Finnish Institute of Occupational Health

Needs and possibilities to protect workers from UV radiation

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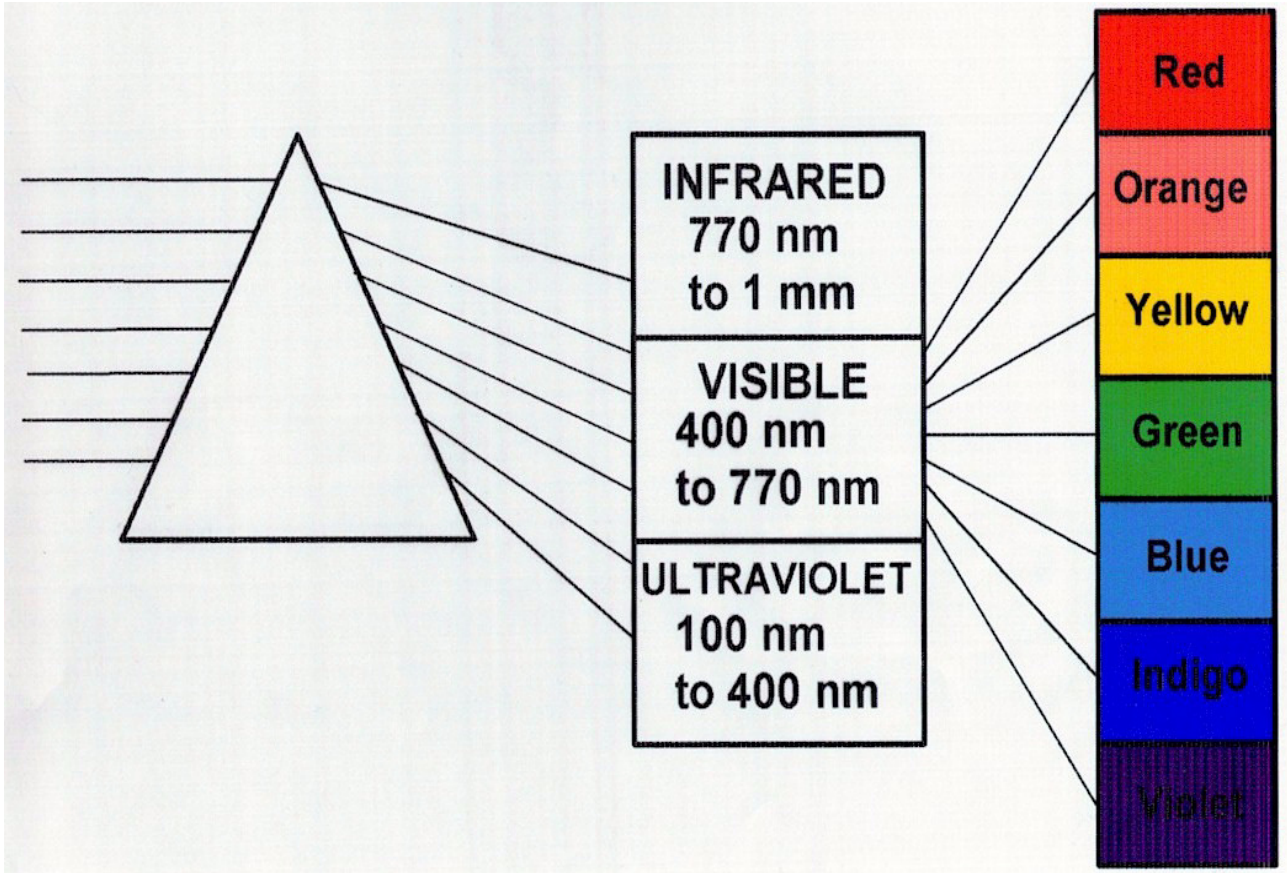
Optical spectrum



UV - radiation wavelength ranges

UV- C	**100 - 280 nm**
UV- B	**280 - 315 nm**
UV- A	**315 - 400 nm**

Visible and infrared-radiation ranges

Visible radiation (light)	400 - 770 nm
IR-A	770 nm - 1.4 µm
IR-B	1.4 - 3 µm
IR-C	3 µm - 1 mm

