

ET0003 / **EXTRATERRESTRIAL** / Extraterrestrial

UV Radiation

Definition

UV radiation is the portion of the electromagnetic (EM) spectrum between X-rays and visible light. Depending on its wavelength, UV radiation can penetrate the ozone layer and affect human health in different ways (Government of Canada, 2019).

Reference

Government of Canada, 2019. Ultraviolet Radiation. www.canada.ca/en/health-canada/services/health-risks-safety/radiation/types-sources/ultraviolet.html Accessed 25 November 2019.

Annotations

Synonyms

None identified.

Additional scientific description

All radiation is a form of energy, most of which is invisible to the human eye. Ultraviolet (UV) radiation is only one form of radiation and is measured on a scientific scale called the EM spectrum (US FDA, 2019).

UV radiation is invisible energy in the wavelength range 100 to 400 nm (a nanometre is one billionth of a metre). UV radiation has a shorter wavelength and is more energetic than visible light. UV radiation comes from natural sources (such as the Sun), and artificial sources (such as black lights, welding equipment, lasers, and tanning equipment) (Government of Canada, 2019).

The shorter the wavelength, the more harmful the UV radiation. However, shorter wavelength UV radiation is less able to penetrate the skin (EU, 2019; Government of Canada, 2019).

UV radiation is divided into three wavelength ranges and all three bands are classified as a probable human carcinogen (Government of Canada, 2019; EU, 2019):

UVA is long-range UV radiation between 320 and 400 nm. Although not as energetic as UVB, UVA can penetrate deep into the skin (dermis). This can cause immediate tanning and premature skin aging and play a role in the development of certain skin cancers. UVA is not readily absorbed by the ozone layer; about 95% gets through.

UVB is short-wave UV radiation between 280 and 320 nm. It can just penetrate the outer protective layer of the skin and is responsible for delayed tanning, sunburn and most skin cancers. A large amount of UVB is absorbed by the ozone layer; only 5% reaches the Earth's surface.

UVC, with wavelengths between 100 and 280 nm, is very energetic. It is very dangerous to all forms of life (even with short exposures). However, UVC radiation is filtered out by the ozone layer, and never reaches Earth. It is created artificially to kill bacteria.

Metrics and numeric limits

The UV Index developed by the U.S. Environmental Protection Agency (US EPA, 2004).

The Electromagnetic radiation spectrum described by the Government of Canada (2019).

Key relevant UN convention / multilateral treaty

The Montreal Protocol on Substances that Deplete the Ozone Layer (UNEP, 2020a,b).

The UN Sustainable Development Goals (SDG)s, Goal 3 'Good Health and Well-Being' (UN, 2015).

The United Nations Convention on the Rights of the Child (UN, 1989).

Examples of drivers, outcomes and risk management

A period when solar UV radiation exceeds a certain threshold with the need to increase awareness to the potential negative impacts of UV radiation on health is usually associated with ozone levels lower than the long-term average and cloudless or at most partially cloudy conditions. Negative impacts of UV radiation can be monitored with the help of the UV index. A threshold can be defined according to geographical location and season in order to raise awareness on the potential danger for health. A practical guide is available from the World Health Organization (WHO, 2002).

The rise in incidence of skin cancers over recent decades is strongly related to increasingly popular outdoor activities and recreational exposure (WHO, 2003). Overexposure to sunlight is widely accepted as the underlying cause for harmful effects on the skin, eyes and immune system. Experts believe that four out of five cases of skin cancer could be prevented, as UV damage is mostly avoidable. Adopting the following simple precautions, adapted from the Sun Wise School Program can make all the difference (WHO, 2003).

Shade, clothing and hats provide the best protection – applying sunscreen becomes necessary for those parts of the body that remain exposed like the face and hands. Sunscreen should never be used to prolong the duration of sun exposure.

- Limit time in the midday sun: The sun's UV rays are the strongest between 10 am and 4 pm. To the extent possible, limit exposure to the sun during these hours.
- Watch for the UV index: This important resource helps to plan outdoor activities in ways that prevent overexposure to the sun's rays. While always taking precautions against overexposure, take special care to adopt sun safety practices when the UV Index predicts exposure levels of moderate or above.
- Use shade wisely: Seek shade when UV rays are the most intense, but keep in mind that shade structures such as trees, umbrellas or canopies do not offer complete sun protection. Remember the shadow rule: 'Watch your shadow – Short shadow, seek shade!'
- Wear protective clothing: A hat with a wide brim offers good sun protection for eyes, ears, face, and the back or neck. Sunglasses that provide 99% to 100% UVA and UVB protection will greatly reduce eye damage from sun exposure. Tightly woven, loose fitting clothes provide additional protection.
- Use sunscreen: Apply a broad-spectrum sunscreen of SPF 15+ liberally and re-apply every two hours, or after working, swimming, playing or exercising outdoors.
- Avoid sunlamps and tanning parlours: Sunbeds damage the skin and unprotected eyes and are best avoided entirely.

Sun protection programmes are urgently needed to raise awareness of the health hazards of UV radiation, and to achieve changes in lifestyle that will stop the trend towards increasing numbers of skin cancers. Beyond the health benefits, effective education programmes can strengthen national economies by reducing the financial burden on health care systems caused by skin cancer and cataract treatments. Children are in a dynamic state of growth and are therefore more susceptible to environmental threats than adults. Many vital functions such as the immune system are not fully developed at birth, and unsafe environments may interfere with their normal development. Schools are vitally important settings to promote sun protection, and effective programmes can make a difference (WHO, 2003).

Children require special protection. The United Nations Convention on the Rights of the Child states that children, including all developmental stages from conception to age 18, have the right to enjoyment of the highest attainable standard of health and to a safe environment (UN, 1989). Children are in a dynamic state of growth and are more susceptible to environmental threats than adults because: Sun exposure during childhood and adolescence appears to set the stage for the development of both melanoma and non-melanoma skin cancers in later life; a significant part of a person's lifetime exposure occurs before age 18; and children have more time to develop diseases with long latency, more years of life to be lost and more suffering to be endured as a result of impaired health (WHO, 2003).

References

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Government of Canada, 2019. Ultraviolet Radiation: Types of UV radiation. www.canada.ca/en/health-canada/services/health-risks-safety/radiation/types-sources/ultraviolet.html Accessed 25 November 2019.

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UN, 2015. Goal 3: Ensure healthy lives and promote well-being for all at all ages. www.un.org/sustainabledevelopment/health Accessed 7 October 2020.

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Coordinating agency or organisation

World Meteorological Organization (WMO), World Health Organization (WHO) and other space weather organisations.