AUSTRALIAN RADIATION PROTECTION AND NUCLEAR SAFETY AGENCY

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Regulatory Impact Statement
Consultation Draft

Radiation Protection Standard
Occupational Exposure to Ultraviolet Radiation

Comment on the Regulatory Impact Statement should be forwarded by 15 August 2003 to:

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Background

Solar ultraviolet radiation

1 Exposure to ultraviolet radiation (UVR), in particular from the sun's rays, is a significant public health hazard and may increase with further depletion of the ozone layer. The possible health hazards range from short term effects such as sunburn and eye damage to chronic effects such as skin cancer and melanoma or cataracts. The energy in the UVR photons in the sunlight that reaches the earth's surface is sufficient to break chemical bonds in the molecules which make up the skin and eyes (such as DNA) and are capable of inducing significant biological damage. The magnitude of these biological effects varies with wavelength. The most significant adverse effects have been reported at wavelengths below 315 nm.

2 The most common acute effect of UVR on the skin is erythema (sunburn), which results in redness and blistering within eight to 24 hours after exposure. The severity depends on the duration of the exposure, the intensity of the UVR and the exposed person's skin type. UVR has also been shown to suppress the immune response in humans and may increase the risk of infection and decrease the effectiveness of the body's defence mechanisms.

3 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 photosensitising agents. Chronic exposure to sunlight, especially the Ultraviolet-B (UVB) component, accelerates the skin's ageing process 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.

Solar UV-Index

4 ARPANSA measures daily solar UVR levels using a network of detectors in Australian capital cities. The information is analysed and distributed daily to news services and interested organisations. UVR levels are reported as a 'Solar UV-Index', which is a measure of the highest level of UVR each day, taking into account cloud cover and other environmental factors. Solar UV-Index values are related to UVR exposure as shown in the table below[1].

UV Index	Exposure Category	Precautions
Less than 3	Moderate	hat, sunscreen, sunglasses
3 to 6	High	hat, sunscreen, sunglasses, shady area
7 to 10	Very High	hat, sunscreen, sunglasses, shady area, stay indoors between 10-2pm (11-3pm daylight savings)
More than 10	Extreme	Stay indoors as much as possible otherwise use all precautions above

[1] Source: *UV Resource Guide*, ARPANSA, 1999 (see www.arpansa.gov.au)

5 Employers can use the Solar UV-Index as a guide to plan protection for their outdoor workers. However, the use of the Index does not necessarily ensure that employers are in compliance with exposure limits provided in a voluntary standard published by the National Health and Medical Research Council (NHMRC). [see paragraph 13 below] In Queensland, the Department of Industrial Relations has produced guidelines for employers of outdoor workers on how they may comply with Queensland's Workplace Health and Safety Act[2]. The guidelines are based on the Solar UV Index but also stipulate the maximum permissible continuous exposure of a person to solar UVR at each level of the Index. When followed diligently, these guidelines, which also refer to the exposure limits in the NHMRC standard, will help employers to comply with the NHMRC standard.

Artificial sources of UVR

6 Exposure to sunlight is the major cause of UVR exposure for outdoor workers but other occupational groups can receive accidental exposure from equipment and devices that emit UVR. There are few artificial sources that result in human exposure to UVR greater than that from the sun. Exceptions are artificial sources used for medical therapy and diagnosis, and cosmetic tanning. Industrial sources are generally effectively enclosed, but accidental exposure may occur.[3] The spectrum of the UVR emitted from artificial sources varies from one source to another. Most man-made sources of UVR can be grouped together in the categories shown below.

(a) Incandescent sources such as tungsten lamps, which are generally not hazardous;

(b) Gas discharges, for example,

- low, medium and high pressure mercury lamps. Low pressure lamps are often used as germicidal and disinfection lamps. Mercury lamps with metal halides are used mainly for lighting, displays, floodlighting, printing, curing and other industrial applications;
- xenon lamps, which are used in photography and as solar simulators;
- hydrogen and deuterium lamps, and flash tubes;

(c) Electric discharges, for example, welding arcs are potential sources of severe retinal hazards due to their compact size and high luminance;

(d) Fluorescent lamps, such as, fluorescent lighting tubes, fluorescent sunlamps (UVB emitters) and fluorescent UVA tubes.

