Sun Buster Solar Shades

Statistical Information as accredited by
ARPANSA.gov.au

Testing laboratories for the CANCER COUNCIL of AUSTRALIA

Colours	UVR	Mean UPF	ShadeFactor%
Sky	95.8	35	93
Deep Merlot	96.7	41	96
Jade Green	94.9	19	89
Gun Metal Grey	93.8	17	94
Pilbra	96.4	44	92
Navy Blue	98.2	99	98
Sahara Beige	95.2	34	90
Chocolate	96.1	44	94
Black	95.5	39.7	95.5

PPC People Protection Cloth

Technical Specifications:

Average Weight	330 gsm
Bursting Force (Steel Ball)	1861 Mean N
Bursting Pressure	3000 Mean Kpa
Tear resistance	Warp 172 N

Sun Buster Solar Shade® are made from virgin resins and only the best UV Stabilisers from Ciba Speciality Products, and is supported by a 10 year UV degredation warranty

For information and conditions of the warranty go the www.sunbuster.net

Ultraviolet Protection Factor UPF 50+ Excellent Protection ARPANSA UPF RATING

SunBuster

Australian Government

Australian Radiation Protection and Nuclear Safety Agency

Resource Guide for UV Protective Products 2003

Information Section

Solar Ultraviolet Radiation

What is solar ultraviolet radiation (UVR)?

Solar radiation is electromagnetic radiation emitted by the sun. At the earth's surface it consists mainly of visible light and infrared radiation (IR). Our eyes respond to visible light and IR can be felt on the skin as heat. Ultraviolet radiation (UVR) is also present and is invisible, high-energy radiation, which is capable of causing damage to living organisms.

Ultraviolet radiation is classified by wavelength into three regions:

UVA - Ultraviolet radiation in the range 315 nanometers (nm) to 400 nm is thought to contribute to premature aging and wrinkling of the skin and has recently been implicated as a cause of skin cancer.

UVB - Ultraviolet radiation in the range 280 nm to 315 nm is more dangerous than UVA and has been implicated as the major cause of skin cancers, sunburning and cataracts.

UVC - Ultraviolet radiation in the range 100 nm to 280 nm is extremely dangerous but does not reach the earth's surface due to absorption in the atmosphere.

Why is there so much solar UVR in Australia?

Due to its geographical position and close proximity to the equator, Australia experiences some of the highest levels of solar ultraviolet radiation in the world. The earth's elliptical orbit brings the earth closer to the sun in January, during summer in the southern hemisphere, resulting in higher levels of UVR in that region. Relatively clear atmospheric conditions and the influence of ozone depletion over Antarctica contribute to higher levels of solar UVR in the southern hemisphere than at similar latitudes in the northern hemisphere.

Why measure solar UVR?

Every year in Australia there are 270,000 new cases of skin cancer diagnosed. Over 1200 Australians die of skin cancer each year. The occurrence of skin cancers is related to UVR exposure. Australia has the highest incidence of skin cancers in the world so accurate information about the levels of solar UVR is very important.

In the mid 1980s ARPANSA, then known as the Australian Radiation Laboratory (ARL) set up a network of detectors to measure UVR levels around Australia and in Antarctica. Evidence of depletion of stratospheric ozone, which has a direct effect on UVR levels, over the Antarctic region has encouraged the monitoring of solar UVR in the region.

How does ARPANSA measure solar UVR?

ARPANSA has measured solar UVR levels using a network of detectors in Australian capital cities and at other sites since 1986. These UVR monitoring devices cover a wide range of latitudes and different climates and record data for the study and reporting of variations and magnitude of UVR changes. However, care must be taken in assuming that a specific site in one city represents all locations within a region, as there can be significant localized differences due to cloud cover and air pollution.

There are currently 12 sites in Australia and Antarctica that have broadband UVR detectors installed. Broadband detectors measure the total energy received over a range of wavelengths in the UVR region. The detectors measure both direct and diffuse radiation. The information is analysed by computer then distributed daily to news services and other interested organizations.

How are UVR levels reported?

ARPANSA has been reporting solar UVR levels for Australian capital cities since 1990. UVR levels are reported as a solar UV-Index, which is a measure of the highest level of UVR each day. The World Health Organization (WHO) developed this standardised method for reporting solar UV-Indexes. The UV-Index is designed to provide 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. The UV-Index allows for cloud cover and other environmental factors and is used worldwide for reporting UVR levels.

UV-Index values are grouped into exposure categories of low, moderate, high, very high and extreme with corresponding colour codes. UV-Index values are related to UVR exposure as shown in the table below. By following some simple precautions shown in the table below you can reduce your risk of sun related damage.

UV-Index range	Exposure category	Sun protection precautions	Colour codes
2 or less	Low	You can safely stay outdoors with minimal protection.	Green
3 to 5	Moderate	hat, sunscreen, sunglasses, shady area.	Yellow
6 to 7	High	hat, sunscreen, sunglasses, shady area, stay indoors between 10-2pm (11-3pm daylight savings).	Orange
8 to 10	Very High	Stay indoors as much as possible otherwise use all precautions above.	Red
11+	Extreme	Same as for the previous category.	Purple

The UV-Index exposure categories are based on the response of fair-skinned people to UVR. People who have skin types that are less likely to burn should note that although they may not sunburn easily, they can still receive high UVR exposures which can increase their long-term risk of skin cancer.

What are skin types?

Skin is classified by sensitivity to UV radiation. If you are very fair skinned (white skin) and tend to burn easily in the summer sun and find it difficult to achieve a tan you have skin type 1. People with skin type 1 have the highest risk of premature skin aging and greatest risk of developing some form of skin cancer. If you are of this type then you should limit your exposure to the sun and always dress to minimise sun exposure, wear a hat and use sunscreen.

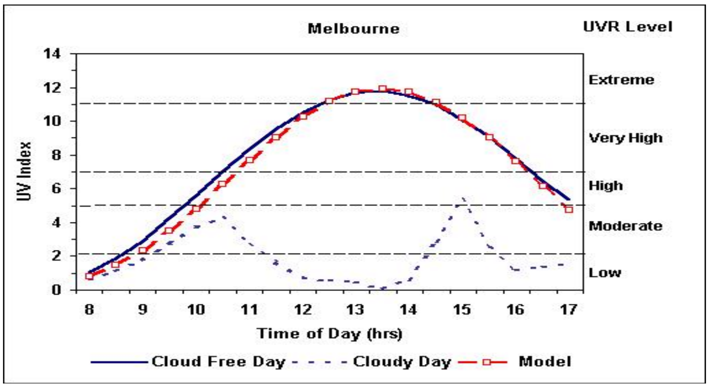
People with skin type 2 (white skin) usually burn and only rarely tan so they need to take the same precautions as skin type 1.

People with skin types 3 and 4 (white and light brown skin respectively) usually tan and occasionally burn so they still require protection from the higher levels of UVR in summer.

