



SOLAR RADIATION: THE FACTS

- Facts and figures
- Find out more
- Free resources



WORKING TOGETHER TO BEAT OCCUPATIONAL CANCER

SOLAR RADIATION

WHAT IS IT?

Solar radiation is the radiant energy emitted by the sun. The sun emits different kinds of light, some of which we can see and others that are invisible:

- the visible light you see
- the infrared radiation you feel as heat
- the ultraviolet (UV) radiation that produces tanned skin.

It's the UV radiation element of the sun which can lead to premature ageing, wrinkles and skin cancer if precautions aren't taken to protect our skin when outside.

UV radiation is classified into three bands:

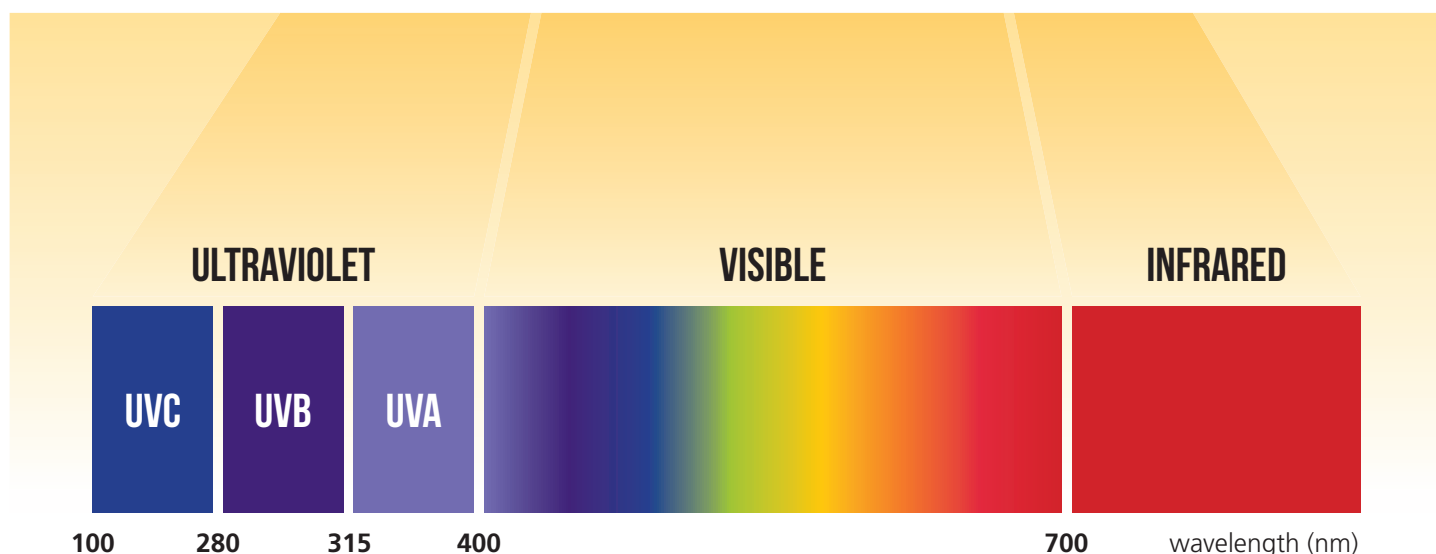
- UVA – accounts for around 95 per cent of the UV radiation reaching the earth's surface. This type penetrates deeply into the skin and is principally responsible for premature ageing and wrinkling of the skin, as well as skin cancer
- UVB – the majority of this type of UV radiation is filtered by the ozone layer before reaching the earth's surface. This type of radiation is more damaging than UVA, affecting outer layers of the skin and causing sunburn, as well as premature ageing, wrinkles and ultimately skin cancer
- UVC – the most dangerous type of UV radiation, but mostly prevented from reaching the earth's surface by the ozone layer.

Solar radiation is classified as a Group 1 carcinogen by the International Agency for Research on Cancer, part of the World Health Organization. It is treated as a definite cause of cancer in humans. Ultraviolet radiation (encompassing UVA, UVB and UVC) and UV-emitting tanning devices are also classified as definite human carcinogens (Group 1) by IARC.

Today, the risk of getting skin cancer from sun exposure is well known and widely understood – we hear about it in the media and we see the marketing associated with sun creams and other products, almost universally aimed at consumers in the holiday, sport and leisure markets. In contrast, in many industry sectors, the risks aren't acknowledged or managed properly, often because there isn't enough awareness of the scale of the issue, and because of the myths around how sun damage can actually happen and risk factors associated with different climates – even misunderstandings around potential vitamin D deficiency from lack of UV exposure. There are cultural challenges in some industries too – for example a 'macho' culture in the face of certain risks in some parts of the construction sector.