7 The health effects from over exposure to UVR from artificial sources are the same as those for solar UVR, namely, erythema and eye damage. However, as some artificial sources can emit more of the hazardous UVR wavelengths and at greater power, the time required to achieve these effects can be as short as a few seconds and the potential for more significant and even extreme health effects is very high.[4]

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[2] Available at http://www.whs.qld.gov.au/safetylink/health/health07.pdf

[3] *Environmental Health Criteria 160, Health and environmental effects of ultraviolet radiation*, UNEP/ICNIRP/WHO, Geneva, 1994, p.25

[4] *Health Effects from Ultraviolet Radiation. Report of an Advisory Group on Non-Ionising Radiation*, Documents of the NRPB, Vol. 13 No. 1, 2002.

Statistics on skin cancer

8 Each year, about 270,000 new cancer cases of non-melanocytic skin cancer are diagnosed in Australia. According to a 1995 survey, incidence rates for treated non-melanocytic skin cancers was an estimated 1,374 per 100,000 population for males and 857 per 100,000 population for females. These rates are 19 times the next most common male cancer (prostate) and 10 times the next most common female cancer (breast), using 1998 data. Despite non-melanocytic skin cancer's high incidence rate it has a relatively low mortality rate at 1.6 per 100,000 population compared with the high mortality rates of male lung cancer at 53.2 per 100,000 population, female breast cancer (22.8) and prostate cancer (29.5).[5]

9 About 6,000 cases of malignant and potentially fatal melanoma cases are reported annually in Australia. Although this is a low incidence rate compared to non-melanocytic skin cancer, it is among the highest melanoma incidence rates in the world. Melanoma risk in Australia is generally highest in the north and lower in the south, showing a correlation to exposure to UVR. Age-standardised mortality ranges from 2.5 deaths per 100,000 population for the NT to 5.8 deaths per 100,000 population for Queensland, making it more deadly than non-melanocytic skin cancer.[6]

10 According to the Cancer Council of Australia cancer costs an estimated $2 billion in direct health system costs (6 per cent of total) and skin cancer is the most expensive, with annual costs in excess of $300 million. There are also the associated costs of the 1000 to 1300 deaths each year from skin cancer, 70% to 80% of which are due to malignant melanoma.[7] A more recent study conducted in Queensland[8] concluded that there is a strong link between occupational exposure to UVR and occurrence of squamous cell carcinoma of the skin and that about 20% of cataract is caused by UVR.[9]

11 The United Nations Environment Programme has estimated that over 2 million non-melanoma skin cancers and 200,000 malignant melanomas occur globally each year. A 10% decrease in stratospheric ozone could, with current trends and behaviour, lead to an additional 300,000 non-melanoma and 4,500 melanoma skin cancers world-wide. Some 12 to 15 million people in the world are blind because they have cataracts. The World Health Organisation has estimated that up to 20% of cataracts or 3 million a year could be due to UV exposure. It has been estimated that for each 1% sustained decrease in stratospheric ozone there would be an increase of 0.5% in the number of cataracts caused by solar UVR. It costs the US Government US$3.4 billion for 1.2 million cataract operations a year. Substantial savings in health care costs can be made by prevention or delay in the onset of cataracts.

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[5] *Cancer in Australia 1998: Incidence and mortality data for 1998*, (Cancer Series Number 17), Australian Institute of Health and Welfare and Australasian Association of Cancer Registries, Canberra, Oct 2001, p.8.
[6] *Cancer in Australia 1998: Incidence and mortality data for 1998*, (Cancer Series Number 17), Australian Institute of Health and Welfare and Australasian Association of Cancer Registries, Canberra, Oct 2001, p.17
[7] *Cancer in Australia 1998: Incidence and mortality data for 1998*, (Cancer Series Number 17), Australian Institute of Health and Welfare and Australasian Association of Cancer Registries, Canberra, Oct 2001, p.8.
[8] *Exposure to Ultraviolet Radiation in the Construction Industry – Audit Report*, Division of Workplace Health and Safety, Queensland, March 2002.
[9] See also WHO Environmental Health Criteria 160, 1994 found at:
http://www.who.int/peh-uv/publications/english/who-ehg-95-16.htm