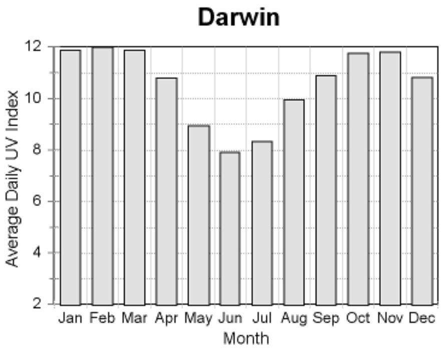
People with skin types 5 and 6 (moderate brown and dark brown-black respectively) have sufficient levels of melanin pigment in their skin to provide protection from solar UVR so they rarely burn and easily tan. However, even though darker skin offers natural protection against UVR those people are still not immune to developing skin cancers.

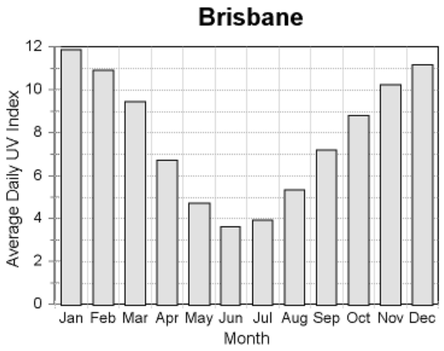
How does UVR intensity vary during the day?

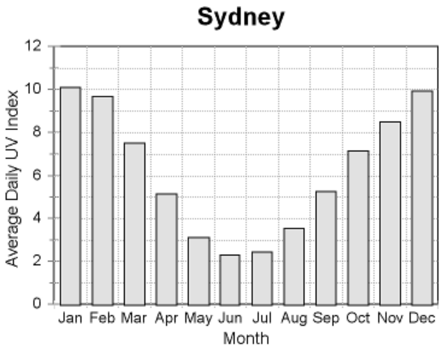
The graph below shows the UV Index for Melbourne on a cloud free day (solid line) and a day when there was heavy cloud and rain, which reduced the UVR (dotted line). There is also a computer model, which is a prediction of the UV levels for a clear sky day (dashed line). The model is calculated using a measured ozone value for the day. Unusual cloud conditions and variation in ozone levels may occasionally cause the measured UV-Index to exceed the model prediction.

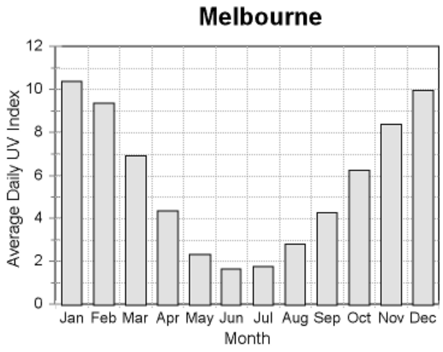


These graphs of average monthly UV-Indexes for some widely separated Australian capital cities show that regions closer to the equator (further north) have significantly higher levels of solar UVR especially during the winter months.

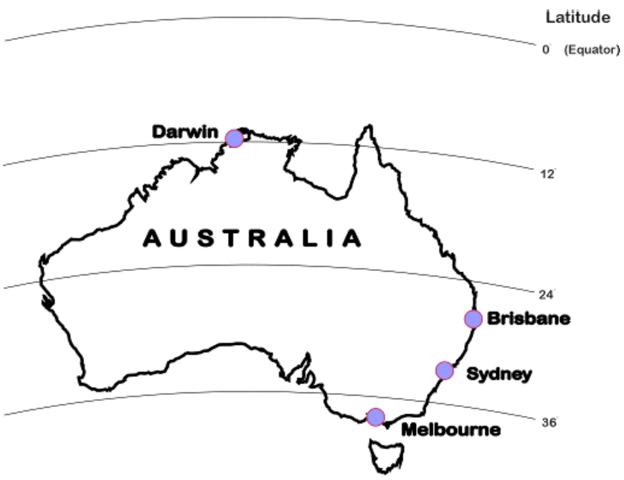






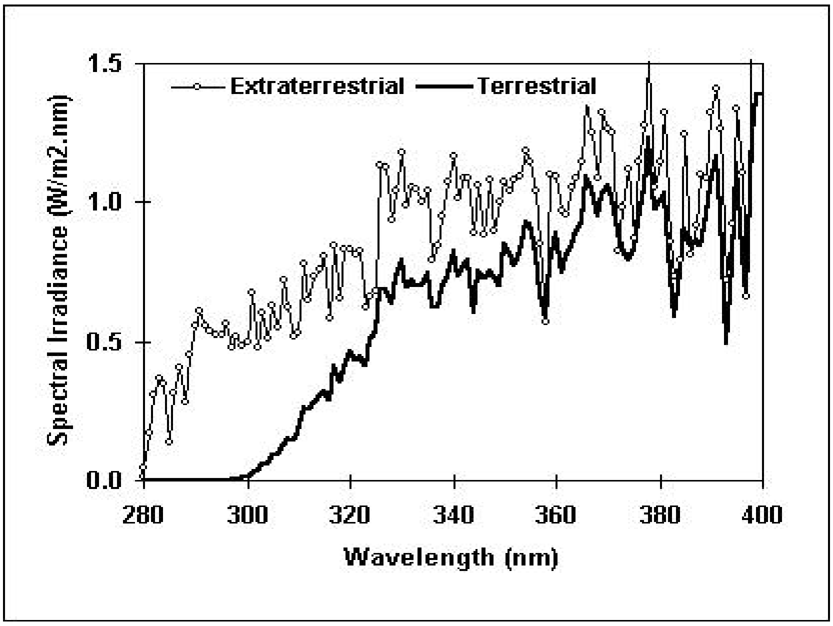


This map shows the latitudes of some widely separated Australian capital cities.



How does the atmosphere affect solar UVR?

The following graph compares the solar UVR spectrum from outside the atmosphere with the spectrum at the earth's surface, as measured by ARPANSA in Melbourne. The effects of absorption by the atmosphere can be clearly seen. The earth's atmosphere absorbs most of the UVB and some of the UVA.

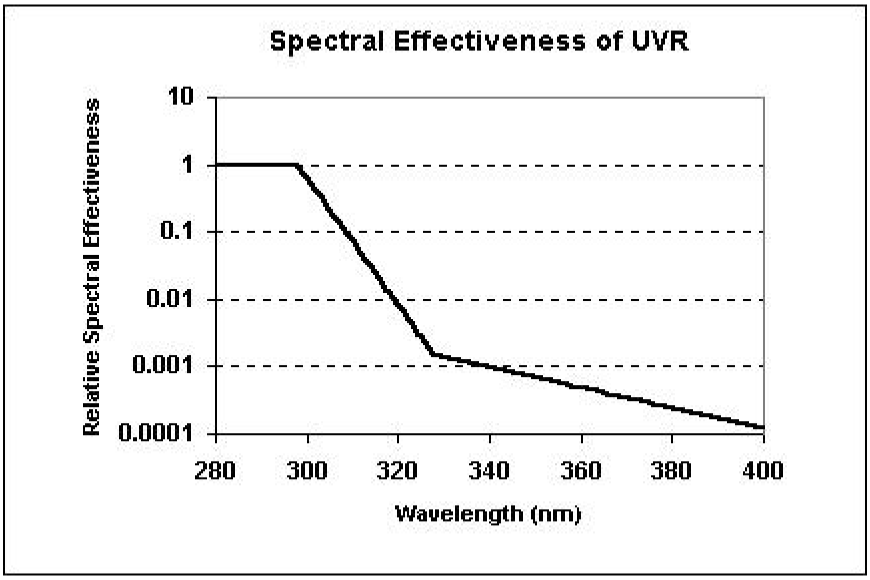


How dangerous is UVR?