The reality is that the risks to ordinary holiday-makers targeted by sun product advertising campaigns aren't comparable to the risks faced by millions of outdoor workers, who for significant periods of the year are typically exposed to solar radiation for hours at a time, day in, day out. We also need to bear in mind that outdoor workers may have long term, chronic solar radiation exposure to their head, neck and hands – but with their arms, legs and trunk exposed intermittently too.

SOLAR RADIATION



WHO IS AFFECTED?

Anyone working outside in the sun can be affected – outdoor work doesn't have to be full-time to pose a problem.

MAIN RISK EMPLOYMENT AREAS:

agriculture and rural industries, construction, dock and maritime industries, grounds and landscape management, outdoor leisure, entertainment and professional sports, police services, railroad working, refuse collection and recycling, roadworking, telecommunications, traffic and parking control, water and sewage treatment

PEOPLE WHO COULD BE AT RISK:

construction workers, dock and maritime workers, farmworkers and other rural workers, glaziers, grounds and landscape workers, outdoor-based police officers, outdoor leisure and entertainment workers, outdoor play supervisors, painters and decorators, postal workers, professional outdoor-based sportspeople, railroad workers, refuse and recycling collectors, roadworkers, roofworkers, signage and outdoor advertising installers, telecoms engineers, traffic and parking workers, water treatment workers

HOW DANGEROUS IS SOLAR RADIATION IN YOUR BUSINESS?

It depends what people involved with your business do, and the country you operate in.

Exposure will vary according to the time of day, the time of year, the altitude and how strong the solar radiation is in different parts of the world. The closer to equatorial regions, the higher the levels of solar UV. Some studies, for example one in the UK which monitored UV levels from 1989 to 2008, suggest that solar radiation levels are getting steadily higher year on year.

The skin type of individual workers is particularly important – have a look at the skin type table. Skin type affects how skin reacts in the sun and how likely individuals are to develop skin cancer. Remember that skin type is genetic; it doesn't vary according to how tanned someone is.



HOW?




Sun exposure is the main cause of skin cancer. The simple fact that skin has changed colour after being exposed to the sun shows that it's being damaged. Sunburn is a reaction to over-exposure of UV radiation – the top layers of skin release chemicals that make blood vessels expand and leak fluid causing swelling, pain and redness. Without protection from the sun, UV radiation starts to penetrate deep into the layers of the skin and damages skin cells, which can lead to the cell mutations associated with cancer.

Worldwide, sun exposure is the main cause of both malignant melanoma and non-melanoma skin cancer. Malignant melanoma is an aggressive form of cancer, less receptive to treatment than non-melanoma skin cancer, and has a higher death rate, especially if diagnosis is delayed and the cancer has spread. Non-melanoma skin cancer, which includes basal cell (rodent ulcers) and squamous cell carcinoma, is rarely fatal but requires treatment and sometimes minor surgery, which can be disfiguring, particularly on the head and neck. Cancer Research UK suggests that people who have been diagnosed with a non-melanoma skin cancer are nine times more likely to get it again. Both non-melanoma skin cancer and malignant melanoma have been shown to be associated with chronic exposure, typically experienced by many outdoor workers, although for malignant melanoma intermittent sun exposure and sunburn history are considered particularly important.

New research commissioned by IOSH from Nottingham University into sun exposure in the UK construction sector found that awareness around solar radiation risks is generally poor – two thirds of workers outside for an average of nearly seven hours a day thought they were not at risk, or didn't know whether they were or not. Fifty-nine per cent of construction workers reported having sunburn at least once in the last year. Just over 40 per cent thought there was no need to wear sunscreen on a cloudy day. Most didn't use measures to protect themselves against sun exposure. Both workers and managers didn't see sun safety as an important issue – mainly because of a misperception that the UK climate doesn't pose a great risk of skin cancer.

