scattered and reflected solar UVR from the environment, which can significantly reduce its effectiveness. If the shade structure offers only partial protection then additional measures will be required.

Elimination of reflected UVR

Modification of highly reflective surfaces would reduce reflected solar UVR.

Provision of Personal Protective Equipment

A number of personal protection measures can help to reduce the exposure from solar UVR. Personal protection should be considered as the last line of defence against solar UVR. A combination of various items of personal protection against solar UVR, such as hats, clothing, sunscreen and sunglasses provides the best protection strategy rather than relying on just one form of protection.

Clothing

The use of appropriate clothing that covers as much of the unprotected skin as possible is a simple method of reducing exposure to solar UVR. An ultraviolet protection factor (UPF) was developed by ARPANSA and adopted into

AS/NZS 4399:1996 'Sun Protective Clothing'. The UPF ratings assist the public and workers in choosing clothing that offers suitable UVR protection. The higher the UPF rating, the greater the UVR protection offered by the clothing. UPF ratings of 50+ provide excellent protection against solar UVR.

Hats

Wearing a hat can provide significant protection to the face, neck, ears and eyes. The measure of protection provided by a hat is determined by the design (Diffey and Cheeseman 1992); broad brimmed (>7cm) hats provide the best protection for the face, neck and ears. Where hard hats are required brim or neck flaps should be worn.

Sunglasses

For the eyes, sunglasses tested to the Australian and New Zealand Standard AS/NZS 1067:2003 'Sunglasses and fashion spectacles' and some prescription spectacles provide excellent protection from exposure to solar UVR. The design of the sunglasses frames is very important. Wrap-around style sunglasses reduce the amount of scattered and reflected solar UVR reaching the eyes.

Sunscreens

For skin not protected by other means, broad-spectrum sunscreen with a SPF rating of at least 15+ or preferably 30+ applied correctly is an effective means of personal protection against solar UVR. The major concern is the inconsistent application of sunscreen on unprotected skin. Studies have consistently shown that people generally apply sunscreens at approximately half the required thickness and only achieve a third to half of the sunscreen rating (Bech-Thomsen, N. and Wulf, H.C. 1992). Factors such as thickness, absorption into the skin, sweating and contact with water must be taken into consideration as they can reduce the effectiveness of the sunscreen. The sunscreen must also be reapplied frequently.

Sources of Artificial UVR in the Workplace

There are many types of artificial UVR sources used in industry, some emit high levels of UVR in industrial processes eg in the printing industry, whilst others are common sources of visible light but may also emit UVR. Arc welders used in industry produce an intense UVR emission and workers or persons exposed to welding radiation may suffer similar health effects to workers with overexposure to solar UVR. There are many other forms of artificial UVR sources such as fluorescent lamps, mercury vapour and metal halide lamps and quartz halogen lights used in industry. Germicidal lamps used in hospitals are also a strong source of hazardous UVR. The UVR hazard of a potential source cannot be based on the level of visible light emissions, as some UVR sources radiate only a faint visible light but can emit high levels of UVR.

The hazards from artificial sources can vary markedly, from non-hazardous with allowed exposure time of greater than 8 hours to extremely hazardous with allowed exposure times of less than a minute as shown in following table.

Table 5: Some artificial sources of UVR and the times taken to exceed the exposure limits of Schedule 1.

Category	Time
Fluorescent lamp	> 8hrs
Quartz halogen lamp	~ 10 mins
UVA lamp	~ 17 mins
Germicidal (UVC) lamp	1 – 3 mins
Arc Welder	1 – 5 mins

Protection Measures for Artificial UVR

The employer can provide protection of workers from exposure to artificial UVR via a combination of engineering and administrative controls in the workplace and the provision of personal protective equipment.

Engineering controls including redesign of equipment or work processes and/or isolation and containment of the hazard. Examples include:

- installing shielding
- enclosing the source either in a container or in a dedicated room
- fail-safe interlocks
- built-in UVR detectors and alarms
- elimination of reflected UVR
- ventilation to remove any ozone produced

Introduction of administrative controls such as:

- signage restricting access
- hazard signs or warning lights
- education and training
- due care during any maintenance and service on the UVR source, particularly if safety shielding is removed.