The biological effects of UVR on the human skin depend on the wavelengths of UVR emitted by the sun. To be able to correctly determine the hazard from the sun, or any artificial UVR source, it is necessary to have information about the spectral emissions.

The graph [4] below shows human skin response to UVR and is called the action spectrum for UVR. The biological weighting factor shown in the graph is based on a fair skinned person's response to UVR from the sun. Notice that the line covers the UVB and UVA regions.

The important point to note is that the biological effectiveness of UVR increases by a factor of over 1000 as the wavelength changes from UVA to UVB. This means that UVB exposure causes 1000 times as much skin damage as the same amount of UVA exposure.



What are the risks from UVR exposure?

Over-exposure to UVR can cause sunburn, skin damage and skin cancer. UVR exposure also places our eyes at risk of photokeratitis, photoconjunctivitus and cataracts. The most obvious short-term effect of over-exposure to UVR is sunburn, also known as erythema. The more UVR exposure, the worse the sunburn becomes. A person's cumulative exposure to UVR along with the number of severe sunburns they have received, especially during childhood, increases their risk of developing skin cancer. Skin cancers affect people of all skin types.

Sun exposure causes the outer layers of the skin to thicken. Long-term exposure can cause skin to wrinkle, sag and become leathery. Due to the high levels of UVR and an outdoors lifestyle, Australians also suffer from high rates of skin cancers.

Melanoma, the least common of the skin cancers but the most dangerous, may be related to severe exposure to solar UVR at an early age. Malignant melanomas may appear without warning as a dark mole or other dark spot on the skin. Any concerns regarding moles or skin spots should be referred to a doctor or skin clinic. Further information about skin cancers can be obtained from the Cancer Councils.

Prolonged exposure to solar UVR can have serious consequences for the eyes. Cataract is one of the most common types of eye damage in Australia. Cataract is the clouding of the lens of the eye, which is responsible for focusing light and producing sharp images. Without intervention cataract can lead to blindness. Wearing wrap around sunglasses and a broad brimmed hat can prevent most of the UVR from reaching the eyes.

The sensitivity to sunburn can vary between different parts of the body. The neck, face, ears and trunk tend to be more sensitive than the limbs. These parts of the body are at more risk from UVR exposure.

Our lips have thinner layers of skin than the rest of the body. They have no sweat or oil glands so they can dry and crack easily in the sun. There are lip balms available that contain sunscreens.

What are the sources of solar UVR exposure?

Solar UVR can reach you on the ground from three sources:

- Directly from the sun.
- Scattered from the open sky.
- Reflected from the environment.

This means that even if you are shaded from the direct sun you can still receive substantial UVR exposure from the open sky and reflective ground surfaces. Reflective surfaces can reduce the effect of protective measures. For example a person in a boat wearing a hat may still receive expose to their face from UVR reflected off the water. Also some ground and building surfaces are quite reflective to UVR including white paint, light coloured concrete and metallic surfaces. These surfaces can reflect UVR onto the skin and eyes.

What factors affect solar UVR levels?

- **Sun Angle:** The most important factor affecting the level of solar UVR at the earth's surface is the height of the sun in the sky. The higher the sun is in the sky, the shorter path the UVR has to travel through the atmosphere, so less is absorbed resulting in higher levels of UVR at the surface. When the sun is low in the sky the radiation has a longer path to travel so more radiation is absorbed and scattered by the atmosphere resulting in lower levels of UVR at the surface.
- **Geographical Position:** Australia generally has high levels of solar UVR in comparison with Europe and many parts of North America, due mainly to its geographical position close to the equator.
- **Seasonal Effects:** There is significantly less UVR in winter as the sun is lower in the sky. In Melbourne the levels of UVR are approximately three times higher in midsummer than in midwinter. The highest risk months are November to February and this period is generally longer at latitudes closer to the equator.
- **Cloud Cover:** Solar UVR can penetrate through light cloud cover, and on lightly overcast days the UVR level can be similar to that of a cloud-free day. Heavy cloud can reduce the intensity of UVR. Scattered cloud has a variable effect on UVR levels, which rise and fall as clouds pass in front of the sun. UVR levels can be high enough to cause sunburn on cloudy days.
- **Ozone:** This is a form of oxygen that occurs naturally in the upper atmosphere and has the ability to absorb UVC and UVB radiation. Atmospheric absorption prevents all UVC and most of the UVB from reaching ground level.

  Ozone levels rise and fall naturally from day to day and seasonally. Ozone over Australia is generally lowest in March. The ozone "hole" is the significant springtime (September-October) reduction in the total ozone over

Antarctica. Publicity about the discovery of an ozone hole over Antarctica has increased general awareness and caused concern about possible increases in UVR levels in southern Australia.

The ozone hole does not extend as far north as Australia but stratospheric winds can occasionally carry ozone-depleted air towards Australia causing a short-term decrease in ozone and a corresponding rise in UVR levels.

Ozone depletion and the associated increase in solar UVR reaching the earth's surface is a major environmental issue. Other factors such as sun height and variations in cloud cover may have more local influence on the intensity of UVR reaching the ground.

- **Scattering:** Due to scattering of solar UVR by molecules and particles in the atmosphere there is often about as much UVR received from the open sky as there is directly from the sun. If you are in the shade but can see a lot of blue sky you are still exposed to UVR scattered from the sky. At times, the amount of scattered solar UVR that reaches your skin may even exceed that from the direct sun.
- **Environment:** A highly reflective environment can also increase UVR levels. Some ground and building surfaces are quite reflective to UVR. White paint, light coloured concrete, snow, water and to a lesser extent soil can reflect UVR onto the skin.
- **Altitude:** The intensity of UVR increases by about 12% for every 1000 metres increase in altitude. At higher altitudes there is less atmosphere for the UVR to pass through before it reaches the ground so less is absorbed.

  Consequently, people at higher altitudes can be exposed to more UVR than those at sea level. In the Australian ski fields, at an altitude of around 2000 metres, the UVR levels on clear days can be substantially higher than at sea level. The fact that snow is extremely reflective to UVR is an additional hazard.

Can you feel UVR?

When people state that the sun has "sting in it" they are confusing infrared (IR) radiation with UVR. The skin detects IR radiation as a sensation of heat but it does not detect UVR. If enough UVR exposure has occurred to cause sunburn, the damaged skin may become more sensitive to IR.

Is temperature related to UVR?

Solar ultraviolet radiation (UVR) levels are generally not related to temperature. There can be high UVR levels even on cool days unless there is considerable cloud cover. UVR and temperature peak at different times of the day. UVR is usually highest around midday but the temperature is often highest later in the afternoon. In general there is a misconception that high temperatures and UVR intensity are related as most people tend to get sunburnt when temperatures are lower. People tend to assume they require less protection from the sun when temperatures are lower. The intensity of UVR can be high on cool clear days as well as hot days during certain times of the year. Without knowing the level of UVR people may incorrectly use temperature as a guide to the level of sun protection required.

What is windburn?

There is no such thing as "windburn". The wind may dry the skin but it does not burn it. Overexposure to UVR can increase the skins sensitivity. What is described, as windburn is actually sunburn.