Current regulations

Occupational health and safety laws and other guidelines

12 The Commonwealth, State and Territory governments have legislated requirements for occupational or workplace health and safety. These include requirements for systems of work that are safe and without risk to health, preventing industrial injuries and diseases and protecting the health and safety of the public in relation to work activities. Some of the legislation refer to broad duties of care of employers to protect their workers from the harmful effects of UVR. Some jurisdictions publish bulletins and guidelines to explain how the public and workers can protect themselves from the harmful effects of UVR and how employers can identify and manage the risks to their workers from solar and other sources of UVR. Some jurisdictions also refer to standards and guidelines published by other agencies such as the NHMRC, Standards Australia[10], the National Occupational Health and Safety Commission (NOHSC)[11] and ARPANSA[12].

Exposure limit values

13 In 1989 the NHMRC published the *Occupational Standard for Exposure to Ultraviolet Radiation* as part of the NHMRC's Radiation Health Series (RHS 29) based on guidelines published by the International Non-Ionizing Radiation Committee of the International Radiation Protection Association (INIRC/IRPA) in 1985[13] and 1989[14]. In 1996, the International Commission on Non-ionising Radiation Protection (ICNIRP)[15], confirmed the 1985 and 1989 recommendations[16].

14 The NHMRC standard provides UVR exposure limit values for exposure of the eye or skin in the spectral region between 180 and 400 nanometres (nm). The exposure limit values are to be used as guides to evaluate potentially hazardous exposure from both pulsed and continuous sources of UVR where the exposure duration is not less than 0.1 μsec. The exposure limit values in the NHMRC standard do not differ from the ICNIRP Guidelines and essentially restrict radiant exposure on unprotected skin to no more than 30 joules per square metre (30 J/m^2). This means that for an eight-hour day, the effective irradiance in a second should not exceed one milliwatt per square metre (1 mW/m^2).

15 The NHMRC standard is currently the only publication in Australia that provides a scientific basis for the prescribed UVR exposure limit values in accordance with the ICNIRP Guidelines.

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[10] For example, AS/NZS 1338 Parts 1,2 and 3 (1992) on eye protection and AS 4174: 1994 on Synthetic shadecloth.
[11] *Guidance Note for the Protection of Workers from Ultraviolet Radiation in Sunlight* [NOHSC: 3012 (1991)]
[12] *UV Resource Guide*, ARPANSA, 1999 (see www.arpansa.gov.au)
[13] *Guidelines on Limits of Exposure to Ultraviolet Radiation of Wavelengths between 180 nm and 400 nm (Incoherent Optical Radiation)*, International Non-Ionizing Radiation Committee of the International Radiation Protection Association (INIRC/IRPA), 1985.
[14] *Proposed change to the IRPA 1985 Guidelines on Limits of Exposure on Ultraviolet Radiation*, International Non-Ionizing Radiation Committee of the International Radiation Protection Association (INIRC/IRPA), 1989.
[15] ICNIRP is the successor organisation of INIRC/IRPA.
[16] *Guidelines on UV Radiation Exposure Limits*, International Commission on Non-ionising Radiation Protection (ICNIRP), 1996.

Problems

Lack of information

16 Although the NHMRC standard does not have an expiry date it is more than 10 years since it was published and is due for a review. However, the NHMRC does not wish to continue publishing its RHS publications and has handed to ARPANSA the responsibility for the review of the NHMRC's RHS publications.

17 An Australian Standard (AS 2243.5-1993**:** *Safety in laboratories - Non-ionizing radiations)* contains tables of maximum permissible eight-hour doses and exposure limits as well as a relative spectral effectiveness table across the wavelengths 200 to 320 nm. However, it is out of date, and relevant only to laboratories.

