Determination of the Ultraviolet Rays in Yangon University of Education Campus

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Abstract

In this work we determine ultraviolet radiation falling on the Campus of Yangon University Education and counting the illumination by using Digital UV AB Light Meter. We also analyze the illumination per month in sunny days. This research paper also explains the types of ultraviolet radiation, and positive and negative effect of ultraviolet radiation. We find that the illumination on April 2016 is the highest level. Average illumination falling on April is 9.714 (mW/cm^2). The value of illumination falling on the campus is not extremely dangerous for people.

Key words: ultraviolet radiation, UV Catastrophe, illumination.

Introduction

The amount of ultraviolet radiation reaching the Earth's surface varies widely around the globe and through time. The sun radiates energy in a wide range of wavelengths, most of which are invisible to human eyes. The shorter the wavelength, the more energetic the radiation, and the greater the potential of harm. Ultraviolet radiation at different wavelengths differs in its effects and we have to live with the harmful effects as well as the helpful ones.

Cloud cover plays a highly influential role in the amount of both UV-A and UV-B radiation reaching the ground. Each water droplet in a cloud scatters some incoming UV radiation back into space, so a thick cover of clouds protects organisms and materials from almost all UV. The larger the percentage of the sky that is covered by clouds, the less UV reaches the ground. The more opaque the cloud, the less UV-B reaches the ground. The effects of UV-B radiation on human skin are varied and widespread. UV-B induces skin cancer by causing mutation in DNA and suppressing certain activities of the immune system.

Natural sunlight stimulates the production of Vitamin D, a vital component in the formation of healthy bones. When low-pressure mercury vapor is ionized, UV radiation is produced which is then absorbed by a phosphorescent coating in the inside of the lamp to convert to visible light. These lamps are used in the treatment of neonatal jaundice and psoriasis. UV light is used in pest control devices and flies traps, as the insects are attracted to the fluorescent light and are trapped on coming in contact with the device.

In this work we determine ultraviolet radiation falling on the Campus of Yangon University Education and counting the illumination by using Digital UV AB Light Meter. We determine UV exposure at the surface by measuring directly with instruments on the ground. These ground-based instruments can tell us the amount of UV radiation reaching on the surface at their exact locations.

Ultraviolet Radiation

Type of Radiation

The sun emits energy over a broad spectrum of wavelengths, visible light that we see, infrared radiation that we feel as heat, and ultraviolet (UV) radiation that we cannot see or feel. UV radiation has a shorter wavelength and higher energy than visible light.

Ultraviolet (UV) radiation is defined as that portion of the electromagnetic spectrum between x rays and visible light shown in figure 1, i.e., between 40 and 400 nm (30–3 eV). The UV spectrum is divided into Vacuum UV (40-190 nm), Far UV (190-220 nm), UVC (200-280 nm), UVB (280-320), and UVA (320-400 nm).

Solar ultraviolet radiation (UVR) that can reach the earth's surface is subdivided into two types; Ultraviolet A (UVA) and Ultraviolet B (UVB).The radiation reach the Earth’s surface contributes to the serious health effects and it also contributes to environmental impacts. Levels of UVA radiation are more constant than UVB, reaching the Earth’s surface without variations due to the time of day or year.

UVC is almost never observed in nature because it is absorbed completely in the atmosphere, as are Far UV and Vacuum UV.

UVB is typically the most destructive form of UV radiation because it has enough energy to cause photochemical damage to cellular DNA, yet not enough to be completely absorbed by the atmosphere. UVB is needed by humans for synthesis of vitamin D; however, harmful effects can include erythema (sunburn), cataracts, and development of skin cancer. Individuals working outdoors are at the greatest risk of UVB effects. Most solar UVB is blocked by ozone in the atmosphere, and there is concern that reductions in atmospheric ozone could increase the prevalence of skin cancer.

UVA is the most commonly encountered type of UV light. UVA exposure has an initial pigment-darkening effect (tanning) followed by erythematic if the exposure is excessive. Atmospheric ozone absorbs very little of this part of the UV spectrum. UVA is needed by humans for synthesis of vitamin D; however, overexposure to UVA has been associated with toughening of the skin, suppression of the immune system, and cataract formation. UVA light is often called black light. Most phototherapy and tanning booths use UVA lamps.