SKIN CANCER CASES ARE RISING FASTER IN THE UK THAN IN THE REST OF EUROPE

THE FITZPATRICK SKIN TYPE SCALE

I IVORY Characteristics Pale skin, light or red hair, prone to freckles. Burns very easily and rarely tans Sun protection At the greatest risk of developing skin cancer. Needs to protect skin, preferably with clothing 	II BEIGE Characteristics Fair skin, likely to have light hair, blue or brown eyes. Some have dark hair but still have a fair skin. Usually burns but may gradually tan Sun protection At the greatest risk of developing skin cancer. Needs to protect skin, preferably with clothing 	III LIGHT BROWN Characteristics Light olive skin with dark hair and brown or green eyes. Burns with long exposure to the sun but generally tans quite easily Sun protection Should protect themselves in strong sunshine 	IV MEDIUM BROWN Characteristics Brown eyes and dark hair. Burns with very lengthy exposures but always tans easily Sun protection Should protect themselves in strong sunshine 	V DARK BROWN Characteristics Naturally brown skin, brown eyes and dark hair. Burns only with excessive exposure to the sun. Skin easily darkens further Sun protection Should protect themselves when outdoors in the sun for a long time 	VI VERY DARK BROWN Characteristics Black skin with dark brown eyes and black hair. Burns only with extreme exposure to the sun. Skin very easily darkens further Sun protection Should protect themselves when outdoors in the sun for a long time 
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HOW MANY?

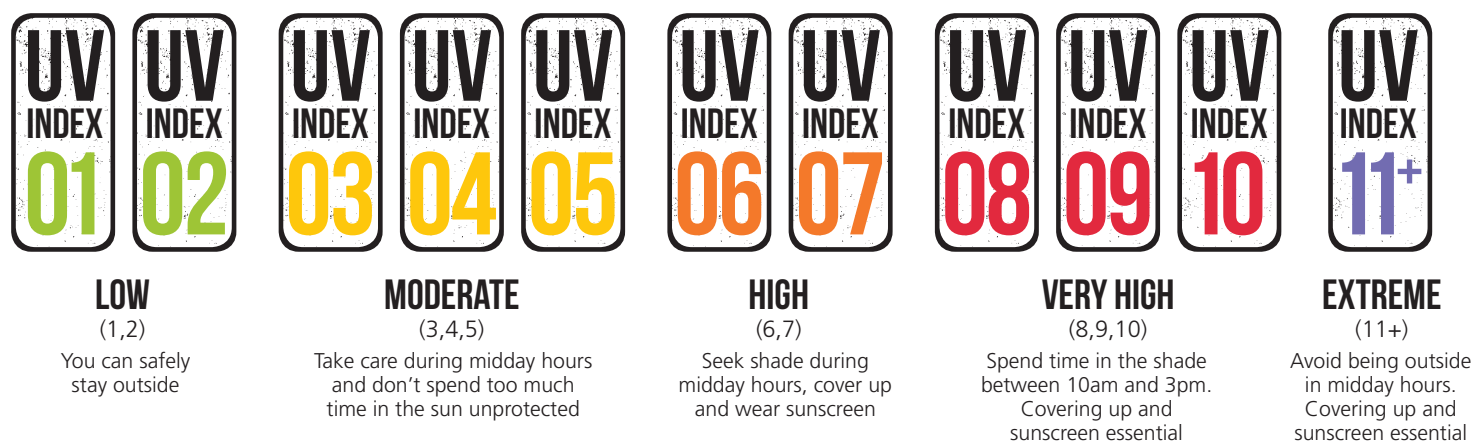
Worldwide, skin cancer is the most common cancer – non-melanoma skin cancer accounts for about 30 per cent of all newly diagnosed cancers. The World Health Organization estimates that between 2 million and 3 million non-melanoma skin cancers and 132,000 melanoma skin cancers occur globally each year. In the UK, there are around 100,000 cases of non-melanoma skin cancer registered a year, although it's estimated that about a third of cases go unrecorded because many patients have more than one tumour and often only the first is recorded. There is evidence that skin cancer is increasing – recent figures show a jump of more than 80 per cent in cases of malignant melanoma of the skin for men. The incidence rate for non-melanoma skin cancer is thought to be rising faster in the UK than in the rest of Europe.

From an occupational perspective, it's difficult to achieve accurate estimates of people exposed to solar radiation at work – only one or two countries have estimated exposure levels. In Germany, it's been estimated that 2.5 million to 3 million outdoor workers are exposed. In Great Britain, it's estimated that 5.5 million people have been exposed to solar radiation through their work – in the service industries, construction sector, manufacturing and agriculture.

Cancer Research UK suggests that outdoor workers are at higher risk from non-melanoma skin cancer (43 per cent higher risk of basal cell carcinoma and 77 per cent higher risk of squamous cell carcinoma).