UV-radiation sources

- *Sun*
- *Welding arcs*
- *General lighting fluorescent lamps*
- *Germicidal lamps*
- *Metal halide and mercury lamps*
- *Xenon lamps*
- *Quartz halogen lamps*

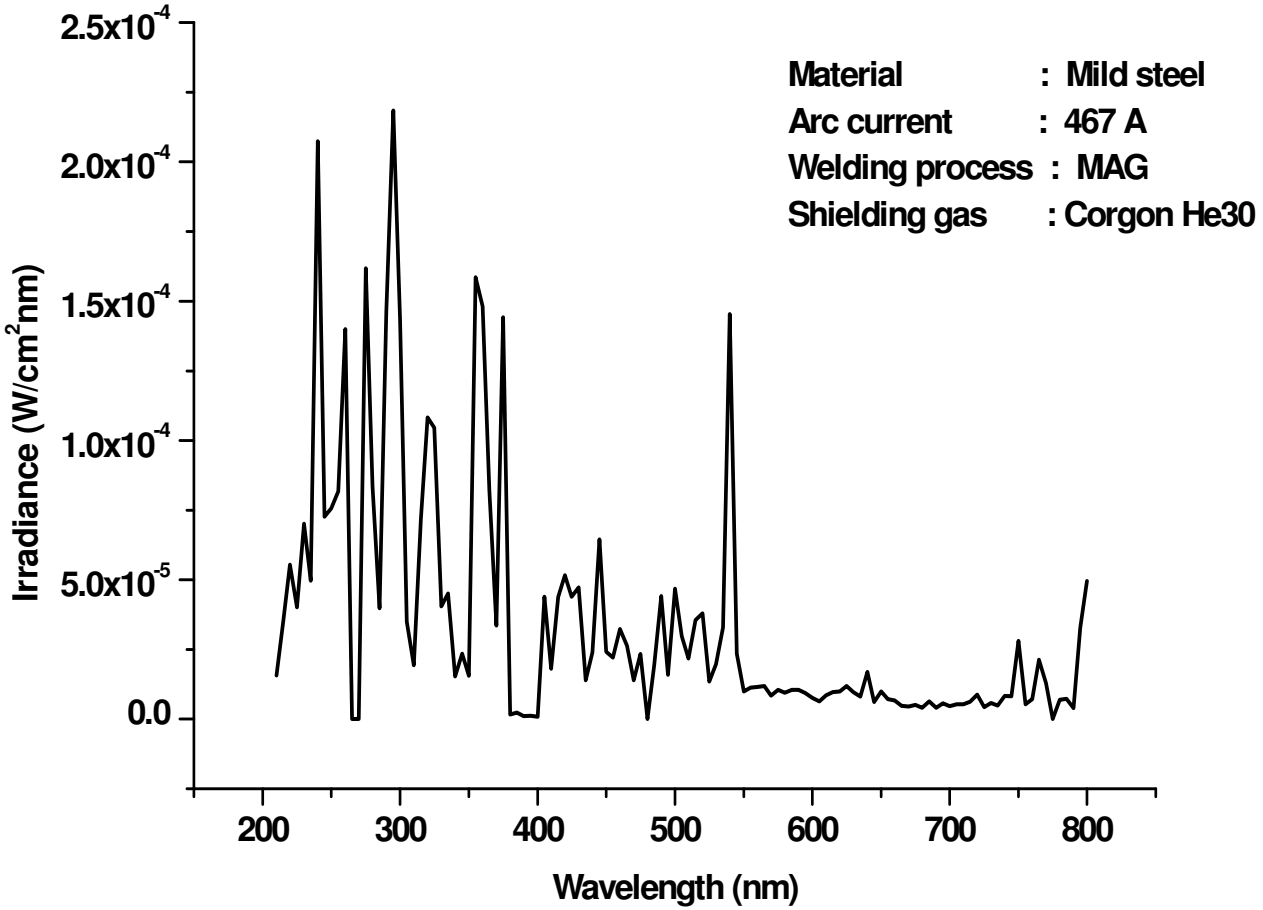
Welders' exposure to optical radiation

Maila Hietanen, ICNIRP Workshop, Rio de Janeiro, Oct 2008

Measurements of welding spectra

- Welding processes
  - MAG,MIG,TIG
  - Manual stick welding
- Base materials
  - stainless steel
  - aluminium
  - mild steel
- Measurements
  - 210 - 800 nm
  - viewing distance normally ~0.5 m