Lack of compliance and Associated Costs

18 The implementation of a standard on exposure limit values for artificial sources of UVR is relatively straight forward. Employers need to measure the exposure from artificial sources used in the workplace (or obtain the information from manufacturers' specifications) and take action to limit occupational exposure or prevent accidental exposure. However, exposure limits for solar UVR is more difficult to comply with as monitoring devices are required to measure the exposure of outdoor workers to solar UVR. The lease of such devices and laboratory measurement of the values recorded in the devices involve costs. This has led to a high degree of non-compliance with the exposure values in the NHMRC standard.

19 Although there is no national data on this problem, a recent study in Queensland of 107 construction sites and 401 outdoor workers found that solar UVR exposure is not being taken seriously[17]. The study showed that 94.7% of the worker exposures exceeded the eight-hour exposure limit of 30 J/m^2 and another 2.8% of exposures reached 2/3rd of the exposure limit in a four-hour period and would probably have exceeded 30 J/m^2 if monitored for an eight-hour period. The study concluded that exposures were very high with 44% being between two and five times the exposure limit, 33% between five and 10 times and 7.3% more than 10 times the limit. Only 12% of workers were able to work in shade, even though 91% of workers sought shade for breaks when this was available or had meal breaks indoors. Also only 10% of workers were appropriately protected by wraparound sunglasses, a UPF-rated shirt with a collar and a broad brimmed hat (or collarless UPF-rated–shirt and brimmed hat with neck protector) with 30+ sunscreen being used every two hours. The Queensland study is assumed to be indicative of the compliance problem across all States and Territories in Australia.

20 An Internet search in www.austlii.edu.au showed instances in Australia when claimants had gone to court to prove adverse health effects caused by exposure to UVR. Many of these actions were brought by war veterans or their widows but there were also instances when employers were sued for compensation for skin cancer allegedly caused by occupational exposure to solar UVR. In one case in 2000, the executrix of a deceased bricklayer's estate successfully sued the deceased's employer, on behalf of his dependent children, for worker's compensation. The NSW Compensation Court held

[17] *Exposure to Ultraviolet Radiation in the Construction Industry – Audit Report*, Division of Workplace Health and Safety, Queensland, March 2002.

that the characteristics of the deceased's employment as a bricklayer gave rise to a material risk of melanoma from exposure to ultraviolet rays.[18]

21 Also, in May 2002, the Federal Court in Melbourne ruled that outdoor workers can claim the cost of sunglasses, sunscreen and hats as tax deductions.[19] In that case, the judge identified the following as issues although they did not arise for consideration in that proceedings:

(a) whether it is desirable that members of the community in general, or outdoor workers in particular, use sun protection items when exposed to the sun;

(b) whether it is desirable that the community in general, or outdoor workers in particular, be educated about the risks of unprotected exposure to the sun and about the available protective measures

(c) whether employers should, or are obliged by law to, ensure that outdoor workers take appropriate steps to protect themselves against the sun

22 From the Queensland study cited above it is clear that previous legal action in courts by employees have not had a significant effect in influencing the level of compliance by Australian employers, especially in the construction industry.

23 The most significant source of potential exposure to man-made UVR is from arc welding equipment and the UVR from this equipment has the greatest potential to harm other people in the vicinity of the workplace where the equipment is being used. The levels of UVR emitted from arc welding equipment can be very high and potential for acute injury to the eye and the skin is great. Welding is also widespread throughout the community. For example, the Australian Bureau of Statistics 2001 Census of Population and Housing lists 48,706 persons as being employed as "Structural Steel and Welding Tradespersons".

Objectives

24 To reduce the risk of exposure to UVR in the workplace, on the basis of an up-to-date authoritative scientific standard on UVR exposure limit values.

Options

The options that were considered are as follows:

(a) Option 1 - Do nothing. Continue with the current NHMRC standard.

(b) Option 2 – Self regulation by the industry.

(c) Option 3 – Adopt the ICNIRP Guidelines as the Australian standard.

(d) Option 4 – Implement an ARPANSA standard.

Impact Analysis

Affected Parties

25 Employers and employees in workplaces that use artificial sources of UVR. This includes the printing and welding industries and every hospital and surgery.

