United States Environmental Protection Agency

UV INDEX

11+

8-10

6-7

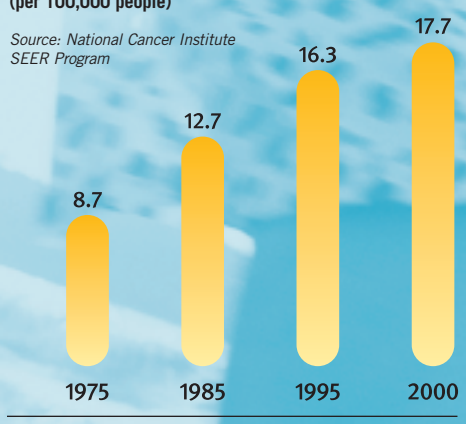
3-5

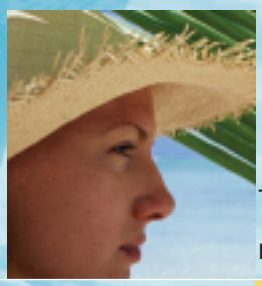
1-2

A GUIDE TO THE UV INDEX

The UV Index is Changing.

The Ultraviolet (UV) Index, developed in 1994 by the National Weather Service (NWS) and the U.S. Environmental Protection Agency (EPA), helps Americans plan outdoor activities to avoid overexposure to UV radiation and thereby lower their risk of adverse health effects. UV radiation exposure is a risk factor for skin cancer, cataracts, and other illnesses. The incidence of skin cancer, including melanoma, has increased significantly in the United States since the early 1970s.



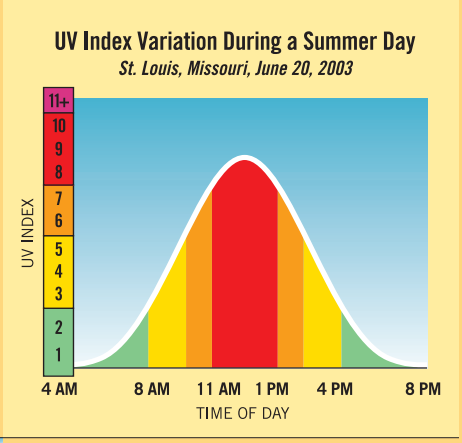


The UV Index is a useful tool to help the general public take steps to reduce their exposure to solar UV radiation, but its effectiveness depends on how well the information is communicated to the public. This brochure provides important information on new reporting guidelines for solar ultraviolet radiation. It is intended to assist communicators in several fields — meteorology, public health, education, and the news media — in conveying UV information to the public. *Professionals in these fields are uniquely positioned to raise awareness of how to prevent skin cancer.*

Beginning in May 2004, EPA and NWS will report the UV Index consistent with guidelines recommended jointly in 2002 by the World Health Organization (WHO), the World Meteorological Organization, the United Nations Environment Programme, and the International Commission on Non-Ionizing Radiation Protection. These organizations recommended a **Global Solar UV Index** in order to bring worldwide consistency to UV reporting and public health messaging.

The UV Index informs the public of the level of UV exposure expected on a given day. It is reported as a prediction of the UV level at noon, although the actual UV level rises and falls as the day progresses.

What's New About the UV Index?



UV Index Prior to May 2004		The New Global Solar UV Index	
Exposure Category	Index Number	Exposure Category	Index Number
MINIMAL	0-2	LOW	1-2
LOW	3-4	MODERATE	3-5
MODERATE	5-6	HIGH	6-7
HIGH	7-9	VERY HIGH	8-10
VERY HIGH	10+	EXTREME	11+

The UV Index was previously reported on a scale of 0 to 10+, with 0 representing "Minimal" and 10+ representing "Very High." As of May 2004, EPA and NWS will report the Global Solar UV Index using a scale of 1 (or "Low") to 11 and higher (or "Extreme"). Additional differences include a new color scheme, revised exposure categories, and different breakpoints between exposure categories.