Spectroradiometric measurements of welding spectra



Eye protection

- Welding processes emit UV, visible and IR radiation
- Effective protection against UV important, but filters against UV need not be dark
- Dark filters are needed against ocular exposure to bright visible radiation
- Visible radiation harmless for the skin of face

Dual shade welding mask

Safe exposure times

- UV radiation
  - without filter: 0.3 - 3 s
  - with any filter: > 8 h

- Blue-light
  - without filter: 3 s - 7 min
  - with filters shade 1.4 to 6: 30 s - > 8 h

Personal protection against IR-radiation

Outdoor workers' exposure to Solar radiation

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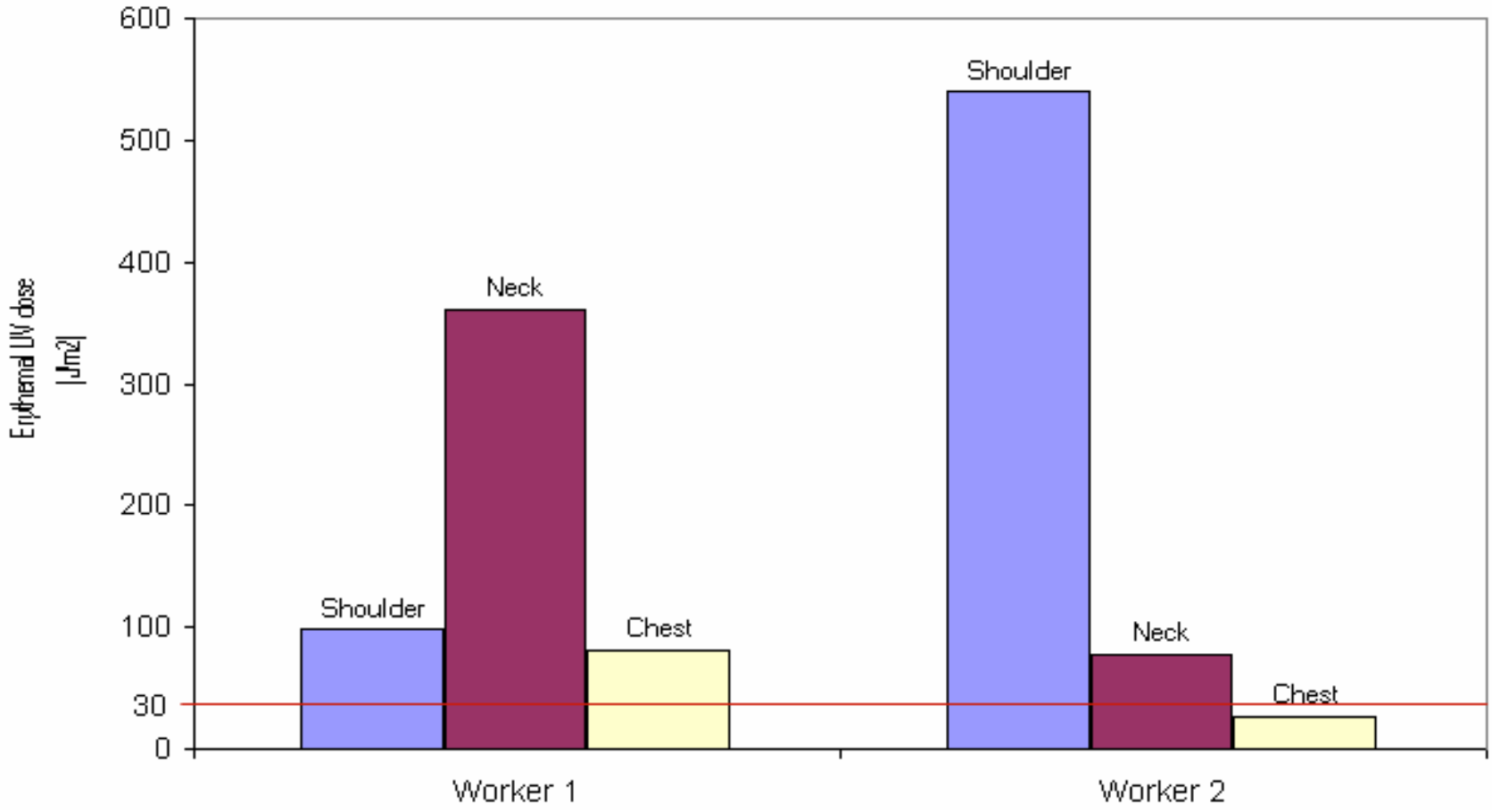
Roof builders at work