[18] Rankin v.Idoko Pty Ltd & Another, (2000) 19 NSWCCR 607
[19] Morris v Commissioner of Taxation (2002)] FCA 616

26 Employers of outdoor workers.

27 Outdoor workers, such as food and drink attendants, porters, tour guides, water sports instructors and attendants, tennis coaches, power boat drivers and deckhands, real estate agents, property managers, life guards and pool attendants, referees and umpires, security personnel, crowd controllers, construction workers and supervisors, door to door salespersons, letter droppers, handypersons, gardeners, cleaners, maintenance personnel, refuse workers, council employees, divers and dive masters, rafting and river guides, actors and traffic controllers.[20]

28 Commonwealth, State and Territory governments, in particular, radiation protection and occupational or workplace health and safety agencies.

Cost-Benefit of Options

Option 1 – Do nothing. Continue with the current NHMRC standard.

29 The NHMRC standard provides UVR exposure limit values for exposure of the eye or skin in the spectral region between 180 and 400 nanometres (nm). The exposure limit values are to be used as guides to evaluate potentially hazardous exposure from both pulsed and continuous sources of UVR where the exposure duration is not less than 0.1 μsec. However, the NHMRC has said that it will not review this standard and has handed responsibility for the re-publishing of the standard to ARPANSA.

Option 1 - Benefits

30 Governments do not have to spend resources to develop a standard, write or amend regulations to reference the standard and need not allocate resources to ensure that industry complies with the standard. Even if the NHMRC standard lapses or is withdrawn by the NHMRC, employers can use the ICNIRP:1996 recommendations as the exposure limits in the NHMRC standard are the same as the ICNIRP Guidelines, which are now available free of charge from the ICNIRP website.

Option 1 - Costs

31 No certainty for employers and employees on how long the NHMRC standard will remain in force. In addition the NHMRC standard, in line with its voluntary nature, is ambiguous on compliance requirements as it uses words such as "should".

32 Even if the NHMRC standard lapses and employers seek to comply with the ICNIRP Guidelines, employers and occupationally exposed persons will have no way of knowing if the ICNIRP Guidelines are suitable for implementation in Australia, without constantly seeking guidance from appropriate regulatory agencies.

33 Governments would not be able to ensure that employers are complying with the NHMRC standard (or the ICNIRP Guidelines) as both the NHMRC standard and the ICNIRP Guidelines are voluntary.

Option 2 – Self regulation by the industry.

34 Under this option the industry may either develop its own standard based on the ICNIRP Guidelines or adopt the ICNIRP Guidelines. The only motivation for to comply would be based on the threat of legal action for breach of duty of care.

[20] Source: Qstats (Office of Economic and Statistical Research, Queensland Government)

Option 2 - Benefits

35 Governments do not have to spend resources to develop a standard, write or amend regulations to reference the standard and need not allocate resources to ensure that industry complies with the standard.

Option 2 - Costs

36 The recent Queensland study referred to above, and the fact that this high level of non-compliance was revealed notwithstanding previous court action by employees, shows that employers have largely not complied with the existing NHMRC standard. This suggests that a continued voluntary standard is unlikely to improve compliance levels.

37 Occupationally exposed persons are likely to prefer limits to be well defined and enforced by regulators. This is because even though employees could sue their employers after being adversely affected by the harmful effects of UVR, this remedy does nothing to prevent the potentially fatal skin cancer. In any case, legal remedies involve delays and costs and it may also be intrinsic difficult to prove that the particular injury or illness was due to exposure to UVR in the workplace.

38 Governments will have no control over exposure limits and this could be detrimental to the health and safety of occupationally exposed persons.

39 The wide variety of industries with outdoor workers or with workers who use artificial sources of UVR, means that it is unlikely for a single peak industry body to take the lead in defining a standard or managing the effective implementation of the ICNIRP Guidelines.

Option 3 – Adopt the ICNIRP Guidelines as the Australian standard

40 This would involve the referencing and/or reproduction of the ICNIRP guidelines as the Australian standard and jurisdictions implementing it as a mandatory standard.