Although the categories have been reorganized and labeled, actual UV levels associated with the exposure categories in the Global Solar UV Index **have not changed**. In other words, a UV index report of 6 represents the same intensity UV radiation on both the old and new scales, even if 6 is called "Moderate" on the old scale and "High" on the new scale.

Consistent reporting of the index will help the public better understand UV risk. **We therefore strongly urge providers of the UV Index to adopt the new scale and color scheme.** The color scheme ranges from green (for "Low") to violet (for "Extreme").

The UV Index reminds people to protect themselves when engaging in their normal outdoor activities. UV radiation exposure poses varying degrees of risk for all people because it affects eyes and skin. People with sensitive skin should always take action to protect themselves. It is especially important that parents and caregivers know how to protect babies and young children who are more susceptible to overexposure.

Communicating the UV Index

EPA recommends that communicators always encourage individuals to understand and practice the following sun protection steps:

- Check the UV Index for the UV forecast.
- Limit exposure during midday hours.
- Seek shade.
- Wear clothing made from tightly woven fabrics. UV rays can pass through holes and spaces in loosely knit fabric. Long-sleeved shirts and pants are recommended.
- Wear a hat with a wide brim that protects the eyes, face, and neck.
- Wear sunglasses that provide 100% UV protection.
- Use broad spectrum sunscreens with at least Sun Protection Factor (SPF) 15 and reapply regularly. Remember to apply sunscreen on any part of the skin that is exposed to the sun, such as the nose, the back of the neck, and the rims of the ears. Use lip balms or creams containing sunscreen.

When used correctly, shade, clothing, and hats provide the best protection from UV radiation. While sunscreen is effective when applied properly, doctors caution that sunscreen should not be used to prolong the duration of sun exposure.

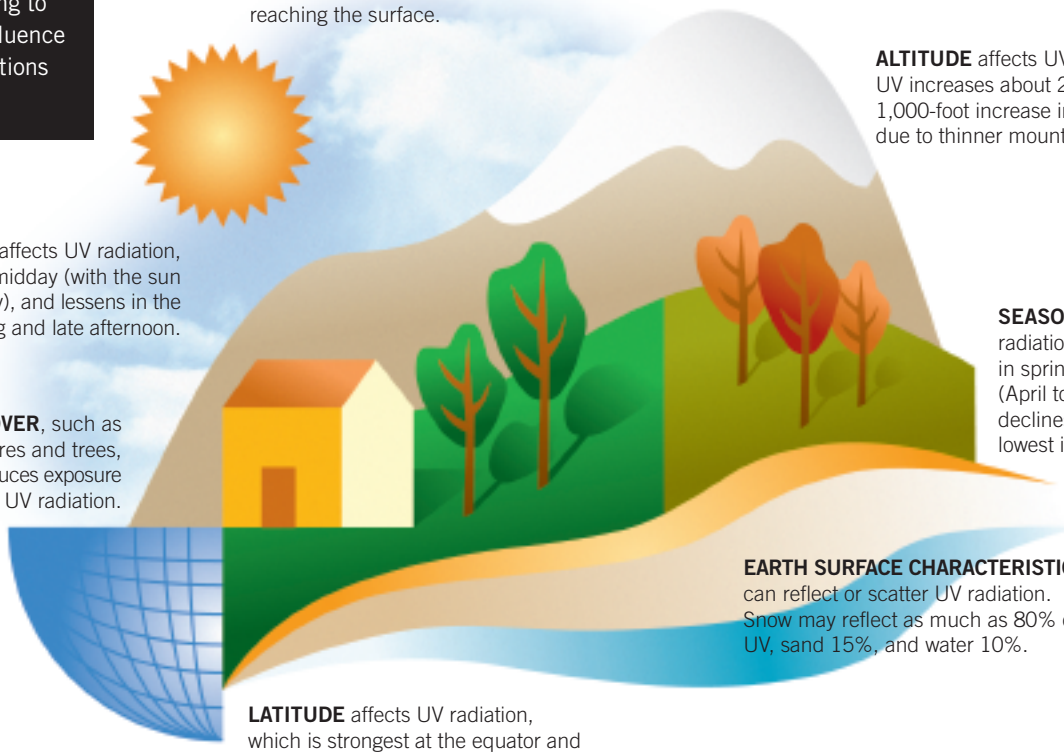
Sun Protection Messages

When reporting or discussing the UV Index, it might be helpful to give your audience more information about the significance of the reported UV Index for a given day by suggesting simple actions they can take to avoid overexposure. For this reason, EPA recommends that you use some of the messages identified in the chart below when reporting the UV Index. The *Myths and Realities About Fun in the Sun* on page 6 of this brochure may also be useful as "health tips."