Personal UV- dose measurements

Typical daily UV doses of roof workers



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Road workers

Global Solar UV-Index

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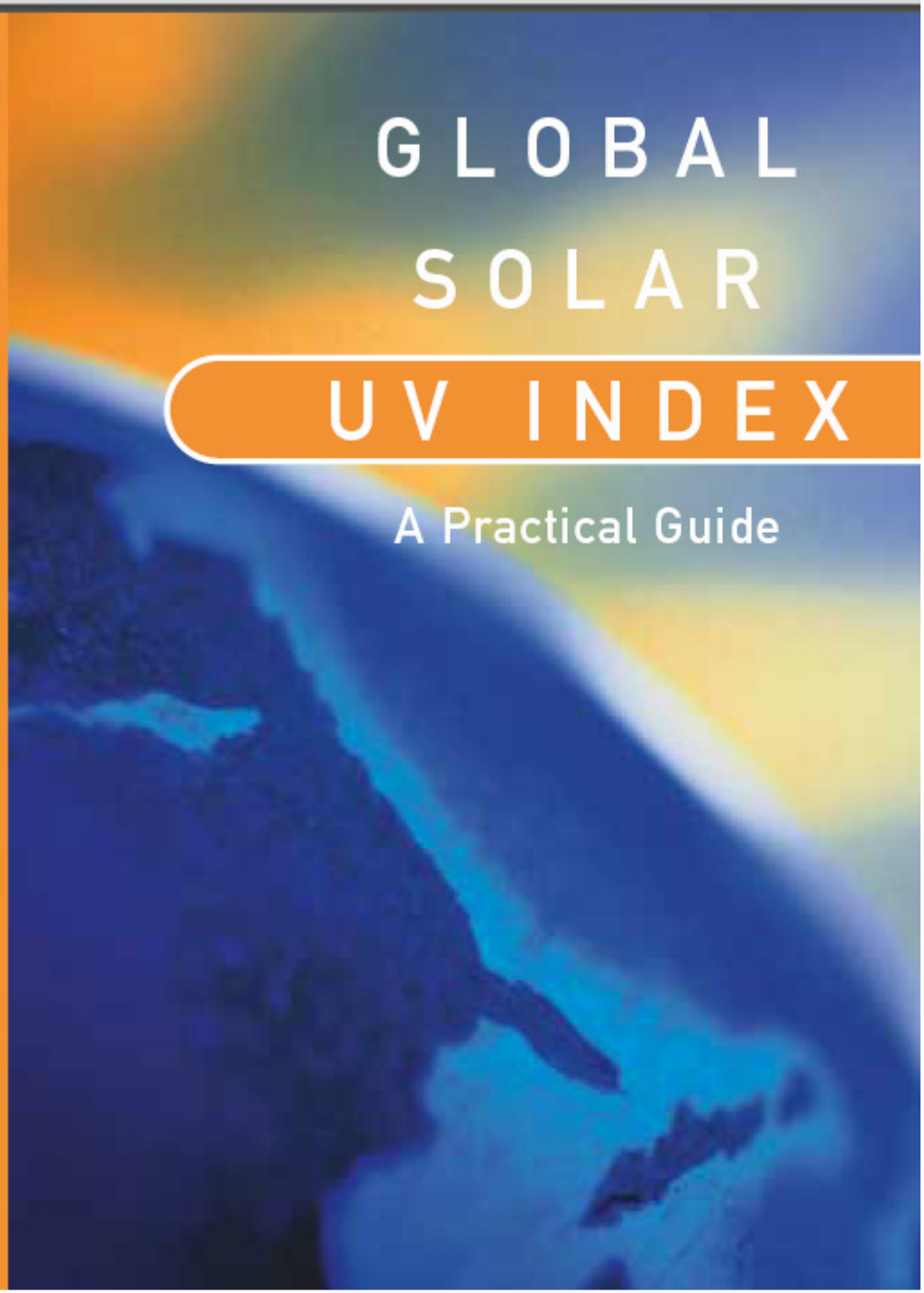
GLOBAL SOLAR UV INDEX