What is a Protection Factor?

The concept of a protection factor (PF) is useful when attempting to quantify the UVR protection that products such as fabrics, sunscreen and eyewear can provide.

The PF indicates how much UVR is blocked by a material. For example, a material with a UPF rating of 20 would only allow $1/20^{th}$ of the hazardous UVR falling on its surface to pass through it. This means that this material would reduce the UVR exposure by a factor of 20. Stated another way, this material would block 95% of the UVR and transmit only 5%.

Technical explanation of PF

An effective UVR dose (ED) for unprotected skin is calculated by convolving the incident solar spectral power distribution with the relative spectral effectiveness function and summing over the wavelength range 290 to 400 nm. In order to get the effective dose (ED_m) for the skin when it is protected, the calculation is repeated with the spectral transmission of the protection item as an additional weighting. The PF is then defined as the ratio of ED to ED_m and is given by the equation below [5]:

$$PF = \frac{ED}{ED_m} = \frac{\sum_{290}^{400} E_\lambda \cdot S_\lambda \cdot \Delta_\lambda}{\sum_{290}^{400} E_\lambda . S_\lambda . T_\lambda . \Delta_\lambda}$$

where :

S_λ	is the solar UVR spectral irradiance in W m^{-2} nm^{-1},
E_λ	is the relative erythemal spectral effectiveness (unitless)
T_λ	is the spectral transmission of the item,
Δ_λ	is the bandwidth in nm, and
λ	is the wavelength in nm.

Commonly used protection factors

There are several types of protection factors used to rate the UVR protection provided by specific types of products. To provide adequate sun protection, materials must usually have a PF of 15 or higher. The following table shows that to provide effective protection a material must block more than 93% of UV radiation.

% of UV Blocked	PF
50	2
90	10
93.3	15
95	20
96.7	30
97.5	40
98	50
99	100
99.5	200

These figures assume that the material transmits uniformly across the UV region.

Ultraviolet protection factor (UPF) is a measure of the protection provided by clothing fabrics. The fabric is exposed to a UVR lamp that simulates the sun's intensity around noon. The amount of UVR blocked by the fabric is then calculated. Inclusion of the biological effectiveness of UVR in the calculations ensures that sufficient weighting is given to the UVB wavelengths and that the UPF can be applied readily to exposure situations involving people.

Sun protection factor (SPF) is a measure of the protection provided by sunscreens. SPF is the ratio of the UVR dose that is required to produce a perceptible reddening of skin treated with sunscreen compared to untreated skin. Use of sunscreen of at least SPF 15 is recommended for any areas of the body exposed to UVR.

Eye protection factor (EPF) is a measure of the protection provided by sunglasses and other eyewear. EPF is the ratio of UVR dose to the unprotected eye to that of the protected eye. EPF has a numerical rating scale from 1 to 10 used to classify how well a lens blocks UVR. Sunglasses with an EPF rating of 9 or 10 transmit almost no UVR.

How can you reduce your UVR exposure?

Many forms of protection are available to reduce your exposure to solar UVR. The best protection is to avoid going outdoors during the middle of the day. When outdoors, wear clothing with good body coverage, a hat, sunglasses and a sunscreen. The following strategies can reduce your UVR exposure:

- Avoid going outdoors when the sun is at its highest. UVR peaks between 10am and 2pm (11am to 3pm during daylight-saving time). This practice can dramatically reduce your UVR exposure;
- Wear clothing that covers the arms and legs as well as the body;
- Wear a broad-brimmed or legionnaires style hat to shade the eyes, face, ears and back of the neck;
- Apply at least SPF 15 and preferably SPF 30+ sunscreen to all areas of your body not covered by clothing. Reapply sunscreen every two hours, even on cloudy days. Reapply sunscreen after swimming or perspiring as it does wear off. The greatest problem with sunscreen as UVR protection is that most people apply it too thinly and do not receive the full protection;
- Wear sunglasses when outside. Choose a style of glasses such as wrap around, that prevent the UVR reaching your eyes from the sides;
- Choose shaded areas where you cannot directly see the open sky. Even if you are out of the direct sun, UVR can still reach you from the open sky. UVR can also reflect from some surfaces such as beach sand, white paint, light coloured concrete, snow and water, increasing your UVR exposure;
- Remember that if the temperature drops it does not mean that the UVR level has also decreased; and
- Protect children from excessive sun exposure with shade, suitable clothing, hats, sunglasses and sunscreens. Use pram covers and shades for babies. Young children are unaware of the dangers. Apply sunscreen liberally and often to children following the directions on the container. The greatest problem with sunscreen as UVR protection is that most people apply it too thinly and unevenly and do not receive the full protection.

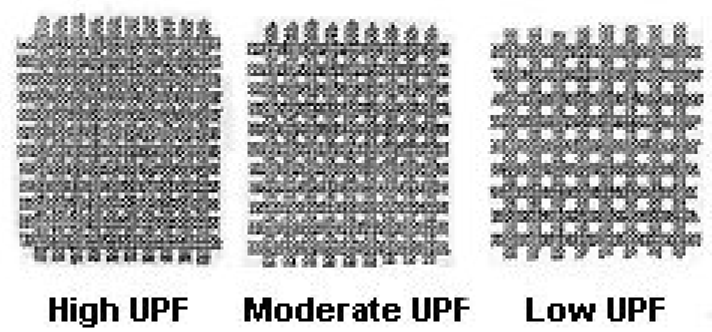
Does clothing offer good UVR protection?
Most sun protective garments rely on the fabric's natural ability to block UVR. Sun protective garments are not usually specially treated, although chemical treatments are available. Laboratory testing determines how effective a material is at blocking UVR and this is often stated on the garment label as a UPF rating. The UPF rating of a material can be determined by placing it under a UVR lamp and measuring the amount of UVR that passes through the fabric. From this UVR transmission data the UPF rating can be calculated.

The UPF rating indicates how much the material reduces UVR exposure. For example, a material with a UPF rating of 20 would only allow $1/20^{th}$ of the hazardous UVR falling on its surface to pass through it. A garment made from this material would reduce UVR exposure on the areas of skin it covered by a factor of 20.

The UVR protection offered by different types of fabrics varies considerably and depends on the factors listed below.

What makes a good sun protective garment?
Several factors determine how effective garments are at reducing UVR:

- **Composition of the fabric:** Different materials such as cotton, polyester and nylon have different natural UVR-absorbing properties.
- **Weave density:** Less UVR passes through tightly woven or knitted fabrics. As shown below the smaller the spacing between the individual fibre strands the higher the protection.