Exposure Category	Index Number	Sun Protection Messages
LOW	1-2	• Wear sunglasses on bright days. In winter, reflection off snow can nearly double UV strength. • If you burn easily, cover up and use sunscreen.
MODERATE	3-5	• Take precautions, such as covering up and using sunscreen, if you will be outside. • Stay in shade near midday when the sun is strongest.
HIGH	6-7	• Protection against sunburn is needed. • Reduce time in the sun between 11 a.m. and 4 p.m. • Cover up, wear a hat and sunglasses, and use sunscreen.
VERY HIGH	8-10	• Take extra precautions. Unprotected skin will be damaged and can burn quickly. • Try to avoid the sun between 11 a.m. and 4 p.m. Otherwise, seek shade, cover up, wear a hat and sunglasses, and use sunscreen.
EXTREME	11+	• Take all precautions. Unprotected skin can burn in minutes. Beachgoers should know that white sand and other bright surfaces reflect UV and will increase UV exposure. • Avoid the sun between 11 a.m. and 4 p.m. • Seek shade, cover up, wear a hat and sunglasses, and use sunscreen.

Variations in the UV Index

The intensity of the sun's UV rays reaching the earth's surface, and the UV Index ratings, vary according to many factors. All influence the UV Index in locations across the U.S.



CLOUD COVER, if heavy, can block most UV radiation. Thin or broken clouds allow most UV rays through. Puffy, fair-weather clouds deflect rays and can increase UV radiation reaching the surface.

OZONE absorbs UV radiation. The higher the amount of ozone, the fewer rays reach the surface. Ozone levels vary from day to day and throughout the year.

ALTITUDE affects UV radiation; UV increases about 2% for every 1,000-foot increase in elevation due to thinner mountain air.

TIME OF DAY affects UV radiation, which peaks at midday (with the sun highest in the sky), and lessens in the early morning and late afternoon.

SEASONS affect UV radiation, which peaks in spring and summer (April to August), declines in fall, and is lowest in winter.

LAND COVER, such as structures and trees, significantly reduces exposure to UV radiation.

EARTH SURFACE CHARACTERISTICS can reflect or scatter UV radiation. Snow may reflect as much as 80% of UV, sand 15%, and water 10%.

LATITUDE affects UV radiation, which is strongest at the equator and declines toward the poles.

HOW THE UV INDEX IS CALCULATED

The UV Index represents the amount of skin-damaging UV radiation reaching the earth's surface at any instant of time. The basic UV Index forecast is given for solar noon — the sun's highest point in the sky and the time of the highest fluctuation in UV radiation (under clear sky conditions).

A UV Index forecast begins with a forecast of the total ozone amount. All the forecast parameters used in the UV Index computation are derived from NWS forecast models. The sun angle at solar noon (or for any other time) for that day is determined. A radiative transfer model determines the flux of UV radiation for a range of wavelengths. An action spectrum weights the response of the human skin to UV radiation at each wavelength. Once weighted, the flux values are integrated over the entire range, resulting in an erythemal dose rate — the instantaneous amount of skin-damaging radiation reaching the surface under clear sky, at sea level, with low aerosol conditions, as measured by units of milliWatts per square meter. Adjustments then account for a location's elevation, aerosol, and cloud conditions. Next, the optical properties of cloud conditions expected at that time refine the dose rate further. Finally, the resultant dose rate is applied to the UV Index. One UV Index unit is equivalent to 25 milliWatts per square meter.