A marked increase in the incidence of skin cancers has been observed in fair-skinned populations worldwide since the early 1970s. This is strongly associated with personal habits in relation to sun exposure and its ultraviolet (UV) component, and the societal view that a tan is desirable and healthy.

The Global Solar UV Index (UVI) described in this document was developed in an international effort by WHO in collaboration with WMO, UNEP and ICNIRP, and is a simple measure of the UV radiation level at the Earth's surface. It serves as an important vehicle to raise public awareness and to alert people about the need to adopt protective measures when exposed to UV radiation.

Intersun, WHO's Global UV Project, aims to reduce the burden of disease resulting from exposure to UV radiation by assessing and quantifying health risks, and developing an appropriate response through guide-lines, recommendations and information



UV-index

The Global Solar UVI is formulated using the International Commission on Illumination (CIE) reference action spectrum for UV-induced erythema on the human skin (ISO 17166:1999/CIE S 007/E-1998). It is a measure of the UV radiation that is relevant to and defined for a horizontal surface. The UVI is a unitless quantity defined by the formula:

$$I_{\mathrm{UV}} = \mathrm{k}_{\mathrm{er}} \cdot \int_{250\ \mathrm{nm}}^{400\ \mathrm{nm}} E_{\lambda} \cdot s_{\mathrm{er}}(\lambda)\mathrm{d}\lambda$$