Option 3 - Benefits

41 It is easily obtained (free of charge from the ICNIRP website). As it contains the same exposure limits as the NHMRC standard (under option 1) and the proposed ARPANSA standard (under option 4), it is a less costly option for Governments than Option 4.

Option 3- Costs

42 ICNIRP Guidelines are not mandatory. Even if the ICNIRP Guidelines were referenced or reproduced as an Australian standard and the regulatory agency in every jurisdiction legislates to make that standard mandatory, words in the ICNIRP Guidelines, such as, '*guidelines*' and '*should*' could confuse users into thinking that the limits are not mandatory. This could make compliance monitoring and enforcement difficult compared to the implementation of an ARPANSA standard (see option 4).

43 Governments are likely to have cost implications depending on the framework that each agency has or establishes to monitor or enforce compliance with a mandatory standard.

Option 4 – Implement an ARPANSA standard

44 ARPANSA has reviewed the NHMRC standard and has developed a draft *Radiation Protection Standard on Occupational Exposure to Ultraviolet Radiation*. The review concluded that there was no need to change the NHMRC limits but found that the voluntary nature of the NHMRC standard was unsatisfactory. The draft ARPANSA

standard now makes compliance with the exposure limits mandatory by using the word '*must'* instead of word, '*should*' in the standard.

Option 4 - Benefits

45 As mentioned previously, cancer costs an estimated $2 billion in direct health system costs (6 per cent of total) and skin cancer is the most expensive, with annual costs in excess of $300 million. Although skin cancer costs from occupational exposure to UVR is only a small part of the total costs, even a small improvement in compliance by employers will have significant effects in reducing the total health costs of skin cancer to the Australian community.

46 Employers in industries that use equipment or devices that emit UVR will have access to an Australian standard with safe exposure limits and will have ARPANSA as a reference point for information, advice and clarification on the exposure limit values.

47 Employees will feel confident that mandatory exposure limit standards are being applied and enforced to protect them from the harmful effects of UVR.

48 Governments can enforce compliance through the combined application of the ARPANSA standard and the legislative underpinning of the standard in each jurisdiction's radiation protection legislation.

49 Governments can maintain the standard through ARPANSA's Radiation Health Committee processes to ensure that the standard is updated to reflect current international guidelines and scientific research.

Option 4 - Costs

50 Employers will incur compliance costs to measure or determine exposure values and provide shielding and other means to ensure that their employees are not exposed beyond the limits specified in the standard. Employers of outdoor workers are likely to encounter difficulties in measuring the exposure of their outdoor workers to solar UVR.

51 As the proposed ARPANSA standard was developed by the Radiation Health Committee with representatives from all States and Territories, it is expected each regulatory agency in the States and Territories will adopt the standard into its regulatory framework. This is likely have cost implications for these agencies, depending on the framework that each agency has or establishes to monitor or enforce compliance with the standard.

Consultation

52 The proposed standard was developed by a working group of the Radiation Health Committee. The Radiation Health Committee includes representatives from all Commonwealth, State and Territory radiation protection regulators.

53 The draft standard has been advertised on 18 June 2003 for a period of public comment until 15 August 2003. Copies of the proposed standard are also available on the ARPANSA web site at www.arpansa.gov.au. The following organisations have been advised of the availability of the proposed ARPANSA standard and this Regulatory Impact Statement and their comments have been requested:

- National Occupational Health & Safety Commission
- Comcare
- ACT Cancer Society
- ACT Workcover

- Queensland Cancer Fund
- Statewide Health Promotion Unit, Queensland Health
- Division of Workplace Health & Safety, Queensland Dept of Industrial Relations
- Cancer Foundation of Western Australia
- Department of Mineral And Petroleum Industries
- University of Western Australia, Safety & Health Office
- Anti-Cancer Foundation, SA
- Workplace Services, SA Attorney-General's Department
- Local Government Association Workers' Compensation Scheme, SA
- SA Workcover Corporation
- NSW Cancer Council
- Workcover NSW
- Anti-Cancer Council of Victoria
- Senior HR Consultant, Health & Rehabilitation, Dept of Education, Tasmania
- Cancer Council of Tasmania
- Workplace Standards Tasmania
- Cancer Council of the Northern Territory
- Work Health NT
- Australasian College of Physical Scientists and Engineers in Medicine
- CSIRO
- Australasian Radiation Protection Society
- Ultraviolet products P/L
- Australasian College of Dermatologists

Conclusion and Recommendation

54 Option 1 does not meet the objectives as NHMRC has decided to discontinue its RHS publications and the current NHMRC standard will not be reviewed or updated in future to be in accord with any change to international guidelines or new scientific findings.

