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GLOBAL SOLAR UV INDEX

A Practical Guide

A joint recommendation of:

World Health Organization

World Meteorological Organization

United Nations Environment Programme

UNEP

International Commission on Non-Ionizing Radiation Protection

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Global Solar UV Index: A Practical Guide.

A joint recommendation of the World Health Organization, World Meteorological Organization, United Nations Environment Programme, and the International Commission on Non-Ionizing Radiation Protection

1. Ultraviolet rays – adverse effects 2. Sunlight – adverse effects 3. Radiation monitoring – instrumentation 4. Radiation monitoring – standards 5. Reference values 6. Health education 7. Environmental exposure – prevention and control 8. Manuals

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Preface

A marked increase in the incidence of skin cancers has been observed in fair-skinned populations worldwide since the early 1970s. This is strongly associated with personal habits in relation to sun exposure and its ultraviolet (UV) component, and the societal view that a tan is desirable and healthy. Educational programmes are urgently needed to raise awareness of the damaging effects of UV radiation, and to encourage changes in lifestyle that will arrest the trend towards more and more skin cancers.

The Global Solar UV Index (UVI) described in this document is a simple measure of the UV radiation level at the Earth's surface and an indicator of the potential for skin damage. It serves as an important vehicle to raise public awareness and to alert people about the need to adopt protective measures when exposed to UV radiation. The UVI was developed through an international effort by the World Health Organization (WHO) in collaboration with the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the German Federal Office for Radiation Protection (Bundesamt für Strahlenschutz, BfS) (see Annex F for list of contributors). Since its initial publication in 1995, several international meetings of experts (Les Diablerets, 1994[1]; Baltimore, 1996[2]; Les Diablerets, 1997[3]; Munich, 2000[4]) have been convened with the aim to harmonize the reporting of the UVI and to improve its use as an educational tool to promote sun protection.

This practical guide, prepared by Eva Rehfuess, is based on the consensus reached at the Munich meeting, and is intended to be used by national and local authorities and non-governmental organizations active in the area of skin cancer prevention, as well as meteorological offices and media outlets involved with UVI reporting. This publication can serve as an entry point for the development and implementation of an integrated public health approach to sun protection and skin cancer prevention.

1 *Report of the WMO meeting of experts on UVB measurements, data quality and standardization of UV indices, Les Diablerets, Switzerland, 22–25 July 1994*. Geneva, World Meteorological Organization, 1995 (Global Atmosphere Watch, No. 95).
2 *Educating the public about the hazards of ultraviolet radiation. Summary report. International workshop, Baltimore, 26–28 August 1996*. Aberdeen Proving Ground MD, U.S. Army Center for Health Promotion and Preventive Medicine, 2001.
3 *Report of the WMO–WHO meeting of experts on standardization of UV indices and their dissemination to the public, Les Diablerets, Switzerland, 21–24 July 1997*. Geneva, World Meteorological Organization, 1997 (Global Atmosphere Watch, No. 127).
4 *UV index in practical use. Proceedings of an international workshop*. Munich, Federal Office for Radiation Protection, Institute of Radiation Hygiene, in press.

Introduction

Everyone is exposed to UV radiation from the sun and many artificial sources used in industry, commerce and recreation. Emissions from the sun include light, heat and UV radiation.

The UV region covers the wavelength range 100–400 nm and is divided into three bands:

UVA (315–400 nm)

UVB (280–315 nm)

UVC (100–280 nm)

As sunlight passes through the atmosphere, all UVC and approximately 90% of UVB radiation are absorbed by ozone, water vapour, oxygen and carbon dioxide. UVA radiation is less affected by the atmosphere.

Therefore, the UV radiation reaching the Earth's surface is largely composed of UVA with a small UVB component.

UV RADIATION LEVELS ARE INFLUENCED BY:

SUN ELEVATION

The higher the sun in the sky, the higher the UV radiation level. Thus UV radiation levels vary with time of day and time of year. Outside the tropics, the highest levels occur when the sun is at its maximum elevation, at around midday (solar noon) during the summer months.

LATITUDE

The closer to equatorial regions, the higher the UV radiation levels.

CLOUD COVER

UV radiation levels are highest under cloudless skies but even with cloud cover, UV radiation levels can be high. Scattering can have the same effect as the reflectance by different surfaces and thus increase total UV radiation levels.