- **Colour:** Many dyes absorb UVR. In darker colours of the same fabric type (black, navy, dark red) will absorb UVR more strongly than light pastel shades (white, sky blue, light green) and consequently will have a higher UPF rating.
- **Tension:** Stretching a fabric may cause a decrease in the UPF rating. This is common in knitted or elasticised fabrics and care should be taken to select the correct size for the wearer.
- **Weight:** Heavier weight materials generally have a higher UPF ratings than lighter materials of the same type.
- **Moisture content:** Many fabrics have lower UPF ratings when wet. The drop in UPF rating depends on the type of fabric and the amount of moisture it absorbs when wet.
- **Design:** As well as considerations of fashion and comfort, selecting garments that are sensibly designed for sun protection can make a large difference to your overall UVR exposure. A shirt with long sleeves and a high collar offers more protection than a short-sleeve shirt without a collar. Loose fitting garments give better protection than garments that are worn close to the skin and also may be more comfortable to wear on hot days. A legionnaire style cap with a flap protects the ears and back of the neck. A broad-brimmed hat shades the face and neck.
- **Condition:** Unless otherwise stated, UPF ratings are made on fabrics that are in new condition. The UPF rating of many cotton based fabrics can improve over the "new" rating after they have been washed at least once. Shrinkage in these fabrics closes small gaps between the fibres and allows less UVR to pass through. However, old, threadbare or faded garments may have a lower UPF rating.
- **UVR absorbers:** Some fabrics are treated to improve the UPF rating. This is usually done if the base fabric has a low natural resistance to UVR. Treatment with a UVR absorber, generally during manufacture, can result in a fabric with a higher UPF rating that still retains the comfort properties of the original fabric.

  Many dyes absorb UVR and therefore increase the UPF rating of the fabric. Some UVR absorbers behave like colourless dyes. They bond to the fabric in a similar way, and have a comparable permanency to coloured dyes. Recently there has been interest in adding UVR absorbers to commercial washing powders.

How effective are windows and window tints at UVR protection?

Although most cars provide substantial shading for the occupants, significant glassed areas create the potential for UVR exposure. Laminated windscreens, which consist of a tough plastic layer bonded between two panes of glass, typically have UPF ratings of 70 or higher. However the UPF of plain window glass as used in car side windows is usually about 15 or less. The amount of UVB radiation transmitted through plain window glass differs markedly between glass types, however most types transmit about 60% of the UVA. This means that a person sitting in a car where the sun can reach them may still suffer UVR exposure.

Most automotive window tints absorb a significant amount of UVR and provide excellent protection. Some tints appear clear to the human eye but strongly absorb UVR. Wearing sunscreen whilst driving is an effective way of preventing sunburn.

How much UVR protection do shade structures offer?

Shadecloths and polycarbonates are synthetic materials whose purpose is to moderate the amount of sunlight entering a particular environment.

Shadecloths

Shadecloths are designed primarily for horticultural use to control visible light for plants. Shadecloths are available in either closely woven or mesh materials. The transmission of solar UVR through shadecloth is dependent on the weave and its gauge with closer weaves offering greater protection against UVR. Shadecloths typically rate between UPF 2 (50% block) to UPF 10 (90% block) and should not be relied upon as the only form of UVR protection.

Awnings

Awnings are a form of shade structure where the canopies are usually made from dense, closely woven materials such as canvas and usually provide very good protection.

Sun umbrellas

Sun umbrellas where the canopies are made from dense, closely woven materials such as canvas usually provide very good protection.

Polycarbonates

Polycarbonate is manufactured in either clear or tinted sheeting. The main purpose of the sheeting is to weatherproof an outdoor area while allowing visible light through. Transparent polycarbonates usually have UPF ratings of 50+.

Evaluating shade structures

UVR can be scattered by particles in the atmosphere and is known as diffuse UVR. This means that apart from UVR reaching the ground directly from the sun overhead a lot of UVR an also reach the ground from the open sky. A person who was shaded from direct sunlight but could see areas of open sky may still receive UVR exposure due to diffuse UVR. UVR can also be reflected from surfaces such as water and buildings. Many types of shade structure provide little or no protection against reflected or diffuse UVR.

Standards such as *AS/NZS 4399 Sun protective clothing – Evaluation and classification* are intended for evaluation of personal sun protective clothing that is worn in close proximity to the skin. When dealing with shade structures such as tents, awnings and umbrellas the protective material is typically at some distance from the person. This may allow UVR directly from the sun, or scattered from the open sky or from reflecting surfaces to reach the occupant. This means that the amount of sun protection the person receives can vary depending on the positioning of the structure.

It is often useful to determine the UPF rating of the materials that comprise shade structures but labelling for a shade structure should make it clear that the UPF rating applies to the material only and not to the sun protection afforded by the structure as a whole. The reason for this is that although the materials may be effective at blocking UV, the effectiveness of shade structures is dependent on the manner in which they are positioned in relation to the sun and the manner in which people use them i.e. the person using the structure cannot be guaranteed to be receiving that much protection at all times.

For example if a tent was positioned so that the sun was streaming in through the open entrance onto the occupant, that person would be receiving little or no protection from the structure. The position of the occupant in the shade structure is very important and the further back the occupants are from the opening the greater the protection.

Labelling for these products should make it clear that the UPF rating is for the material only and not the overall protection provided by the shade structure as this can vary depending on the manner in which it is used. For many types of shade structures it is also appropriate to state that they do not provide protection against reflected or scattered solar ultraviolet radiation, as is required in the labelling of sun protective headwear.

Two factors to consider when evaluating the effectiveness of a shade structure for UVR protection are how protective the materials are that it is made of, and how much coverage does it provide to the user. The effectiveness of the material can be determined by testing it to determine its UPF rating. The coverage, or how much sunlight it prevents from reaching the user depends on the positioning of the structure with respect to the sun. Generally shade structures of larger area offer more protection than smaller ones.

What sun protection precautions should outdoor workers take?

For most outdoor workers the sun is the primary source of ultraviolet radiation (UVR) exposure. Construction workers, landscape gardeners, lifeguards and farmers, for example, have potentially high-risk workplaces due to the long hours they spend outdoors in the sun. This results in greater solar UVR exposures than indoor workers and places them at greater risk of developing skin cancers.

Workers who spend a significant amount of time during the day in a motor vehicle can also receive high levels of solar UVR. The 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.

Protection measures for outdoor workers from solar UVR

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. Workers should avoid exposure to the sun if possible during these times. Even on a cloudy day a worker may still receive high exposure to solar UVR due to scattering and reflection of UVR from surfaces.

A number of simple personal protection measures can help to reduce exposure from solar UVR. Wearing clothing that covers as much unprotected skin as possible is an effective method of reducing UVR exposure. A standardized UPF rating system (AS/NZS 4399:1996 *'Sun Protective Clothing-Evaluation and Classification'*) has been developed to assist consumers in choosing clothing that offers suitable sun protection. The higher the UPF rating the greater the UVR protection offered by the clothing. Garments with UPF ratings of 30 or higher provide all day sun protection to areas of the body they cover.

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; broad brimmed (more than 7cm) hats provide the best protection for the face, neck and ears. Where hard hats are required, brim or neck flaps should be worn.

For the eyes, sunglasses that comply with AS/NZS 1067: 2003 *'Sunglasses and fashion spectacles'* provide excellent protection from exposure to solar UVR. The design of the sunglass frames is very important. Wrap-around style sunglasses reduce the amount of scattered and reflected solar UVR reaching the eyes.

For skin not protected by other means, broad-spectrum sunscreens with SPF ratings of at least 15 but preferably 30+ applied correctly can provide good sun protection. Factors such as thickness of application, 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.

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

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 workers to improve their perception of sun protection. Workers with photosensitivity reactions to UVR may require additional protective measures.

How effective are sunscreens?