Administrative management requires the identification of potential UVR hazards associated with the workplace and equipment and then restricting all unauthorised workers and people from close proximity to the equipment or work area. The workers operating the equipment need adequate training to understand the hazards involved and to carry out their work safely. For worker safety the distance from which they operate the equipment has to be assessed as well as the duration of any exposure. Finally warning signs, lights and labelling of potential equipment that emit UVR are additional measures to aid in protection of workers. Employees with photosensitivity reactions to UVR require additional protective measures.

Assessment of UVR Levels and Potential Hazards

Assessment of the UVR hazards from artificial sources of UVR can be achieved in a number of ways.

(a) Knowledge of the source emissions and power allows an initial assessment of potential hazards. Such information can be obtained from the manufacturer's data sheets on the source, which can list the spectral output or the amounts of UVA, UVB and UVC.

(b) Dosimetric assessment using UVR sensitive polysulphone film can give an indication of the presence of hazardous UVR. If the source spectrum is known, then the hazard can be accurately assessed.

(c) Radiometric or spectral assessment of the source output can provide the information to accurately quantify the amount and type of UVR emitted and thus allow calculation of the hazard.

Annex 4

ARPANSA RADIATION PROTECTION SERIES PUBLICATIONS

ARPANSA has taken over responsibility for the administration of the former NHMRC Radiation Health Series of publications and for the codes developed under the *Environment Protection (Nuclear Codes) Act 1978*. The publications are being progressively reviewed and republished as part of the *Radiation Protection Series*.

All publications listed below are available in electronic format, and can be downloaded free of charge by visiting ARPANSA's website at **www.arpansa.gov.au/codes.htm**.

Radiation Protection Series publications are available for purchase directly from ARPANSA. Further information can be obtained by telephoning ARPANSA on 1800 022 333 (freecall within Australia) or (03) 9433 2211.

RPS 1. Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation (republished 2002)

RPS 2. Code of Practice for the Safe Transport of Radioactive Material (2001)

RPS 3. Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)

RPS 4. Recommendations for the Discharge of Patients Undergoing Treatment with Radioactive Substances (2002)

RPS 5. Code of Practice and Safety Guide for Portable Density/Moisture Gauges Containing Radioactive Sources (2004)

RPS 6. National Directory for Radiation Protection, Edition 1 (2004)

RPS 7. Recommendations for Intervention in Emergency Situations Involving Radiation Exposure (2004)

RPS 8. Code of Practice for the Exposure of Humans to Ionizing Radiation for Medical Research Purposes (2005)

RPS 9. Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005)

RPS 10. Code of Practice and Safety Guide for Radiation Protection in Dentistry (2005)

RPS 11. Code of Practice for the Security of Radioactive Sources (2006)

RPS 12. Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation (2006)

RPS 13. Code of Practice and Safety Guide for Safe Use of Fixed Radiation Gauges (2006)

The Nuclear Codes Series have now all been republished. Those publications from the NHMRC Radiation Health Series that are still current are:

RADIATION HEALTH SERIES

RHS 3. Code of practice for the safe use of ionizing radiation in veterinary radiology: Parts 1 and 2 (1982)

RHS 8. Code of nursing practice for staff exposed to ionizing radiation (1984)

RHS 9. Code of practice for protection against ionizing radiation emitted from X-ray analysis equipment (1984)

RHS 10. Code of practice for safe use of ionizing radiation in veterinary radiology: part 3-radiotherapy (1984)

RHS 13. Code of practice for the disposal of radioactive wastes by the user (1985)

RHS 14. Recommendations for minimising radiological hazards to patients (1985)

RHS 15. Code of practice for the safe use of microwave diathermy units (1985)

RHS 16. Code of practice for the safe use of short wave (radiofrequency) diathermy units (1985)

RHS 18. Code of practice for the safe handling of corpses containing radioactive materials (1986)

RHS 19. Code of practice for the safe use of ionizing radiation in secondary schools (1986)

RHS 21. Revised statement on cabinet X-ray equipment for examination of letters, packages, baggage, freight and other articles for security, quality control and other purposes (1987)

RHS 22. Statement on enclosed X-ray equipment for special applications (1987)

RHS 23. Code of practice for the control and safe handling of radioactive sources used for therapeutic purposes (1988)

RHS 24. Code of practice for the design and safe operation of non-medical irradiation facilities (1988)