Different areas of the country have different degrees of variation in the UV Index from day to day and from season to season. Communicators should consider how best to report the UV Index value to their audience so that people actually put recommendations into practice and use the UV Index as a guide to healthy behavior. If UV levels in your area tend to be unchanging — particularly if they are consistently high during summer months — EPA suggests that you emphasize general sun protection steps (for example, reminding people to wear sunglasses with 100% UVA & UVB protection); make note of local factors that can affect daily UV levels; and encourage special protection for children.

LOCATION	AVERAGE UV INDEX VALUE	
	Winter	Summer
Atlanta, Georgia	2 (Low)	8 (Very High)
Phoenix, Arizona	3 (Moderate)	10 (Very High)
Anchorage, Alaska	<1 (Low)	3 to 4 (Moderate)
Honolulu, Hawaii	6 (High)	11 to 12 (Extreme)
New York, New York	1 to 2 (Low)	6 to 7 (High)
Portland, Oregon	1 (Low)	5 to 6 (Moderate-High)
St. Louis, Missouri	1 to 2 (Low)	7 to 8 (High-Very High)
Miami, Florida	4 (Moderate)	10-11 (Very High-Extreme)

Typical UVI values for different parts of the U.S. at midday. These values may vary significantly depending on cloud cover and ozone levels.

UV Radiation and Public Health

Overexposure to the sun's ultraviolet rays is the most important preventable factor in the development of skin cancer. Skin cancer is largely preventable when sun protection measures against UV rays are used consistently. However, many young people and adults do not consistently use sun protection measures and are unaware of the link between overexposure and health risks.

Reporting Burn Times Not Recommended

Communicators sometimes report "time to burn" in lieu of the UV Index level, as a simple concept that can easily be translated into action. However, people can interpret *burn times* as a *safe period* during which they do not have to take protective action. Relating UV Index values to "time to burn" or "safe tanning time" sends an incorrect and potentially harmful message to the general public. **The UV Index should not be used to suggest that unprotected exposure is risk-free.**

Myths and Realities About Fun in the Sun

MYTH: *A suntan is healthy. Establishing a base suntan protects you from sun damage.*	REALITY: A tan results from the body defending itself against further damage from UV radiation. Any change in your skin's natural color is a sign of damage to the skin.
MYTH: *You cannot get a sunburn on a cloudy day.*	REALITY: Sunburn is possible on a cloudy day. Up to 80% of solar UV radiation can penetrate light cloud cover.
MYTH: *UV radiation during winter is not a concern.*	REALITY: UV radiation is generally lower in winter, but snow reflection can double overall exposure — especially at high altitudes — leading to sunburn and snowblindness.
MYTH: *Sunscreen protects you so that you can sunbathe much longer.*	REALITY: Sunscreen should not be used to increase sun exposure time but to increase protection during unavoidable exposure.
MYTH: *If you take breaks while sunbathing, you won't get sunburn.*	REALITY: UV radiation exposure is cumulative during the day.
MYTH: *If you don't feel the sun's hot rays, you won't get sunburn.*	REALITY: Sunburn is caused by UV rays that cannot be felt. The heating effect is caused by the sun's infrared radiation and not by UV.
MYTH: *Skin cancer only occurs on parts of the body that are exposed to the sun all the time.*	REALITY: Melanoma occurs most commonly on the back (for men) and legs (for women), which are sites with only intermittent exposure.
MYTH: *Skin cancer only happens to people who are very fair-skinned.*	REALITY: Skin cancer commonly occurs in people who tan before they burn.

RISK FACTORS

Everybody, regardless of race or ethnicity, is subject to the adverse effects of overexposure to the sun. Some people might be more vulnerable to certain conditions, however.

Skin type affects the degree to which some people burn and the time it takes them to burn. The Food and Drug Administration (FDA) classifies skin type on a scale from 1 to 6. Individuals with lower-number skin types (1 and 2) have fair skin and tend to burn rapidly and more severely. Individuals with higher-number skin types (5 and 6), although capable of burning, have darker skin and do not burn as easily.