In Australia two out of three people will develop some form of skin cancer during their lifetime. Often the best ways to protect skin from the sun are by use of clothing and shade. However, any remaining exposed skin should be protected by use of a sunscreen of at least SPF 15 and preferable SPF 30+. Remember that the purpose of using sunscreens is to reduce UVR exposure, not to extend the time spent outside in the sun.

Sunscreen is used on the skin to stop harmful UVR from reaching the skin. There are two main types of sunscreens, chemical absorbers and physical blockers.

A sunscreen that absorbs UVR is a chemical barrier and is the most common type of sunscreen available. Additionally, these sunscreens may be waterproof, non-greasy and contain a variety of water-soluble or oil soluble chemicals. Chemical sunscreens are usually easy to apply to the skin.

A sunscreen that scatters or reflects UVR from the skin is called a physical blocker. Zinc cream, which contains zinc oxide, is this type of blocker but is generally only used on small areas of skin as it also prevents heat loss and perspiration from the skin. Titanium dioxide is also used in sunscreens due to its reflective properties. The physical blockers tend to mainly reflect UVR, however, they can also absorb UVR at specific wavelengths.

The individual chemicals in sunscreens absorb UVR at specific wavelengths. Broad spectrum sunscreens contain several ingredients that each absorb at different wavelengths and so are effective over more of the UVR spectrum.

The effectiveness of sunscreens is dependent upon many factors including how thickly the sunscreen is applied to the exposed skin. When considering how much sunscreen is adequate, it is internationally accepted that the application should be about two milligrams per square centimetre. This translates to about thirty millilitres (ml), which is approximately six teaspoons, of sunscreen lotion to protect the entire exposed skin of an adult male. Therefore a 120ml tube of sunscreen should only last four applications if used on the entire body of an average adult.

The sun protection factor (SPF) rating indicates the level of protection provided by a sunscreen against UVR. Sunscreens sold in Australia must be labeled with an SPF rating of at least 4, up to a maximum of 30+. Sunscreens of less than SPF 15 offer only moderate to low protection.

A sunscreen with a rating of SPF 15+ would provide a fair-skinned person with 15 times more protection for their exposed skin than if they didn’t use a sunscreen. For example, if a fair skinned person reddens after 10 minutes of sun exposure, then correctly applying SPF 15 sunscreen will provide protection for up to 10 x 15 = 150 minutes. It is important to remember that after 150 minutes in the sun while wearing sunscreen this person would still have received the same UVR exposure as they would have received in 10 minutes if they had not been wearing sunscreen. In both cases their skin has received the same amount of UVR exposure.

Factors that may alter the effectiveness of sunscreen are the time of year, time of day, amount of surface reflection, cloud cover, water resistance and the person’s skin type. Use of sunscreens with a higher SPF rating than SPF 30+ is not generally recommended as they may not provide much greater protection but require an increased amount of active chemicals which may irritate some sensitive skins.

The following table shows that a broad spectrum sunscreen of SPF 15 blocks approximately 93% of the UVR and one of SPF 30 blocks approximately 96% of the UVR. Simply looking at the ratio of the SPF value one can compare the amount of protection offered by SPF 15 and SPF 30 sunscreens. For any exposure time an SPF 30 sunscreen has double the protection of an SPF 15 sunscreen. In practice the amount of sunscreen applied and the evenness of the coverage can have a significant affect on the duration of protection offered by the sunscreen.

SPF rating	% UVR blocked
4	75
8	87
15	93
30	96

The values shown in the above table are approximate

Sunscreen is best applied to clean, dry skin. Sunscreen must be applied at least 15 minutes before going outside to all exposed areas of skin and reapplied every two hours to maintain the stated protection. Reapplication does not give additional protection but ensures that the stated protection is achieved. Application of sunscreen ineffectively or too sparingly may considerably reduce the level of protection for the wearer.

Remember that sunscreens do not block out all of the UVR so a person is not completely protected by sunscreen and may still sunburn.

The current Australian sunscreen standard (AS/NZS 2604:1998 *‘Sunscreen products - Evaluation and classification’*) limits the maximum protection claimed on labelling of sunscreen products to SPF 30+.

Are solariums safe?

Sunbeds used in solariums, and sun tanning lamps are artificial tanning procedures said to offer an effective, quick and harmless alternative to natural sunlight. However, there is growing evidence that the ultraviolet radiation (UVR) emitted by the lamps used in solariums may damage the skin and increase the risk of developing skin cancer. This discussion relates to the use of sunbeds and tanning lamps for cosmetic purposes.

Most solariums claim that only UVA radiation is emitted from the lamps used in sunbeds. However, most lamps also emit some UVB which even in small amounts can be hazardous. The lamps used in solariums need to be tested regularly to monitor the output and the effectiveness of the diffuser in filtering out any harmful UVB or UVC radiation.

Many solariums advertise that artificial tanning does not cause skin aging or skin cancer. However, UVA radiation is known to penetrate the top layer of the skin and can cause premature skin aging and wrinkling. The important thing to remember is that UVR dose accumulated while obtaining the tan increases the risk of developing skin cancer later in life. Also the artificial tan provided by the solarium will not provide adequate protection from the harmful effects of natural sunlight. Individuals with skin that does not tan and burns easily are most at risk of developing skin cancer later in life.

People must also consider exposure of their eyes to UVR emitted from the lamps, which are in close proximity when lying on a sunbed. Permanent eye damage may result from long-term exposure to the UVR. If you intend on using a sunbed wear UV protective eyewear (goggles) to prevent exposure of the eyes to harmful levels of UVR and blue light.

Solariums may produce minor skin irritation in people who already suffer from skin rashes. Also some prescription drugs such as antibiotics and cosmetics may increase a person's sensitivity to UVR. Use of a solarium under these conditions may result in severe sunburn. People who tend to freckle and have a history of childhood sunburn are at high risk of incurring adverse health effects from UVR.

Do artificial light sources emit UVR?

Fluorescent and halogen lamps may emit small amounts UVR. However, research has shown that most do not pose a risk especially if they are fitted with a diffuser or filter that absorbs the UVR. Long-term exposure to unprotected fluorescent or halogen lamps used at close distances may increase UVR exposure.

Tungsten halogen lamps with incorporated reflectors are used extensively in area, display and home lighting. These lamps emit some UVR, which may be a hazard to the skin and eyes of people who remain in close proximity for long periods. In lighting applications where the lamps are close to people they should be fitted with a glass cover to block the UVR emissions.

Are there standards or guidelines related to UVR protection?

Increasing public awareness and interest in UVR protection is due in part to the requirements for occupational protection of outdoor workers as well as the provision of sun protection for the recreational market. In 1989 the National Health and Medical Research Council (NHRMC) issued a standard for occupational exposure limits to ultraviolet radiation, based on International Radiation Protection Association (IRPA) and International Commission on Non-Ionizing Radiation Protection (ICNIRP) limits. An ARPANSA radiation protection standard for occupational exposure to UVR based on the NHRMC standard is in preparation.

Australian clothing standard

In July 1996 Australia became the first country to introduce a standard for evaluating and classifying sun protective clothing (AS/NZS 4399:1996 *'Sun Protective Clothing-Evaluation and Classification'*). The standard uses the term ultraviolet protection factor (UPF) to designate the amount of protection provided by personal clothing and also classify clothing into broad protection categories as shown in the following table.