RHS 25. Recommendations for ionization chamber smoke detectors for commercial and industrial fire protection systems (1988)

RHS 28. Code of practice for the safe use of sealed radioactive sources in bore-hole logging (1989)

RHS 30. Interim guidelines on limits of exposure to 50/60Hz electric and magnetic fields (1989)

RHS 31. Code of practice for the safe use of industrial radiography equipment (1989)

RHS 34. Safety guidelines for magnetic resonance diagnostic facilities (1991)

RHS 35. Code of practice for the near-surface disposal of radioactive waste in Australia (1992)

RHS 36. Code of practice for the safe use of lasers in schools (1995)

RHS 37. Code of practice for the safe use of lasers in the entertainment industry (1995)

RHS 38. Recommended limits on radioactive contamination on surfaces in laboratories (1995)

Annex 5

RADIATION PROTECTION AND REGULATORY AUTHORITIES

Table 6: Radiation Protection Authorities

Where advice or assistance is required from the relevant radiation protection authority, it may be obtained from the following officers:

COMMONWEALTH, STATE / TERRITORY	CONTACT
Commonwealth	Chief Executive Officer ARPANSA PO Box 655 Tel: (02) 9541 8333 Miranda NSW 1490 Fax: (02) 9541 8314 Email: info@arpansa.gov.au
Australian Capital Territory	Manager Radiation Safety Radiation Safety Section ACT Health Locked Bag 5 Tel: (02) 6207 6946 Weston Creek ACT 2611 Fax: (02) 6207 6966 Email: radiation.safety@act.gov.au
New South Wales	Manager Hazardous Materials and Radiation Section Department of Environment and Conservation PO Box A290 Tel: (02) 9995 5000 Sydney South NSW 1232 Fax: (02) 9995 6603 Email: radiation@environment.nsw.gov.au
Northern Territory	Manager Radiation Protection Radiation Protection Section Department of Health and Community Services GPO Box 40596 Tel: (08) 8922 7152 Casuarina NT 0811 Fax: (08) 8922 7334 Email: envirohealth@nt.gov.au
Queensland	Director, Radiation Health Department of Health 450 Gregory Terrace Tel: (07) 3406 8000 Fortitude Valley QLD 4006 Fax: (07) 3406 8030 Email: radiation_health@health.qld.gov.au
South Australia	Director, Radiation Protection Division Environment Protection Authority PO Box 721 Tel: (08) 8130 0700 Kent Town SA 5071 Fax: (08) 8130 0777 Email: radiationprotection@state.sa.gov.au
Tasmania	Senior Health Physicist Health Physics Branch Department of Health and Human Services GPO Box 125B Tel: (03) 6222 7256 Hobart TAS 7001 Fax: (03) 6222 7257 Email: health.physics@dhhs.tas.gov.au
Victoria	Manager, Radiation Safety Program Department of Human Services GPO Box 4057 Tel: (03) 9637 4167 Melbourne VIC 3001 Fax: (03) 9637 4508 Email: radiation.safety@dhs.vic.gov.au
Western Australia	Secretary, Radiological Council Locked Bag 2006 PO Tel: (08) 9346 2260 Nedlands WA 6009 Fax: (08) 9381 1423 Email: radiation.health@health.wa.gov.au

Please note: This table was correct at the time of printing but is subject to change from time to time. For the most up-to-date list, the reader is advised to consult the ARPANSA web site (www.arpansa.gov.au). For after hours emergencies only, the police will provide the appropriate emergency contact number.

Table 7: Regulatory Authorities

The following organisations regulate various aspects of the occupational use of ultraviolet radiation:

