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EPA

The Sun, UV, and You

A Guide to SunWise Behavior

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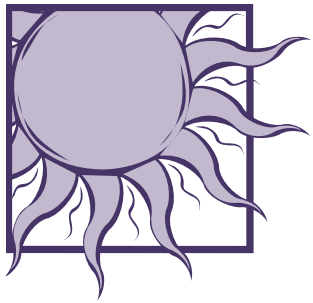


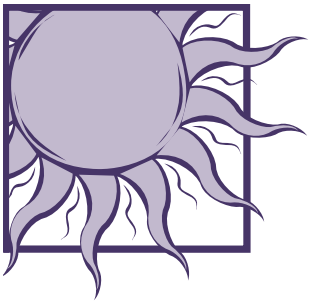
While some exposure to sunlight is enjoyable, too much can be dangerous and cause immediate effects like blistering sunburns and long-term problems like skin cancer and cataracts. Overexposure also causes wrinkling and aging of the skin. Scientists are concerned that ultraviolet (UV) radiation might even impair the human immune system.

The U.S. Environmental Protection Agency (EPA) prepared this booklet to help you understand the risks from overexposure to the sun's harmful UV rays and how to protect yourself and your loved ones from UV radiation.

This booklet presents the following information:

- The science behind UV radiation and stratospheric ozone.
- The health risks from overexposure to UV radiation.
- The steps you can take to protect yourself and your children.
- What the UV Index is and how you can use it.
- Details about EPA's SunWise School Program.
- Where to get more information about the UV Index and ways to protect yourself from the sun.

We hope you find this booklet useful and that you will use the information provided to help you be SunWise!



UV Radiation

The sun gives out energy over a broad spectrum of wavelengths. UV radiation, which has a shorter wavelength than either visible blue or violet light, is responsible for sunburn and other adverse health effects. Fortunately for life on earth, stratospheric ozone screens most harmful UV radiation. What gets through the ozone layer, however, can cause the following health problems, particularly for people who spend substantial time outdoors:

- Skin cancer and other skin disorders
- Cataracts and other eye damage
- Immune suppression

Because of these adverse health effects, you should limit your exposure to UV radiation and protect yourself when working, playing, or exercising outdoors.

Types of UV Radiation

Scientists have classified UV radiation into three types: UVA, UVB, and UVC.

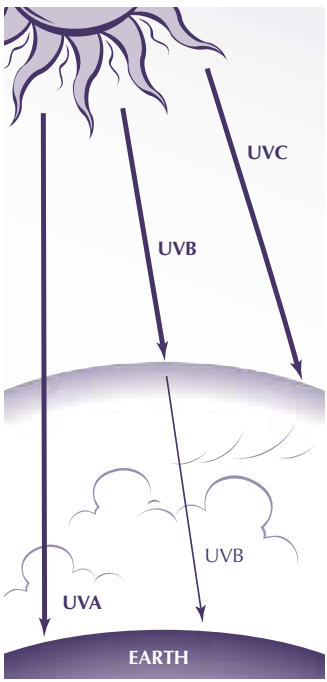
The stratospheric ozone layer absorbs some but not all of these types of UV radiation:

UVA
Not absorbed by the ozone layer

UVB
Partially absorbed by the ozone layer

UVC
Completely absorbed by oxygen and ozone in the atmosphere

UVA and especially UVB penetrate into the skin and eyes, and can cause the adverse health effects listed above.



UV Levels Depend on a Number of Factors

Stratospheric Ozone

The ozone layer absorbs most of the sun's harmful UV rays, but its thickness varies depending on the time of year and changing weather patterns. The ozone layer has thinned in certain areas due to the emission of ozone-depleting chemicals.

Time of Day

The sun is at its highest in the sky around noon. At that time, the sun's rays have the least distance to travel through the atmosphere, and UVB levels are at their highest. In the early morning and late afternoon, the sun's rays pass obliquely through the atmosphere, and the intensity of UVB is greatly reduced. UVA levels are not sensitive to ozone and vary throughout the day much like visible sunlight does.

Time of Year

The sun's angle varies with the seasons, causing the intensity of UV rays to vary. UV intensity tends to be highest during the summer months.