ALTITUDE

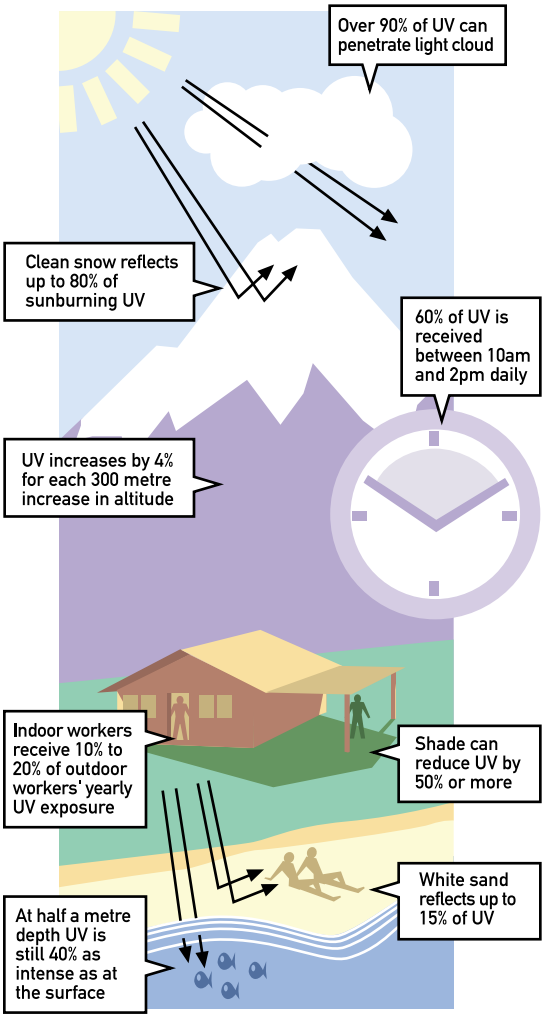
At higher altitudes, a thinner atmosphere absorbs less UV radiation. With every 1000 metres increase in altitude, UV radiation levels increase by 10% to 12%.

OZONE

Ozone absorbs some of the UV radiation that would otherwise reach the Earth's surface. Ozone levels vary over the year and even across the day.

GROUND REFLECTION

UV radiation is reflected or scattered to varying extents by different surfaces, e.g. fresh snow can reflect as much as 80% of UV radiation, dry beach sand about 15% and sea foam about 25%.



Small amounts of UV radiation are beneficial for people and essential in the production of vitamin D. UV radiation is also used to treat several diseases, including rickets, psoriasis and eczema. This takes place under medical supervision and the benefits of treatment versus the risks of UV radiation exposure are a matter of clinical judgement.

Prolonged human exposure to solar UV radiation may result in acute and chronic health effects on the skin, eye and immune system. Sunburn and tanning are the best known acute effects of excessive UV radiation exposure; in the long term, UV radiation-induced degenerative changes in cells, fibrous tissue and blood vessels lead to premature skin ageing. UV radiation can also cause inflammatory reactions of the eye, such as photokeratitis.

Chronic effects include two major public health problems: skin cancers and cataracts. Between two and three million non-melanoma skin cancers and approximately 132000 melanoma skin cancers occur globally each year. While non-melanoma skin cancers can be surgically removed and are rarely lethal, malignant melanoma substantially contributes to mortality rates in fair-skinned populations. Some 12 to 15 million people are blind from cataracts. According to WHO estimates, up to 20% of these cases of blindness may be caused or enhanced by sun exposure, especially in India, Pakistan and other countries of the "cataract belt" close to the equator. Furthermore, a growing body of evidence suggests that environmental levels of UV radiation may enhance the risk of infectious diseases and limit the efficacy of vaccinations. Please see Annex A for a detailed description of the health effects of exposure to UV radiation.

People's behaviour in the sun is considered to be a major cause for the rise in skin cancer rates in recent decades. An increase in popular outdoor activities and changed sunbathing habits often result in excessive exposure to UV radiation. Many people consider intensive sunbathing to be normal; unfortunately, even children, adolescents and their parents perceive a suntan as a symbol of attractiveness and good health.

Sun protection programmes are urgently needed to raise awareness of the health hazards of UV radiation, and to achieve changes in lifestyle that will arrest the trend towards more and more skin cancers. Beyond the health benefits, effective education programmes can strengthen national economies by reducing the financial burden to health care systems caused by skin cancer and cataract treatments. Billions are spent worldwide to treat these diseases, many of which could have been prevented or delayed. The Global Solar UV Index should be an important element of an integrated and long-term public health approach to sun protection.

The Global Solar UV Index

AN EDUCATIONAL TOOL

WHAT IS THE GLOBAL SOLAR UV INDEX?

The Global Solar UV Index (UVI) describes the level of solar UV radiation at the Earth's surface. The values of the index range from zero upward – the higher the index value, the greater the potential for damage to the skin and eye, and the less time it takes for harm to occur.

WHY DO WE NEED THE UVI?

A marked increase in the incidence of skin cancer in fair-skinned populations worldwide is strongly associated with excessive UV radiation exposure from the sun; it may also be associated with the use of artificial UV radiation sources such as sunbeds. Current evidence indicates that personal habits in relation to sun exposure constitute the most important individual risk factor for UV radiation damage. The UVI is an important vehicle to raise public awareness of the risks of excessive exposure to UV radiation, and to alert people about the need to adopt radiation exposure. The UVI should especially aim at vulnerable and highly-exposed groups within the population, e.g. children and tourists, and should inform people about the range of UV radiation-induced health effects including sunburn, skin cancer and skin ageing, and effects on the eye and immune system. Educational messages should emphasize that the risk of adverse health effects from UV radiation exposure is cumulative, and that exposure in everyday life may be as important as exposure during vacations in sunny climates.

HOW IS THE UVI PRESENTED?

UV radiation levels and therefore the values of the index vary throughout the day. In reporting the UVI, most emphasis is placed on the maximum UV radiation level on a given day. This occurs during the four-hour period around solar noon. Depending on geographical location and whether daylight saving time is applied, solar noon takes place between local noon and 2 p.m. The media usually present a forecast of the maximum