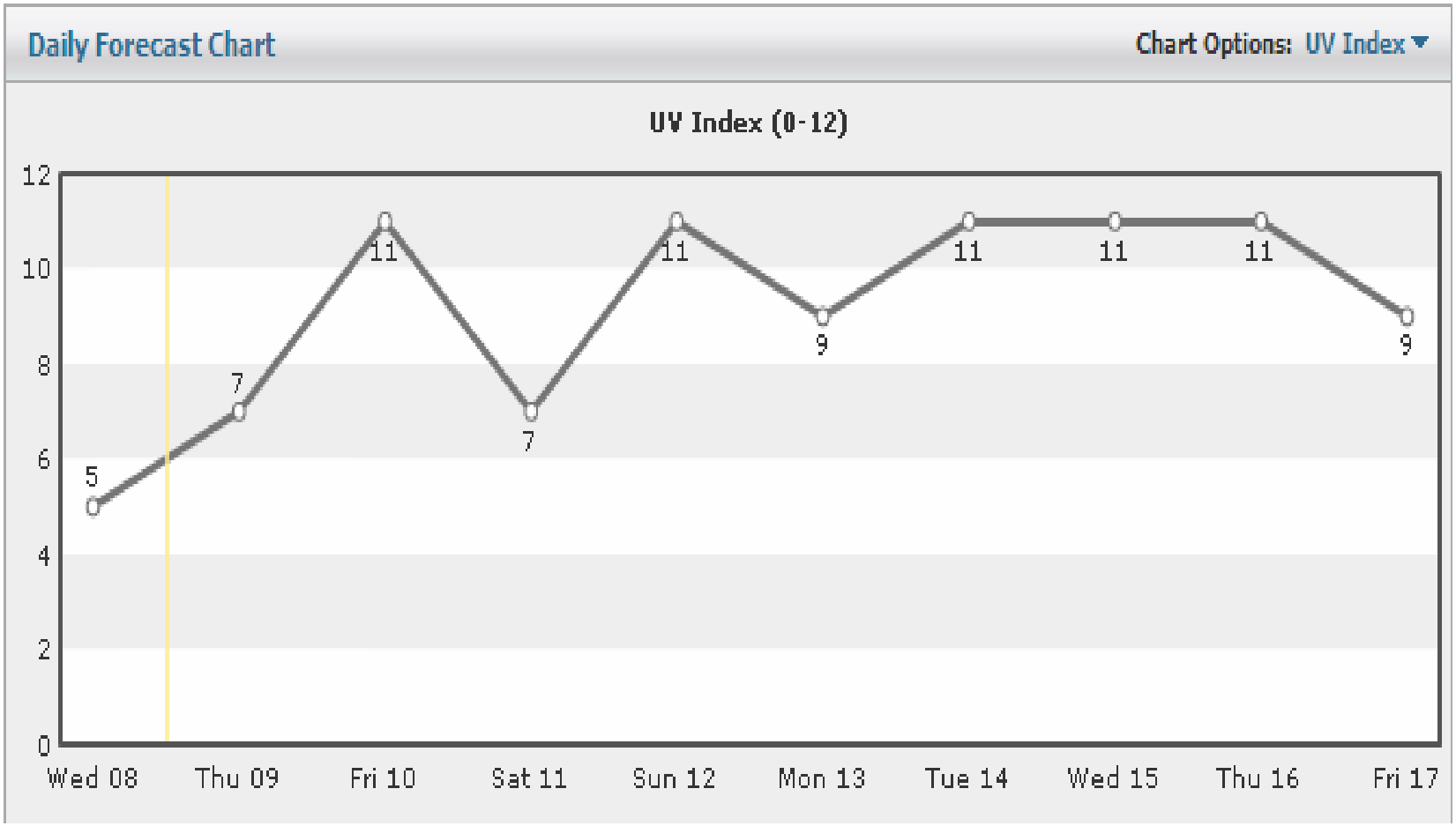
where E_{λ} is the solar spectral irradiance expressed in W·/(m²·nm') at wavelength λ and d_{λ} is the wavelength interval used in the summation. $s_{er\lambda}$ is the erythema reference action spectrum, and k_{er} is a constant equal to 40 m²/W.

The determination of the UVI can be through measurements or model calculations. Two measurement approaches can be taken: the first is to use a spectroradiometer and to calculate the UVI using the above formula. The second is to use a broadband detector that has been calibrated and programmed to give the UVI directly. Prediction of the solar UVI is achieved with a radiative transfer model that requires the input of total ozone and the aerosol optical properties. A regression model is used to predict the total ozone using the input from ground-based ozone spectroradiometers or from satellites. A good cloud parameterisation is also required unless only clear sky values are reported.