Latitude

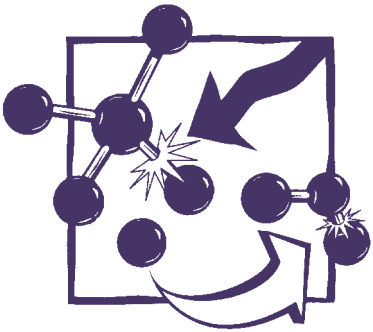
The sun's rays are strongest at the equator where the sun is most directly overhead and where UV rays must travel the least distance through the atmosphere. Ozone also is naturally thinner in the tropics as compared to the mid- and high-latitudes, so there is less ozone to absorb the UV radiation as it passes through the atmosphere. At higher latitudes the sun is lower in the sky, so UV rays must travel a greater distance through ozone-rich portions of the atmosphere and in turn expose those latitudes to less UV radiation.

Altitude

UV intensity increases with altitude because there is less atmosphere to absorb the damaging rays.

Weather Conditions

Cloud cover reduces UV levels, but not completely. Depending on the thickness of the cloud cover, it is possible to burn on a cloudy day even if it does not feel very warm.



Ozone Depletion

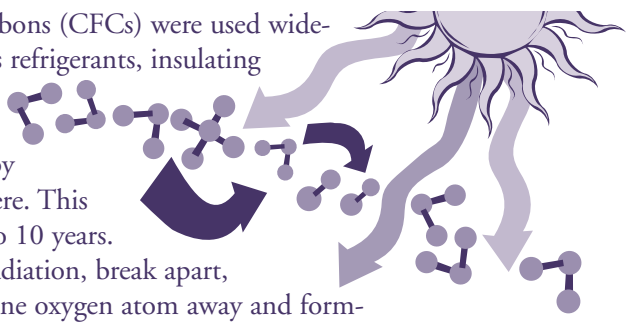
The ozone layer forms a thin shield in the stratosphere, protecting life on earth from the sun's harmful UV rays. In the 1980s, scientists began accumulating evidence that the ozone layer was being depleted. Depletion of the ozone layer can result in increased UV radiation reaching the earth's surface, which can lead to a greater chance of overexposure to UV radiation and consequent health effects including skin cancer, cataracts, and immune suppression.

How Stratospheric Ozone Protects Us

Ozone is a naturally occurring gas that is found in two layers in the atmosphere. In the layer surrounding the earth's surface—the troposphere—ground-level or "bad" ozone is an air pollutant that damages human health and vegetation and is a key ingredient of urban smog. The troposphere extends up to the stratosphere, which is where the "good" ozone protects life on earth by absorbing some of the sun's ultraviolet rays. Stratospheric ozone is most concentrated between 6 to 30 miles above the earth's surface.

Ozone is formed when oxygen molecules absorb UV radiation and split apart into two oxygen atoms (O), which combine with other oxygen molecules (O_2) to form ozone molecules (O_3). Ozone also is broken apart as it absorbs UV radiation. In this way, UV radiation helps sustain the natural balance of ozone in the stratosphere, while ozone in turn absorbs UV radiation, protecting life on earth from harmful radiation.

How Ozone Is Depleted



Until recently, chlorofluorocarbons (CFCs) were used widely in industry and elsewhere as refrigerants, insulating foams, and solvents. They migrate into the upper atmosphere after use, carried by air currents into the stratosphere. This process can take as long as 5 to 10 years. These chemicals absorb UV radiation, break apart, and react with ozone, taking one oxygen atom away and form-

ing highly reactive chlorine monoxide. Chlorine monoxide in turn breaks down O_3 again by pulling away a single oxygen atom, creating two O_2 molecules, and allowing the chlorine to move freely to another ozone molecule. In this way, each chlorine atom acts as a catalyst, repeatedly combining with and breaking apart as many as 100,000 ozone molecules during its stratospheric life.

Other compounds also damage the ozone layer in much the same way as do CFCs. These ozone-depleting substances include pesticides such as methyl bromide, halons used in fire extinguishers, and methyl chloroform used in industrial processes.

What Is Being Done About Ozone Depletion

Countries around the world have recognized the threats posed by ozone depletion and have responded by adopting the Montreal Protocol on Substances That Deplete the Ozone Layer. Parties to this treaty, including the United States, are phasing out the production and use of ozone-depleting substances.