55 Option 2 is not preferred for the following reasons:

(a) Self-regulation will not satisfy concerns of occupationally exposed persons that their health and safety has been adequately addressed by their employers. This is exemplified by the current lack of compliance to the voluntary NHMRC standard as shown in the Queensland study referred to above.

(b) The potential for occupational exposure to unsafe levels of UVR is neither a low risk event nor of low significance. This is illustrated by the skin cancer statistics and health cost burden of skin cancer described above.

(c) There is little evidence that the industry has the structure to organise itself for self regulation and keep up with international guidelines or scientific findings.

(d) Governments cannot fully divest their responsibility to monitor compliance and take action to remedy non-compliance in matters concerning radiation health and safety. This view is supported by the fact that ICNIRP recommendations on non-ionizing radiation in general and World Health Organisation (WHO) recommendations on solar UVR in particular refer to governments' roles to facilitate the establishment of standards and educational programs.

(e) In the area of UVR, ICNIRP and WHO play an important role in recommending measures to protect people and environment from the harmful effects of UVR.

The WHO recommends the prevention of the ill effects of excessive exposure to UVR through protective measures. [21] From the Queensland study mentioned above, it is clear that the voluntary NHMRC standard has not been effective to optimise preventive measures, at least in the construction industry. It is felt that industry self regulation is not likely to improve the situation.

56 Option 3 is not suitable as the ICNIRP Guidelines are not mandatory and are in fact recommendations meant to be used by Governments to formulate and establish standards in their own countries. The voluntary nature of the ICNIRP Guidelines makes it unsuitable to deal with the compliance problem.

57 On balance, the benefits of Option 4 outweighs its costs for the following reasons:

Lack of information

(a) Although there is no short term benefit (as the specified levels of protection in the proposed standard are the same as the NHMRC standard), the proposed ARPANSA standard will ensure that there is no information gap when the NHMRC's standard eventually lapses or is withdrawn.

(b) Option 4 enables ARPANSA to be a reference point for information, advice and clarification. ARPANSA has the appropriate scientific resources and international liaison framework in place to ensure that the standard is updated to reflect current international guidelines and scientific research.

Lack of compliance

(c) Under the proposed ARPANSA standard employers *must* apply the limits to unprotected eye and skin. This involves compliance costs but under the NHMRC standard employers were under the same obligation albeit on a voluntary basis. As such, employers who have complied with the NHMRC standard previously will not incur additional costs to comply with the proposed ARPANSA standard.

(d) Unless practical measures for compliance are promulgated to supplement the proposed standard, employers of outdoor workers will find it difficult to comply. As such, an Annex has been produced detailing practical and cost-effective means of complying with the standard. The proposed Annex is published as Annex 3 of the proposed ARPANSA standard.

Stakeholders are encouraged to provide their views on the adequacy of Annex 3 to the proposed ARPANSA standard.

(e) Jurisdictions will incur costs to implement, monitor and enforce compliance with the standard as the problem of exposure to UVR, in particular solar UVR, is real, current and significant. This has been demonstrated by the Queensland study (March 2002) cited above. However, jurisdictions will retain control over the cost of implementation and enforcement as these matters are not prescribed in the proposed ARPANSA Standard and it is up to regulators to determine the most cost-effective implementation and enforcement mechanism.

[21] *Protection Against Exposure to Ultraviolet Radiation (WHO/EHG/95.17)*: *Basic measures needed to protect against the adverse effects of UV exposure*, Joint publication by WHO, UNEP, Geneva, 1995.