According to new research commissioned by IOSH into sun exposure at work in Britain, malignant melanoma (the more serious form of skin cancer) kills nearly 50 people each year, with 240 new cancer cases being registered. The majority affected are men, and just under half those diagnosed with malignant melanoma linked to occupational exposures are under 65. These findings, from Imperial College London, are echoed in studies from around the world, including North America, Australia and other European countries. In addition, at least 1,500 new cases of work-related non-melanoma skin cancer (more treatable than malignant melanoma) are also registered each year in Britain, with 12 deaths. Imperial College's research shows that 55 per cent of work-related non-melanoma skin cancer cases and 42 per cent of malignant melanoma cancer cases involve construction workers – other key sectors include agriculture, public administration/defence and land transport.

THE UV INDEX



WHAT YOU NEED TO DO

Skin cancer is an avoidable disease. Tackling solar radiation exposure is relatively easy to achieve, and doesn't have to be costly. Start by assessing the risks of exposure:

- do any employees work regularly outside?
- are workers exposed to higher levels of solar radiation for significant periods? Remember that even on cloudy days there can be enough radiation to damage the skin – 30–40 per cent of UV rays can penetrate overcast skies, and up to 80 per cent gets through sky half covered in clouds. The strength of solar UV radiation isn't connected to temperature and can bounce off reflective surfaces like metal, water, snow and some concrete finishes
- are workers unprotected from the effects of solar radiation?

If you answer 'yes' to these basic questions there could be a risk of people being harmed by solar radiation and you'll need to either prevent or control the potential exposure.

SUN EXPOSURE CAUSES 99 PER CENT OF NON-MELANOMA SKIN CANCER AND UP TO 65 PER CENT OF MALIGNANT MELANOMA SKIN CANCER

Typical actions to control exposure, implemented as part of a sun safety strategy or initiative, include:

- checking the UV index from the weather forecast, and communicating information to relevant workers, alongside prompts to use protective measures to minimise exposure. Many weather forecast apps and websites include the UV index – you can also get monitoring devices that trigger action at certain levels. Action should be taken when the index is at three or above
- avoiding or minimising exposure to direct sunlight in the middle part of the day – 60 per cent of daily UV radiation occurs between 10.00 and 14.00. Many advise minimising exposure until at least 15.00. 'Holloway's rule' indicates when UV exposure is more likely to be at a higher level – when your shadow is shorter than you are tall, the sun is more likely to burn
- regularly swapping job tasks between workers to make sure everyone on the team can spend some time in the shade

**90 PER CENT OF
SKIN CANCER
DEATHS COULD
BE PREVENTED IF
EXPOSURE TO UV IS
CONTROLLED**

- using heavy duty cover or shade when working outdoors in the sun – shade can cut UV exposure by 50 per cent or more. Check protection levels with your supplier
- making sure rest breaks are taken in shaded areas or indoors – sitting water points in shaded areas or indoors can help encourage breaks to be taken out of the sun
- if employees are regularly driving during high UV months, adding UV protective films or tints to plain glass vehicle windows if they're not laminated (lamination can filter most UVA). Of course, on side windows, lamination, films or tints are only effective when the windows are closed, so this measure is less likely to be successful in vehicles without air-conditioning
- raising awareness of solar radiation issues with workers, using toolbox talks or training sessions – using a resource like IOSH's free 'Sun safety in construction' film will help get the message understood and encourage outdoor workers in any sector to take responsibility for their own health
- wearing long-sleeved, loose-fitting tops and trousers when working outdoors during months with high UV levels – you'll need to check the ultraviolet protection factor (UPF) rating and make sure the design of the clothing fits the job and doesn't introduce other hazards. 'High wicking' fabrics are designed to draw moisture away from the skin
- wearing wide-brimmed hats that shade the face, head, ears and neck or if safety helmets are worn, using those fitted with Legionnaire-style neck flaps
- wearing sunglasses with 100 per cent UV protection or using UV-filtering safety goggles with the same level of protection if the work means physical eye protection is needed. Look for the 'UV 400' marking
- using high factor sunscreen where the skin can't be protected by other measures, for example, on the hands, face and lips. Sunscreen should be water-resistant and have 'broad spectrum' protection, with a sun protection factor (SPF) of at least 30 and a UVA rating of four or five stars. Sunscreen

BEFORE TREATMENT



Non-melanoma skin cancer

AFTER TREATMENT



People diagnosed with an NMSC are nine times more likely to get it

should only be used alongside other protective measures – it's best not to rely on sunscreen alone. Sunscreen should be applied half an hour before exposure and reapplied at least every couple of hours. If skin has been exposed to dusts, it should be washed before sunscreen is reapplied, to avoid causing dermatitis. 'More is better' – it's recommended that sunscreen should be applied very generously

- encouraging workers to check their skin for changes to moles or other changes. Detecting the early signs of skin cancer and undergoing early treatment can save lives

You should also check whether any workers could be suffering from photosensitivity, where eyes and skin become abnormally sensitive to UV radiation. Photosensitivity can be caused by a range of substances including some industrial chemicals, plants and medication.