Effect of Ozone Depletion on UV Radiation Levels

Current studies predict that CFC levels in the atmosphere should peak by around 2000 and should fall to pre-1980 levels by about 2050. As international control measures reduce the release of CFCs and other ozone-depleting substances, natural atmospheric processes will repair the ozone layer. Until that time, we can expect increased levels of UV radiation at the earth's surface. These increased UV radiation levels can lead to a greater chance of overexposure to UV radiation and the consequent health effects.

Health Effects From Overexposure to the Sun

Americans love the sun and spend a great deal of time outside—working, playing, exercising—often in clothing that exposes a lot of skin to the sun. Most people are now aware that too much sun has been linked to skin cancer. However, few know the degree of risk posed by overexposure, and fewer are aware that the risks go beyond skin cancer. Recent medical research has shown that overexposure to the sun's UV radiation can contribute to serious health problems. Each year, for example, more than 1 million cases of skin cancer are diagnosed in the United States, and one person dies every hour from melanoma or nonmelanoma skin cancer.

This section provides a quick overview of the major problems linked to excess UV exposure: skin cancer (i.e., melanoma, basal cell carcinoma, and squamous cell carcinoma); other skin problems; cataracts and other eye damage; and immune system suppression. Understanding these risks and taking a few sensible precautions described in this booklet will help you to enjoy the sun while lowering your chances of sun-related health problems later in life.

A Word About Risk

Overexposure to UV radiation poses the risk of serious health effects for everyone, but not everyone is equally at risk. For example, you may be at greater risk of contracting skin cancer if your skin always burns, or burns easily, and if you have blond or red hair, or blue, green, or gray eyes. Other factors indicating an increased risk of skin cancer include: a history of blistering sunburns in early childhood, usually from acute sun overexposure; the presence of many moles; or a family history of skin cancer. Also, people who work or otherwise spend a large amount of time outdoors (i.e., chronic exposure to the sun) may be at higher risk of health effects. It's a good idea to remember that anyone can contract skin cancer, and that all people, no matter what skin type, are equally at risk of eye damage.

Melanoma

Melanoma, the most serious form of skin cancer, also is one of the fastest growing types of cancer in the United States. Many scientists believe there might be a link between childhood sunburns and malignant melanoma later in life. Melanoma cases in this country have more than doubled in the past 2 decades; according to

the American Cancer Society, about 44,200 new cases of melanoma and 7,300 deaths are currently reported each year.

Cure Rate

Melanoma can spread to other parts of the body quickly, but when detected in its earliest stages it is almost always curable. If not caught early, melanoma is often fatal.

Warning Sign

Melanoma begins as an uncontrolled growth of pigment-producing cells in the skin. This growth leads to the formation of dark-pigmented malignant moles or tumors, called melanomas. Melanomas can appear suddenly without warning but also can develop from or near a mole. For this reason, it is important to know the location and appearance of moles on the body so any change will be noticed. Melanomas are found most frequently on the upper backs of men and women, and the legs of women, but can occur anywhere on the body. Be aware of any unusual skin condition, especially a change in the size or color of a mole or other darkly or irregularly pigmented growth or spot; scaliness, oozing, bleeding, or change in the appearance of a bump or nodule; spread of pigment from the border into surrounding skin; and change in sensation including itchiness, tenderness, or pain.

Nonmelanoma Skin Cancers

Unlike melanoma, nonmelanoma skin cancers are rarely fatal. Nevertheless, they should not be taken lightly. Untreated, they can spread and cause more serious health problems. An estimated 1 million Americans will develop nonmelanoma skin cancers this year, while 1,900 will die from the disease.

There are two primary types of nonmelanoma skin cancers:

Basal Cell Carcinomas are tumors of the skin that usually appear as small, fleshy bumps or nodules on the head and neck but can occur on other skin areas as well. It is the most common skin cancer found among fair-skinned people. Basal cell carcinoma does not grow quickly and rarely spreads to other parts of the body. It can, however, penetrate below the skin to the bone and cause considerable local damage.

Squamous Cell Carcinomas are tumors that might appear as nodules or as red, scaly patches. The second most common skin cancer found in fair-skinned people, squamous cell carcinoma is rarely found in darker-skinned people. This cancer can develop into large masses, and unlike basal cell carcinoma, it can spread to other parts of the body.