Protection category	UPF ratings	% UVR blocked
Excellent protection	40, 45, 50, 50+	More than 97.5
Very good protection	25, 30, 35	95.9 to 97.4
Good protection	15, 20	93.3 to 95.8

In Australia garments with UPF ratings less than 15 cannot be labelled as sun protective. Garments with UPF ratings higher than 50 are labelled as UPF 50+. ARPANSA offers a UPF testing service for rating sun protective materials.

Companies can have their materials tested for UPF rating then make UPF labels follow the directions for in AS/NZS 4399. ARPANSA can supply ready made UPF swing tags that are made according to this standard.

Australian sunglass standard

In 1971 Australia was the first country to introduce a national standard for sunglasses (AS 1067.1: 1990 '*Sunglasses and fashion spectacles')*. Australia is now one of the few countries along with UK, Germany, France and USA to have a standard for sunglasses. AS/NZS 1067 is the only mandatory sunglass standard in the world and the requirements for complying with the *Safety Requirements* and *Performance Requirements* sections are quite demanding. All sunglasses sold in Australia must comply with the standard.

In 2003 a revised sunglass standard AS/NZS 1067:2003: *'Sunglasses and Fashion Spectacles'* was released. The new standard defines five categories of lenses:

Description of lens
Fashion spectacles that are not sunglasses and provide very low reduction in sunglare with some UV protection
Fashion spectacles that are not sunglasses and provide a limited reduction in sunglare with some UV protection
Sunglasses that provide a medium level protection against sunglare with good UV protection
Sunglasses that provide a high level of protection against sunglare with good UV protection
Sunglasses for special purposes that provide a very high level of protection against sunglare with good UV protection

All sunglasses sold in Australia must be labelled to indicate which AS/NZS 1067:2003 category they comply with to provide consumers with the necessary information to select the correct sunglasses or fashion spectacles depending on their intended use.

For best protection choose wrap around sunglasses to reduce the amount of UVR entering from the sides. Non-wraparound designs allow UVR to enter from the sides reducing protection to the eyes even though the lenses themselves may provide 100% UVR protection. ARPANSA developed an eye protection factor (EPF) where sunglasses that comply with AS/NZS 1067:2003 can be assigned an EPF rating from 1 to 10. Sunglasses with EPF values of 9 and 10 transmit almost no UVR.

Sunglasses that provide excellent protection need not be expensive; the price of the sunglasses should not be used to gauge the quality of the lenses in respect to protection from UVR. Low cost sunglasses, which comply with the sunglass standard, may also provide excellent protection against UVR.

Prescription glasses, either clear or tinted, are excluded from the AS/NZS 1067 but may still provide protection against UVR. Optometrists have a professional duty to ensure that prescription sunglasses comply with the standard. The standard also covers children's sunglasses. It does not cover toy sunglasses that are clearly identified as such, ski goggles, spectacles for special purposes such as protection in solariums and protection against artificial UVR sources.

Australian safety glasses standard
In 1986 Australia and New Zealand published a joint standard for protective eyewear used in industry. The current standard for safety glasses is AS/NZS 1337:1992 *'Eye protectors for industrial applications'*. UVR protective eyewear is required in a variety of occupations both indoors and outdoors where UVR may reach potentially hazardous levels. The requirements of protective eyewear for indoor situations are markedly different from outdoor occupational situations. Indoor protective eyewear is generally clear yet transmitting little or no UVR. If the source being used is very bright in the visible region then the eyewear may require some tinting. Eyewear for use outdoors will generally require considerable tinting since the wearer will sometimes be working in full sunlight and possibly near highly reflective surfaces.

Australian sunscreen standard
Australia first published a standard for sunscreen products in 1983. The current joint Australian and New Zealand standard is AS/NZS 2604:1998 *'Sunscreen Products Evaluation and Classification'*. A major change in the current edition was the lifting of the maximum SPF that may be claimed on a product label from 15+ to 30+. This means that SPF 30+ is the highest rating that can be used for labelling sunscreen products in Australia. Other changes relate to category descriptions and an explanation of the sun protection factor (SPF) rating system.

The following table shows the major changes from the previous standard:

Current categories	**Previous categories**	**SPF range**
Low protection	Moderate protection	4 to 8
Moderate protection	High protection	8 to 15
High protection	Very high protection	15 to 30
Very high protection	-	30+

Currently the Australian standard requires the labelling of the container to show the sun protection factor with a numerical value not greater than 30+ and clear/adequate directions for the use of the product. The name of all active ingredients must also be stated on the container including its broad spectrum and water resistance properties. The existing requirements for labelling of sunscreen products require the expiry date and storage conditions based on stability data to be shown on the container. The expiry date for sunscreens is usually one to two years but varies among manufacturers depending on the chemical constituents used.

Australian solarium standard
In 1983 Standards Australia introduced AS 2635:1983, a set of requirements on the installation, maintenance and operation of commercial solariums. In 2002 a new joint standard, AS/NZS 2635:2002 *'Solaria for Cosmetic Purposes'*, was published and applies to establishments where artificial tanning treatments are offered, such as health clubs, sporting clubs and beauticians. The main aim of the standard is to establish a safer environment for solarium users and operators. Some of the new requirements specify that individuals under 15 years of age are not permitted to use sun-tanning units under any circumstances. Also, users must complete a consent form prior to commencement of a tanning session. The standard excludes sunlamps sold for use at home.

Clothing standards in the USA
There have been sun protective clothing standards in the USA since 2001. In the USA testing is performed according to the standard AATCC 183 available from the American Association of Textile Chemists and Colorists (http://www.aatcc.org). In Australia the fabric is tested in new condition. In the USA there is an additional preparation stage in which the fabric is first laundered, exposed to simulated sunlight and chlorinated water. This is done according to ASTM D6544 available from the American Society for Testing and Materials (http://www.astm.org). Labeling in the USA is specified in ASTM D6603.

British and European clothing standards
The recently-released European standard EN 13758-1 replaced BS 7914. BS 7949 (UV protection requirements for children's clothing) remains current but will eventually be replaced by EN 13758-2.

Similarities and differences among clothing standards
The calculation and expression of results is similar in EN 13758-1, AATCC-183 and AS/NZS 4399. All three standards report results as a UPF rating. When samples are found to have a UPF rating over 50, EN 13758-1 reports them as >50 where as ASTM D6603 and AS/NZS4399 report them as 50+.

EN 13758-1 (and BS 7914) stipulates that fabric samples are to be conditioned at a specified temperature and humidity before testing. AS/NZS 4399 does not specify any conditioning. ASTM D6603 specifies that the fabric samples should be conditioned with laundering, UV exposure and chlorinated pool water equivalent to two years of normal use.

EN 13758-1 and AATCC 183 uses a solar spectrum measured in Albuquerque whereas AS/NZS 4399 uses a solar spectrum measured in Melbourne. UPF results calculated with either spectrum do not differ significantly.

EN 13758-1 and AATCC 183 provides for reporting of measurements made when the fabrics are wet and/or stretched. AS/NZS 4399 currently specifies testing in the dry and relaxed state only.

AS/NZS 4399 specifies testing and labelling requirements whereas EN 13758-1 is concerned only with testing. ASTM D6603 specifies USA labelling requirements.