(f) The key issue is whether the costs of implementing the standard outweigh the benefits. It is clear that improved compliance will significantly reduce occupational exposure to solar UVR, which in turn will impact positively on the reduction of the incidence of skin cancer. Any reduction in the incidence of skin cancer will have far reaching cost savings, especially in direct health costs and insurance pay-outs, noting that health costs from skin cancer is about $300 million annually and melanoma accounts for up to 1,300 deaths annually.

Stakeholders who disagree with the conclusion above are urged to substantiate their view with a description and quantification of costs to implement, administer or enforce the proposed standard.

Enforcement

(g) It is clear from the Queensland study cited above that there has been a lack of compliance in ensuring that the exposure of outdoor workers to solar UVR is kept within the safe exposure levels. The proposed ARPANSA standard will provide a common national standard on UVR exposure limit values for all Australian jurisdictions to use as the basis for regulatory measures to protect occupationally exposed persons from the adverse health effects of exposure to UVR.

58 It is recommended that the proposed ARPANSA *Radiation Protection Standard on Occupational Exposure to Ultraviolet Radiation* (Option 4) be implemented by the Commonwealth as a standard in ARPANSA's Radiation Protection Series.

National Competition Policy Statement

59 Under the National Competition Policy agreement, there is a need for every regulatory proposal to satisfy the two- fold test of:

(a) whether the benefits of the restrictions in the proposal outweigh the costs; and

(b) whether the restrictions are necessary to achieve the objective/s of the proposal.

60 The limits in the proposed ARPANSA standard and the mandatory requirement for employers to comply with the limits are restrictions as they set prescribed levels.

61 On balance, based on the benefits and costs listed under Option 4 above and the evaluation of the benefits and costs in paragraph 57 above, the restrictions imposed by the proposed standard were found to outweigh the costs. In addition, the restrictions imposed by the proposed standard are necessary to achieve the objectives of the proposed ARPANSA standard.

62 It must be noted that apart from specifying the permissible limits of occupational exposure to UVR, there is no other prescription in the standard and employers are free to determine the most cost-effective method of radiation protection for their employees.

Implementation and Review

63 The proposed standard will be published by ARPANSA under its Radiation Protection Series. The standard will be reviewed by ARPANSA's Radiation Health Committee within 10 years of its commencement to ensure it is still relevant to radiation protection needs. Earlier review would be undertaken if there are problems in the implementation of the standard, if international or national radiation protection objectives change or if there is new information from international research.

64 After publication, the standard will be proposed for incorporation into the National Directory for Radiation Protection, which is now being prepared by ARPANSA. In August 1999, the Australian Health Ministers' Conference endorsed the National Directory as the mechanism for implementing national standards and codes of practice in radiation protection. When the standard is incorporated into the National Directory, regulators in the States and Territories must adopt the standard into their regulatory frameworks, paving the way for the proposed ARPANSA standard to become a common national standard in Australia.

References

Cancer in Australia 1998: Incidence and mortality data for 1998, (Cancer Series Number 17), Australian Institute of Health and Welfare and Australasian Association of Cancer Registries, Canberra, October 2001.

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Abbreviations

ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
ICNIRP	International Commission on Non-Ionizing Radiation Protection
INIRC	International Non-Ionizing Radiation Committee of the International Radiation Protection Association
IRPA	International Radiation Protection Association
NHMRC	National Health and Medical Research Council
NOHSC	National Occupational Health and Safety Commission
NRPB	National Radiological Protection Board (UK)
OH&S	occupational health and safety
RHS	Radiation Health Series (published by the NHMRC)
RPS	Radiation Protection Series (published by ARPANSA)
UNEP	United Nations Environment Programme
UPF	Ultraviolet Protection Factor
UV	Ultraviolet
UVA and UVB	UVR is classified as UVA, UVB and UVC. UVB and UVC are potentially the most dangerous to humans. Ozone and oxygen in the atmosphere absorb all the UVC and most of the UVB before it reaches the earth's surface. UVB is more damaging to the skin and eyes than UVA, however, both UVB and UVA are implicated as causes of skin cancers and some eye disorders.
UVR	ultraviolet radiation
WHO	World Health Organisation