Cure Rate

These two nonmelanoma skin cancers have cure rates as high as 95 percent if detected and treated early. The key is to watch for signs and to detect the cancer in its early stages.

Warning Sign

Basal cell carcinoma tumors usually appear as slowly growing, raised, translucent, pearly nodules that, if untreated, might crust, discharge pus, and sometimes bleed. Squamous cell carcinomas usually are raised, red or pink scaly nodules, or wart-like growths that form pus in the center. They typically develop on the edge of the ears, the face, lips, mouth, hands, and other exposed areas of the body.

Actinic Keratoses

These sun-induced skin growths occur on body areas exposed to the sun. The face, hands, forearms, and the "V" of the neck are especially susceptible to this type of blemish. They are premalignant, but if left untreated, actinic keratoses can become malignant. Look for raised, reddish, rough-textured growths. See a dermatologist promptly if you notice these growths.

Premature Aging of the Skin

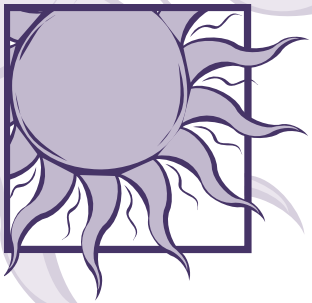
Chronic exposure to the sun causes changes in the skin called actinic (or solar) degeneration. Over time, the skin becomes thick, wrinkled, and leathery. Since it occurs gradually, often manifesting itself many years after the majority of a person's exposure to the sun, this condition is often regarded as unavoidable, a normal part of growing older. With proper protection from UV radiation, however, premature aging of the skin can be substantially avoided.

Cataracts and Other Eye Damage

Cataracts are a form of eye damage, a loss of transparency in the lens that clouds vision. Left untreated, cataracts can rob people of vision. Research has shown that UV radiation increases the likelihood of certain cataracts. Although curable with modern eye surgery, cataracts diminish the eyesight of millions of Americans and necessitate billions of dollars of eye surgery each year. Other kinds of eye damage include: pterygium (tissue growth on the white of the eye that can block vision), skin cancer around the eyes, and degeneration of the macula (the part of the retina near the center, where visual perception is most acute). All of these problems could be lessened with proper eye protection from UV radiation.

Immune Suppression

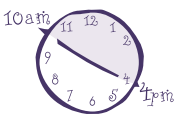
Scientists have found that sunburn can alter the distribution and function of disease-fighting white blood cells in humans for up to 24 hours after exposure to the sun. Repeated exposure to UV radiation might cause more long-lasting damage to the body's immune system. Mild sunburns can suppress immune functions in people of all skin types.



Action Steps for Sun Protection

Be SunWise

Protecting yourself from overexposure to UV radiation is simple if you take the precautions listed below.



Limit Time in the Midday Sun as Much as Possible

The sun's UV rays are strongest between 10 a.m. and 4 p.m. To the extent you can, limit exposure to the sun during these hours.

Watch for the UV Index

The UV Index provides important information to help you plan your outdoor activities in ways that prevent overexposure to the sun's rays. Developed by the National Weather Service (NWS) and EPA, the UV Index is issued daily in selected cities across the United States.

Wear Sunglasses That Block 99 to 100 Percent of UV Radiation

Sunglasses that provide 99 to 100 percent UVA and UVB protection will greatly reduce sun exposure that can lead to cataracts and other eye damage. Check the label when buying sunglasses.

Wear a Hat

A hat with a wide brim offers good sun protection for your eyes, ears, face, and the back of your neck—areas particularly prone to overexposure to the sun.

Seek Shade

Staying under cover is one of the best ways to protect yourself from the sun.

Protect Other Areas of Your Body With Clothing During Prolonged Periods in the Sun

Tightly-woven, loose-fitting, and full-length clothes are best for protection of exposed skin.

Always Use a Sunscreen When Outside

A sunscreen with a sun protection factor (SPF) of at least 15 blocks most harmful UV radiation. Apply sunscreen liberally and reapply every 2 hours when working, playing, or exercising outdoors. Even waterproof sunscreen can come off when you towel off sweat or water. Consult your physician about sunscreen use on children under 6 months of age. Also use lip balm of SPF 15.