Research commissioned by IOSH from Nottingham University suggests that to shield the body, arms and legs from solar radiation it's more effective to issue workers with clothing rather than offering sunscreen and encouraging workers to use it – it's difficult to reapply in dusty or dirty conditions and tougher to make sure that work teams are using it effectively.

Sunscreen is less effective than covering up with clothing in any case – studies show that providing sunscreen can lead to people taking more risks, for example relying on cream alone rather than covering up, or forgetting to reapply it. Sunscreen is obviously still needed to protect the face, assuming that headgear shields the neck and ears, and of course the hands if gloves aren't worn.

Although protective equipment should usually only be used as a last resort, in the case of solar radiation it will typically form a significant part of your control programme. Relying heavily on controls like protective clothing means that you may need to concentrate on changing the way people do things. You should explain to your employees why these actions are necessary to protect their health – if people understand why you're making changes, they're more likely to comply. It's worth carrying out observational assessments to see if the controls are working, and that people are doing what they've been asked to do.

If your employees have to wear protective clothing and equipment to help cut down solar radiation exposure, make sure it fits properly and comfortably, especially when the temperature is rising – it's a common reason not to bother using it. Talk to your supplier about getting the most appropriate equipment for your workforce, and include workers in the choices you make. You also need to make sure workers wear the equipment at the right times.



**GETTING SUNBURN
JUST ONCE EVERY TWO
YEARS CAN TRIPLE THE
RISK OF MELANOMA**

After you've put new control measures in place you should assess the risk again to see if the actions you've taken have made a difference – for example, are task rotations working in practice, are workers following site rules on taking rest breaks under cover?

THE LAW

You'll need to check legal requirements for the country you operate in. In the UK, there are three pieces of legislation that can be interpreted as applicable to sun safety.

Under the Health and Safety at Work Act employers should assess and control health and safety risks. The Management of Health and Safety at Work Regulations, with an emphasis on risk assessment, can similarly be interpreted in the context of sun exposure. The Construction (Design and Management) Regulations are also relevant here, especially the regulation referring to outdoor work and protection from the weather.

In the UK, while health surveillance isn't compulsory for workers exposed to solar radiation, the Health and Safety Executive's guidance says that health surveillance is required if these three criteria are met:

- there is an identifiable disease/adverse health effect and evidence of a link with workplace exposure
- it is likely the disease/health effect may occur
- there are valid techniques for detecting early signs of the disease/health effect.

In addition to formal health surveillance, you could also, for example, encourage basic self-checks for mole or skin changes among outdoor workers. Use our **free pocket card**, 'Check it out', with simple tips on what to look out for, as well as a reminder of protection measures. Given how reluctant many men are to visit their doctor, you may also want to consider annual skin checks by a trained health professional as an additional way of trying to catch possible skin cancers in the early stages. This could form part of a more general

health check-up, or fit into a health and wellbeing campaign. Remember that health surveillance of workers alone is the least effective strategy in terms of preventing new cases of cancer, although it can help raise awareness of health issues and reinforce the need for protective measures.

You should also give people who could be at risk from exposure to solar radiation information about the possible risks and how exposure can be cut down – download or order copies of our **free leaflet**, 'Skin deep?' and **posters**, reminding workers of protective measures. And you need to instruct or train affected employees too – the free IOSH 'Sun safety in construction' **film** – at www.notimetolose.org.uk/sunsafety – is a good introduction, and is relevant in most outdoor sectors. The hard-hitting short film can be used as part of toolbox talks and induction training, and is designed to get across the risks of over-exposure to solar radiation – and how to protect yourself at work. You can also use our 'My story' **film**, featuring a skin cancer sufferer, to bring home the dangers of sun exposure. For a lighter approach, use our 'Fake or for real' **mythbuster quiz**.

If you need to brief your management team about the risks from solar radiation, then use the IOSH 'Sun safety' film to set the scene, and hand out our **briefing sheet**, giving a quick overview of the risks, and how to tackle them.