The same individuals who are most likely to burn are also most vulnerable to skin cancer. Studies have shown that individuals with large numbers of freckles and moles have a higher risk of developing skin cancer. Although individuals with darker skin types are less likely to develop skin cancer, they should still take action to protect their skin and eyes from overexposure to the sun.

SKIN CANCER

UV radiation causes genetic mutations in skin cells. Over time, such mutations due to exposure to the sun and severe sunburns can lead to skin cancer. Every year, more than one million Americans are diagnosed with skin cancer, making it the most common form of cancer in the country. In the United States, one person dies of skin cancer every hour. The most common places for skin cancer to develop are on those body parts exposed to the sun, such as the face, neck, ears, forearms, and hands. The three main types of skin cancer are basal cell carcinoma, squamous cell carcinoma, and melanoma.

- Basal carcinomas are tumors that usually appear as small, fleshy bumps or nodules.
- Squamous cell carcinomas appear as nodules or as red, scaly patches.
- Melanomas may appear without warning as a dark mole or other dark spot in the skin. Melanoma causes more than 75% of skin cancer deaths. There are more than 50,000 new cases of melanoma per year. One in four persons who develop melanoma is under 40.

All three types of skin cancer may be successfully treated if detected in their early stages. For more information about how to detect skin cancer, visit the Center for Disease Control's skin cancer website at http://www.cdc.gov/cancer/nscpep/index.htm.

SUNBURN

The most obvious result of too much UV exposure is sunburn, which involves skin redness and sometimes tenderness, swelling, blistering, fever, and nausea. However, tanned skin also poses a skin cancer risk.

SUN SENSITIVITY

Some people may develop bumps, hives, blisters, or red blotchy areas as an allergic reaction to sun exposure. Certain drugs, perfumes, and cosmetics also may make some people sensitive to the sun.

EYE DAMAGE

Excess exposure to UV radiation can cause a painful burn of the cornea. Chronic eye exposure to UV radiation may also increase the incidence of *cataract*, which is a clouding of the eye lens; *pterygium*, in which a flesh membrane covers the eye; and possibly *macular degeneration*, or the development of spots that could result in blindness. About 13 million Americans age 40 or older have cataracts, and more than half of all Americans 65 or older have some evidence of cataracts.

PREMATURE WRINKLING

In the long run, too much exposure to the sun may change the skin's texture, giving it a tough, leathery appearance. Up to 90 percent of the visible skin changes commonly attributed to aging are caused by sun exposure. The sun also may cause discolorations in skin tone including red, yellow, gray, or brown spots.

IMMUNE SYSTEM SUPPRESSION AND DISEASE

Sun exposure suppresses the immune system and may make the body more vulnerable to infections and cancers, regardless of an individual's skin type or susceptibility to burns.

FOR MORE INFORMATION

Additional sun safety information from EPA's SunWise Program is available by calling the National Service Center for Environmental Publications at **1-800-490-9198**.

The Environmental Protection Agency offers a free SunWise Kit to meteorologists. The kit provides fun and interactive ways to teach kids about UV science and sun safety. Information is available at **http://www.epa.gov/sunwise**.

EPA also offers next-day UV Index forecasts by ZIP code for the continental United States, contoured UVI maps, and additional UVI information at **http://www.epa.gov/sunwise/uvindex.html**.

The National Weather Service provides UVI forecasts for 58 cities, UVI climatologies, and additional information at **http://www.cpc.ncep.noaa.gov/products/stratosphere/uv_index/index.html**.

The World Health Organization's INTERSUN program has developed a graphics package, including a UVI logo, an international color code for different UVI values, and a choice of ready-made graphics for reporting the UVI and sun safety messages. The materials may be downloaded and used free of charge. An overview of these graphics is available at **http://www.who.int/entity/uv/publications/en/UVIclip.pdf**. GIF images may be downloaded at **http://www.who.int/docstore/peh-uv/UVIndex_Graphics/gif**. To request a CD-ROM containing formats other than GIF, please contact **UVinfo@who.int**.

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