Avoid Sunlamps and Tanning Salons

The light source from sunbeds and sunlamps damages the skin and unprotected eyes. It's a good idea to avoid artificial sources of UV light.

The UV Index Describes the Next Day's Likely Levels of the Intensity of UV Rays. The Index Predicts UV Levels on a 0 to 10+ Scale in the Following Way:

INDEX NUMBER	INTENSITY LEVEL
0 to 2	Minimal
3 to 4	Low
5 to 6	Moderate
7 to 9	High
10+	Very High

While always taking precautions against overexposure, take special care to adopt the safeguards recommended above when the UV Index predicts exposure levels of moderate or higher.

Some medications cause serious sun sensitivity, as do some diseases such as lupus erythematosus. The UV Index is *not* intended for use by seriously sun-sensitive individuals. Consult your doctor about additional precautions you might need to take.

How NWS Calculates the UV Index

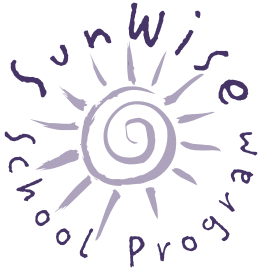
The National Weather Service uses a computer model to calculate the next day's UV levels for selected cities across the United States. The model takes into account a number of factors including the amount of ozone and clouds overhead, latitude, elevation, and time of year.

To compute the UV Index forecast, the model first calculates a UV dose rate, or amount of UV radiation to which a person will be exposed at the next day's solar noon (when the sun is highest in the sky) under "clear sky" (no clouds) conditions.

The UV dose rates obtained from the model are then adjusted for the effects of elevation and cloud cover at specific locations. Higher elevations will increase the UV dose rate because there is less atmosphere to absorb and scatter UV rays. Greater cloud cover will tend to reduce the UV dose rate because clouds screen out some—but not all—UV rays.

The resulting value is the next day's UV Index forecast. The UV forecasts for selected locations are provided daily on a 0 to 10+ scale, where 0 indicates a minimal likely level of exposure to UV rays and 10+ means a very high level of exposure.

For more information about the UV Index, or for daily forecasts, please consult <www.epa.gov/sunwise>.



Special Considerations for Children

Although many of the sun's harmful effects do not appear until later in life, recent medical research has shown that it is very important to protect children and young adults from overexposure to UV radiation. The majority of most people's sun exposure occurs before age 18, and studies increasingly suggest a link between early exposure and skin cancer as an adult.

Helping Children Be SunWise

Take special care with children, since they tend to spend more time outdoors than adults and can burn more easily. The precautions described in this booklet can help ensure that the children around you avoid UV-related health problems, both now and later in life. Started early and followed consistently, each of these steps will become an accepted habit, as easy as fastening seatbelts every time you drive the car.

In response to the serious public-health threat posed by overexposure to UV radiation, EPA is working with schools and communities across the nation to launch the SunWise School Program. SunWise teaches children in elementary school and their caregivers how to protect themselves from overexposure to the sun. Educating children about sun safety is the key to reducing the risk of future UV-related health problems.

Participating schools will sponsor activities that raise children's awareness of the largely preventable health risks from UV radiation and teach simple steps to avoid overexposure. Such activities might include:

- Cross-curricular classroom lessons.
- Reporting the UV Index and UV ground data on the SunWise Internet Learning Site.
- Infrastructure enhancements (e.g., policy changes and shade structures).
- Community partnerships.
- Schoolwide sun safety activities.
- Train-the-trainer video.

For additional information about the SunWise School Program, please contact EPA's Stratospheric Ozone Information Hotline at 800 296-1996 or visit the program's Web site at <www.epa.gov/sunwise>.

For More Information

To learn more about the UV Index and how to protect yourself from overexposure to the sun's UV rays, call EPA's Stratospheric Ozone Information Hotline at 800 296-1996 or visit our Web site at <www.epa.gov/sunwise>. Hotline staff can supply you with the following fact sheets and other useful information:

- Health Effects of Overexposure to the Sun
- UV Radiation
- Action Steps for Sun Protection
- Ozone Depletion
- What is the Ultraviolet (UV) Index?
- Ultraviolet Index: What You Need to Know
- SunWise School Program

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UV INDEX