New IOSH-commissioned research into the UK construction sector, focusing on large construction companies, found more than 70 per cent of workers had never had any sort of training on the risks of working in the sun

**UP TO 80 PER CENT
OF UV RAYS CAN
PENETRATE CLOUDS**

MORE INFO

- Download IOSH-commissioned research from Imperial College London into malignant melanoma cases caused by solar radiation at work in Britain at www.iosh.co.uk/skincancer
- Download IOSH-commissioned research from Nottingham University on sun safety in the UK construction industry at www.iosh.co.uk/sunsafety
- Get more information and guidance on skin cancer, including early signs to look out for, from Cancer Research UK at www.sunsmart.org.uk
- Download a free UV exposure app giving forecasts for over 10,000 locations worldwide at www.metoffice.gov.uk/health/healthissues/uvandsunhealth/uvapp
- The Health and Safety Executive has basic guidance on working in the sun. Download 'Sun protection: advice for employers of outdoor workers' at www.hse.gov.uk/pubns/indg337.pdf, and 'Keep your top on' at www.hse.gov.uk/pubns/indg147.pdf
- get free awareness-raising materials on skin cancer from the British Association of Dermatologists at www.bad.org.uk/for-the-public/sun-awareness-campaign
- Get more information from guides such as at webcommunities.hse.gov.uk/connect.ti/OccupationalDisease/view?objectId=528389
- Use sample risk assessments and other materials from skin cancer charity Skcin at www.sunsafeworkplaces.co.uk
- Look at the International Agency for Research on Cancer's overview of radiation, including solar radiation, at monographs.iarc.fr
- Get an overview of international data at occmed.oxfordjournals.org/content/59/2/82.full.pdf+html?sid=18cd595e-90c0-4352-a076-766945650c65
- Read an academic review of the effects of solar radiation on workers at www.researchgate.net/publication/8043747_Skin_cancer_as_an_occupational_disease_the_effect_of_ultraviolet_and_other_forms_of_radiation
- Data from clinical specialists, occupational physicians and GPs for the UK's Health and Occupation Reporting network found that among skilled tradesmen exposure to solar UV was the suspected cause in all but a single reported case of skin cancer – find out more at occmed.oxfordjournals.org/content/60/5/340.full.pdf+html?sid=4c769615-7993-4b12-8355-7b303d15af76. Cases reported through the Health and Occupation Reporting network showed that some construction workers were at higher risk of getting skin cancer than other workers from a similar social group and background
- Find out about Australia's successful sun safety campaign at www.cancer.org.au/preventing-cancer/sun-protection/campaigns-and-events/slip-slop-slap-seek-slide.html
- Read about a sun protection project in Australia at www.icanhop.com.au/study-QUT%20Outdoor%20workers.html. In 2010, Australia saw the first successful legal case where a payout was awarded for skin cancer attributable to occupational solar UV exposure
- Read about awareness levels of sun protection among New Zealand outdoor workers, and recommendations for action, at www.ncbi.nlm.nih.gov/pubmed/23385117
- Download IOSH's jargon-buster and access the 'Ask the experts' panel at www.notimetolose.org.uk



**9 OUT OF 10
CONSTRUCTION
WORKERS WOULD
FOLLOW SITE RULES
ABOUT SUN SAFETY**



Download IOSH's free pack on solar radiation at www.notimetolose.org.uk. In the pack you'll find:



fast facts sheets



a link to our 'Sun safety' film, introducing the risks to workers, showing them how to protect themselves and signs to look out for



a manager briefing sheet



a good practice case study outlining how Royal Mail Group tackles solar radiation risks



a link to our mythbuster quiz



a toolbox talk to share headline information with workers



a leaflet to hand out to workers, covering the risks, and how to protect themselves



a pocket card to remind workers of protection measures and skin changes to watch out for



a range of posters – choose the one that best suits your workplace



a link to a 'My story' film telling one sufferer's experience of contracting skin cancer after being exposed to solar radiation at work

All our materials are available free as hard copies too – please contact campaigns@iosh.co.uk to find out more.

Sources: Cancer Research UK, Health and Safety Executive, Institute of Occupational Medicine, International Agency for Research on Cancer, Institution of Occupational Safety and Health, Office for National Statistics, Dr Lesley Rushton (Imperial College London).

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Reviewed by Professor John Cherrie, Heriot-Watt University and Institute of Occupational Medicine

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FIND OUT MORE, GET FREE RESOURCES




www.notimetolose.org.uk



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**INVESTORS
IN PEOPLE**