COMMONWEALTH, STATE / TERRITORY	CONTACT
Commonwealth	Chief Executive Officer ARPANSA PO Box 655 Tel: (02) 9541 8333 Miranda NSW 1490 Fax: (02) 9541 8314 Email: info@arpansa.gov.au Web: www.arpansa.gov.au
New South Wales	Manager Hazardous Materials and Radiation Section Department of Environment and Conservation PO Box A290 Tel: (02) 9995 5000 Sydney South NSW 1232 Fax: (02) 9995 6603 Email: radiation@environment.nsw.gov.au Web: www.environment.nsw.gov.au
Queensland	Workplace Health & Safety Queensland, Department of Industrial Relations GPO Box 69, Ph: (07) 3225 2000 Brisbane Qld 4001 Fax: (07) 3247 4519 Web: www.whs.qld.gov.au
South Australia	Director, Radiation Protection Division Environment Protection Authority PO Box 721 Tel: (08) 8130 0700 Kent Town SA 5071 Fax: (08) 8130 0777 Email: radiationprotection.branch@state.sa.gov.au
Tasmania	Workplace Standards Tasmania Department of Infrastructure Energy and Resources 30 Gordons Hill Road (PO Box 56) Rosny Park, Tas, 7018 Tel: 1300 366 322 (inside Tas) 03 6233 7657 (outside Tas) email: wstinfo@dier.tas.gov.au web: www.wsa.tas.gov.au
Victoria	[No regulator]*
Western Australia	Secretary Radiological Council of Western Australia Locked Bag 2006 PO Tel: (08) 9346 2260 Nedlands WA 6009 Fax: (08) 9381 1423 Email: radiation.health@health.wa.gov.au
Australian Capital Territory	ACT Workcover PO Box 224 CIVIC SQUARE ACT 2608 Ph: 02 6205 0200 Email: workcover@act.gov.au Fax: (02) 6205 0797 Web: www.workcover.act.gov.au
Northern Territory	[No regulator]*

* In these jurisdictions, while there is no specific regulation of occupational use ultraviolet radiation, Occupational Health & Safety Legislation applies.

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Index

A

accident 4, 15
actinic UVR 9
action spectra 15
acute effect 17, 18
administrative controls 2, 6, 23, 25
aphakic 15, 18
artificial 1, 2, 8, 9, 17, 24, 25

B

bandwidth 9
broadband source 9

C

cataracts 1, 15, 18
chronic effects 17, 18
clothing 1, 23
conditioned skin 2, 15
control priorities 6
cosmetic 2, 19, 21

D

DNA 18

E

effective irradiance 9, 12, 15
emission lines 11
employee 2, 3, 4, 7, 15, 21, 23
employer 2, 3, 4, 5, 7, 8, 15, 21, 22, 25
engineering controls 6, 25
erythema 15, 18, 22
exposure limits 1, 2, 8, 9, 10, 11, 13, 17, 21, 22, 25
eye 1, 2, 7, 9, 15, 17, 18, 21, 22, 24

H

hat 1, 13, 23, 24
health effects 3, 7, 18, 21, 24

I

immune response 18
incident 4, 7, 9, 15, 22
International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1, 13
irradiance 9, 15, 16

L

laser 2, 8, 13, 15, 28
lens damage 18

M

maintenance 5, 6, 25
maximum exposure duration 9
medical treatment 2
melanoma 18
mercury discharge 11
monitor 5, 21

N

National Health and Medical Research Council (NHMRC) 1, 13, 17
non-coherent radiation 15
non-melanoma 18

O

occupational exposure ... 1, 2, 3, 5, 8, 9, 17, 21, 22, 27
ocular exposure 2

P

permissible exposure time 9
personal protective equipment (PPE) 4, 6, 21, 22, 25
photoconjunctivitis 1, 18
photokeratitis 1, 18
photosensitizer 2, 18, 19, 20
protective 8, 18, 22, 23, 25
pterygium 18

R

radiant exposure 9
rationale 3, 17, 18
Regulatory Authority 3, 29, 30
relative spectral effectiveness .. 9, 10, 11, 16
retinal injury 18
review 1, 4, 5, 17, 18, 21, 27

S

self-employee 5, 21
shade 21, 23
shielding 6, 21, 25
skin aging 18, 21
skin cancer 1, 13, 18, 21
solar elastosis 18
spectral effectiveness 9, 15, 17
spectral irradiance 9, 16
sunburn 18, 21, 22
sunglasses 1, 23, 24
sunscreen 1, 13, 19, 23, 24
supervision 6

T

therapeutic 2, 21, 28
training 4, 5, 6, 23, 25

U

UVA 16, 17, 25
UVB 16, 25
UVC 16, 25
UVR 1, 2, 3, 5, 6, 8, 9, 15, 16, 17, 18, 21, 22, 23, 24, 25, 26

V

Visible radiation 16

W

workers 1, 2, 5, 6, 7, 8, 9, 13, 19, 20, 21, 22, 23, 24, 25