How can you test sun protective materials?
ARPANSA operates a service for measuring the Ultraviolet Protection Factor (UPF) rating of sun protective materials. UPF testing is performed according to Australian/New Zealand Standard AS/NZS 4399. This testing service has been operating since 1990.

The ARPANSA UPF Testing Service can be contacted by phone +61 3 9433 2211 or fax +61 3 9432 1835. Information is also available from the ARPANSA web page.

How can you label products with a UPF rating?
Labeling of sun protective clothing is done according to Australian/New Zealand Standard AS/NZS4399. Companies can have their materials tested to determine the UPF ratings then follow the directions in this standard and make their own UPF labels.

ARPANSA can supply ready-made UPF tags made according to AS/NZS4399. The ARPANSA tags feature one of ARPANSA's trademarks, known as the UPF Certification Trade Mark, and companies that wish to use the ARPANSA UPF tags must first licence use of this trademark. Further information is available from the ARPANSA UPF Testing Service or from the ARPANSA web page.

References
1. Thakekara M.P., (1973) *Solar energy outside the earth's atmosphere.* **Solar Energy 14**: 109-127.
2. Bird R.E., Hulstrom R.L., Kliman A.W. and Eldering H.G., (1982) *Solar spectral measurements in the terrestrial environment.* **Appl Optics 21**: 1430-1436.

3. Joint ISO/CIE Standard ISO 17166:1999/CIE S007-1998 *Erythema Reference Action Spectrum and Standard Erythema Dose.*
4. CIE Research Note, *A reference action spectrum for ultraviolet induced erythema in human skin*. **CIE J. (1987)**, **6**, 17-22.
5. Gies H.P., Roy C.R., Elliott G. and Zongli W., (1994) *Ultraviolet radiation protection factors for clothing*. **Health Physics** 67: 131-139.

Further information about UVR protection

For further information, services and products related to personal UVR protection contact your local state cancer authority:

Cancer councils:

Cancer Council ACT...(02) 6262 2222
Cancer Council New South Wales..(02) 9334 1982
Cancer Council South Australia ....(08) 8291 4111
Cancer Council Tasmania...(03) 6233 2030
Cancer Foundation of Western Australia ....(08) 9381 4515
Cancer Society of New Zealand Inc. .... +61 4 494 7270
Northern Territory Anti-Cancer Foundation................................. 1800 188 070
Queensland Cancer Fund ....(07) 3258 2200
The Cancer Council Australia ....(02) 9306 3100
The Cancer Council Victoria...(03) 9635 5000

Sources of UVR protection information on the Internet

AATCC	www.aatcc.org
ASTM	www.astm.org
ARPANSA	www.arpansa.gov.au
Australian Academy of Science	www.science.org.au
Australian Bureau of Meteorology	www.bom.gov.au
Australian Suppliers Database	www2.austrade.gov.au/aod/IndustryC21.asp
British Standards Institute	www.bsi.org.uk
ICNIRP	www.icnirp.de
IRPA	www.irpa.net
National Occupational Health and Safety Commission	www.nohsc.gov.au
National Radiological Protection Board	www.nrpb.org.uk
Skin and Cancer Resources	www.melanoma.com
Standards Australia	www.standards.com.au
SunSmart	www.sunsmart.com.au
The Cancer Council Australia	www.cancer.org.au
The Cancer Council Victoria	www.accv.org.au
WHO Intersun (UV Site)	www.who.int/peh-uv/index.htm
World Health Organisation	www.who.int
UPF Certification Trade Mark	www.arpansa.gov.au/upfcert.htm.
UPF Swing Tags	www.arpansa.gov.au/swing_tag.htm
UPF Testing Services	www.arpansa.gov.au/fab_test.htm

Australian standards related to UVR protection

AS 4174: 1994 Synthetic Shadecloth.

AS/NZS 2635: 2002 Solaria for Cosmetic Purposes

AS/NZS 2604: 1998 Sunscreen products - Evaluation and classification

AS 1067.1: 1990 Sunglasses and fashion spectacles

AS/NZS 1337: 1992 Eye protectors for industrial applications.

AS/NZS 4399: 1996 Sun protective clothing - Evaluation and classification

Official guidelines on UVR protection

National Health and Medical Research Council. Occupational standard for exposure to ultraviolet radiation. Radiation Health Series No.29. Canberra: NHMRC; 1989

National Occupational Health and Safety Commission (NOHSC) guidelines:

- UV Radiation and Outdoor Work
- Guidance Notes for the Protection of Workers from Solar UVR
- Occupational Standard for Exposure to UVR (1989)
- Solar Radiation Protection for Outdoor Workers
- UVR: Sources, Biological Interaction and Personal Protection

Explanation of some UVR-related terms

Cataract - Clouding of the lens of the eye caused by UVR exposure.

EPF - Eye Protection Factor. Applied to sunglasses tested in accordance with Australian Standard AS1067: 1990.

MED - Minimal Erythemal Dose. The amount of UVR exposure required to cause perceptible reddening of the skin of fair-skinned people. MED is not a standard measure of UVR exposure and only considers individuals sensitivity to UVR. One MED is equivalent to an erythemal effective radiant exposure of 200 Jm^{-2}.

Erythema - Reddening of the skin due to UVR exposure, as in sunburn.

Nanometer – (nm) A unit of length that is 10^{-9} meter, or one billionth of a meter.

Photoconjunctivitus - a painful inflammation of the conjunctiva, the tissue coating the eyelid and part of the eyeball.

Photokeratitis – a painful inflammation of the cornea of the eye.

SED – Standard Erythemal Dose [3]. The International Committee of Illumination (CIE) [4] undertook a review of the current terminology used to describe erythemal effects. Until recently the term MED was used widely as a measure of erythemal radiation. The term SED was introduced as a standardised measure of erythemal UVR. One SED is equivalent to an erythemal effective radiant exposure of 100 Jm^{-2}.

SPF - Sun Protection Factor. Applied to sunscreens and is a measure of the amount of protection against UVR provided by a sunscreen. Sunscreen SPF ratings are determined by testing sunscreens on the skin of human volunteers in accordance with Australian Standard AS2604: 1998.

Skin cancer - Malignant skin damage due to UVR exposure. Three common types are **basal cell carcinoma** and **squamous cell carcinoma** and **melanoma**.

Sunburn - Reddening of the skin due to UVR exposure, also known as erythema.

UPF - Ultraviolet Protection Factor. This value is a measure of the UVR protection provided by a fabric. UPF ratings are determined by testing fabrics in a laboratory in accordance with Australian Standard AS/NZS4399: 1996.

UVR - Ultraviolet Radiation. Refers to all ultraviolet radiation in the range 100 nanometres to 400 nanometres. Solar UVR that reaches the earth's surface contains radiation in the range 290 to 400 nanometres due to atmospheric

UV-Index - The UV-Index was developed from a joint recommendation of the World Health Organization (WHO), the World Meteorological Organization, the United Nations Environment Programme, and the International Commission on Non-Ionizing Radiation Protection. The UV Index is a unitless number relating to how much solar UVR reaches the earth's surface. The higher the UV-Index the more UVR present and the greater the potential for skin and eye damage. In 2002 the UV Index categories were revised to improve its use as an educational tool to promote sun protection worldwide. The "Global Solar UV Index – A Practical Guide" can be found at the WHO's Intersun web site.