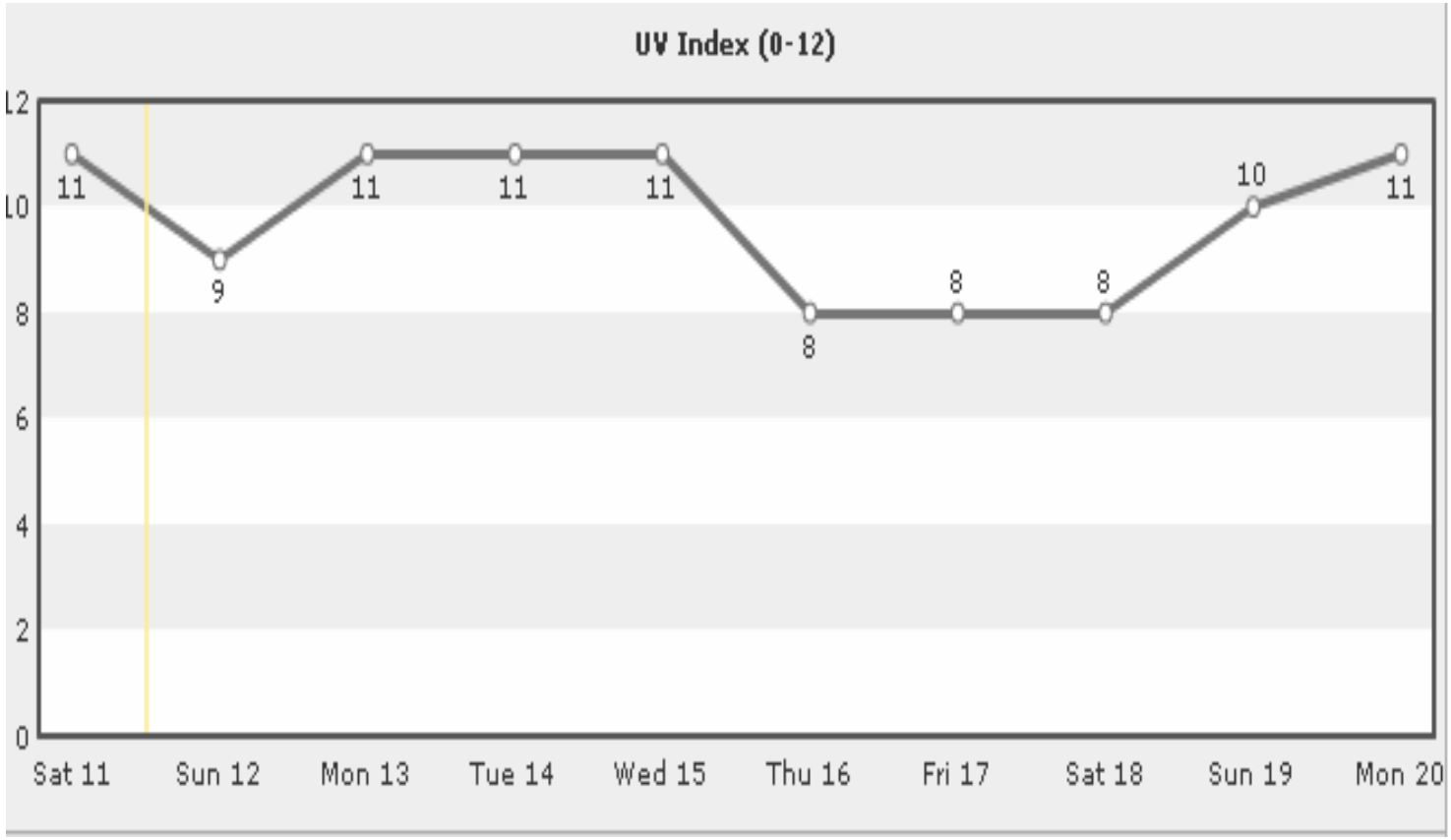
UV exposure category and UV Index

EXPOSURE CATEGORY	UVI RANGE
LOW	< 2
MODERATE	3 TO 5
HIGH	6 TO 7
VERY HIGH	8 TO 10
EXTREME	11+

UV Index Forecast for Rio on 8 Oct



UV Index Forecast for Rio on 11 Oct



Practical advice

SUNTANNING MESSAGES

- Tanning does not stop much UV radiation! Even when your skin is tanned, limit your exposure during midday hours, and continue to protect yourself.
- Don't UV OD. Sunburn is literally an indication that your skin has overdosed on UV radiation so Slip! Slop! Slap! and Save Your Skin.

SUN PROTECTION MESSAGES

- Wear sunglasses, a wide-brimmed hat and protective clothing, and frequently apply sunscreen of SPF 15+ to protect yourself.
- Applying sunscreen is not a means to prolong your stay in the sun but to reduce the health risk of your exposure.
- Taking certain medications as well as using perfumes and deodorants can sensitize your skin, causing serious burns in the sun. Ask your pharmacist for advice.
- Sun exposure increases skin cancer risk, accelerates skin ageing and causes damage to the eyes. Protect yourself!
- Shade is one of the best defences against the sun's radiation. Try to find some shade during midday hours when the sun's UV rays are at their peak.

PERCEPTION OF UV RADIATION

- Cloudy weather doesn't mean you can't get burnt. It's the UV radiation in the sun's rays that burns you and causes skin cancer, and UV radiation can penetrate through cloud.
- Remember the sun does not need to feel hot to damage your skin and eyes. The damage is done by UV radiation, which is not seen or felt – so don't be fooled by mild temperatures.

ACTIVITY-BASED MESSAGES

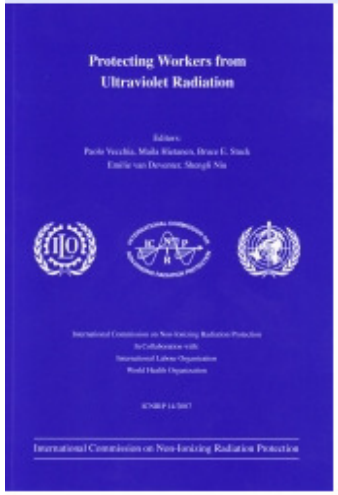
- If you're out to watch or participate in (name of event), don't forget your sunscreen, hat and long-sleeved shirt. That should be all you need to make sure all you go home with are great memories of today's events – and not a nasty dose of sunburn.
- This is a great time to head to the ski slopes. High altitudes and fresh snow can double your UV radiation exposure, so wear sunglasses and sunscreen!
- Going on a sunny vacation? Make sure to pack your wide-brimmed hat, sunglasses and sunscreen.
- School break means fun in the sun for the lucky ones. If you're one of them, remember to pack a hat, sunscreen and sunglasses.

Guidebook for workers exposed to UV radiation

Protecting Workers from UV Radiation

Vecchia P, Hietanen M, Stuck B, van Deventer E, Niu S (eds). Munich: International Commission on Non-Ionizing Radiation Protection, International Labour Organization, World Health Organization; 2007.

ISBN 978-3-934994-07-2. Price: 40 EUR - Order here.



Content: Workers may be exposed to ultraviolet radiation (UVR) from the sun and artificial sources such as specialized lamps and welding arcs. Although indoor workers are normally protected by clothing and eyewear, the same level of protection is not generally achieved for outdoor workers. Outdoor workers receive significant exposure to solar UVR and are thereby at increased risk of the adverse consequences associated with UVR exposure. The magnitude of the risk for the skin depends greatly upon climatological factors and personal sensitivity to UVR, the latter incorporating both the color of the skin and degree of acclimatization to UVR. However, this great range of individual susceptibiity does not exist for the eye, and people of all skin phototypes are susceptible to cataract and other environmentally related eye diseases.

This book provides information and advice on protecting workers from ultraviolet radiation exposure. The adverse health effects of both acute and chronic UVR exposures are reviewed, emphasizing solar UVR exposure of the outdoor worker.

Maila Hietanen, ICNIRP Workshop, Rio de Janeiro, Oct 2008

World Health Organization

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Ultraviolet radiation and the INTERSUN Programme

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Tourism, tourists and tour operators

Tourism is regarded as one of the world's biggest industries. In 2001 there were 639 million tourists who contributed 463 billion US$ to the world's economy. Many tourists seek sunny and warm destinations as part of their holiday experience. However, sunburn is a common holiday experience that can cause considerable pain and discomfort and may lead to more serious consequences.

Evidence is showing that a short period of intense exposure, such as sunbathing, is associated with a 2-fold increase in melanoma risk. Unfortunately skin cancer rates are on the rise in many parts of the world including the United States and Europe. A part of the reason for the rise can be explained by the more recent affordability and accessibility of airline travel, particularly to warm and sunny destinations.

Tourism industry representatives/players can play a crucial role in minimizing the risks associated to sun exposure by disseminating information to their clients and by taking into account some few, but very important measures in their facilities as well as tourism services.

RELATED LINKS

- Guide for tour operators: Minimizing risks associated with ultraviolet radiation exposure [pdf 136kb]
- Sun protection message for tourists [pdf 7kb]
- Cancer Research UK: information to help tour operators

www.hpa.org.uk


Thank you for your attention!