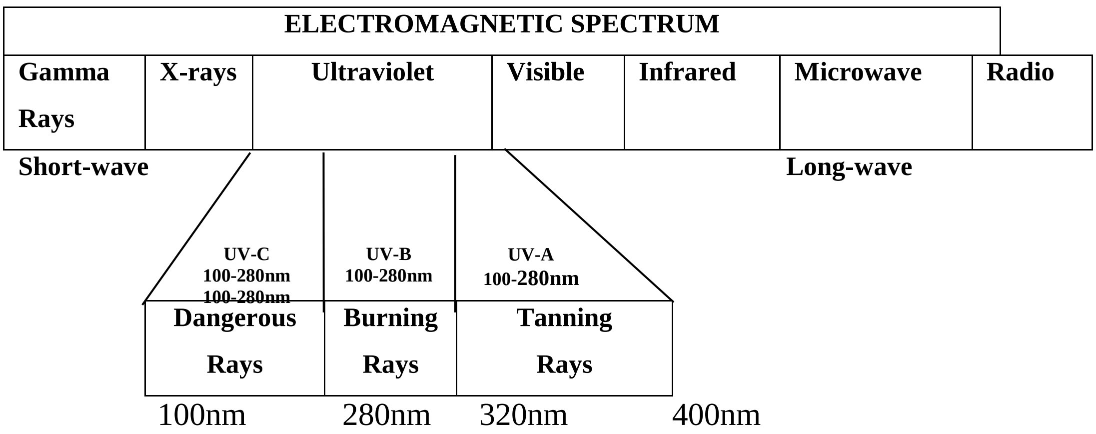

Figure 1. Electromagnetic Spectrum

Some Sources of Ultraviolet Radiation

Sunlight is the greatest source of ultraviolet radiation. Therefore the sun is our primary natural source of UV radiation. Man-made ultraviolet sources include several types of UV lamps, arc welding and mercury vapor lamps. Artificial sources include tanning booths, black lights, curing lamps, germicidal lamps, mercury vapor lamps, halogen lights, high-intensity discharge lamps, fluorescent and incandescent sources, and some types of lasers.

UV Levels Dependence Factors

The level of UV radiation reaching the Earth's surface can vary. Each of the following factors can increase your risk of UV radiation overexposure and consequent health effects.

Stratospheric Ozone Layer

The amount of UV rays the ozone layer absorbs varies depending on the time of year and other natural events. Additionally, the ozone layer is thinner than it used to be due to ozone-depleting chemicals used in industry and consumer products. These chemicals are being phased out, but the ozone layer is not predicted to heal to pre-1980 levels until mid– to late-century.

Time of Day and Time of Year

The sun is highest in the sky around noon. At this 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 through the atmosphere at an angle and their intensity is greatly reduced. The sun's angle varies with the seasons, causing the intensity of UV rays to change. UV intensity tends to be highest in the summer.

Latitude and Altitude

The sun's rays are strongest at the equator, where the sun is most directly overhead and UV rays must travel the least distance through the atmosphere. Ozone also is naturally thinner in the tropics 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. UV intensity increases with altitude because there is less atmosphere to absorb the damaging rays. As a result, your chance of damaging your eyes and skin increases at higher altitudes.

Weather Conditions and Reflection

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 warm. Surfaces like snow, sand, pavement, and water reflect much of the UV radiation that reaches them. Because of this reflection, UV intensity can be deceptively high even in shaded areas.

Positive and Negative Effect of UV Radiation

The Earth's atmosphere blocks most of the Sun's UV radiation from penetrating through the atmosphere. The small amount that gets through has both positive and negative effects. The photochemical effects of UV radiation can be exacerbated by chemical agents including birth control pills, tetracycline, sulphathizole, cyclamates, antidepressants, coal tar distillates found in antidandruff shampoos, lime oil, and some cosmetics. Protection from UV is provided by clothing, polycarbonate, glass, acrylics, and plastic diffusers used in office lighting. Sun-blocking lotions offer limited protection against UV exposure.

It affects human health both positively and negatively. Short exposure to UVB radiation generates vitamin D, but can also lead to sunburn depending on an individual's skin type. Fortunately for life on Earth, our atmosphere's stratospheric ozone layer shields us from most UV radiation.

Positive (Beneficial) Effects of UV

UV from the Sun is needed by our bodies to produce vitamin D, triggers vitamin D. Vitamin D helps strengthen bones, muscles and the body's immune system. It may also lower the risk of getting some kinds of cancers such as colon cancer. UV is used in the treatment of skin conditions such as psoriasis. This is a condition where the skin sheds its cells too quickly and develops itchy, scaly patches. Exposure to UV slows the growth of the skin cells and relieves the symptoms and helps some skin conditions. Some animals (including birds, bees and reptiles) are able to see UV light to locate many ripe fruits, flowers and seeds that stand out more strongly from the background, so it helps some animals' vision. The fruits, flowers and seeds often appear quite different from how humans see them. For example, when seen in UV light, some flowers have different line markings, which may help direct bees and birds to the nectar. Many insects use UV emissions from celestial objects as references for navigating in flight. This is why a light sometimes attracts flying insects by disrupting their navigation process. UV has positive applications in the fields of disinfection and sterilization. UV can effectively 'kill' (deactivate or destroy) microorganisms such as viruses and bacteria, for example, when hanging cloth nappies, underwear and tea-towels outside on the clothesline. To destroy the microorganisms, UV rays penetrate the cell's membrane, destroying the DNA, and so stops its ability to reproduce and multiply.

Not many people consume sufficient vitamin D for their body's needs, so most people need some sunlight to boost their vitamin D to the levels required for best health. For example, if we do not produce enough vitamin D by consuming it or being in the sun, our bodies can't extract calcium from the food we eat, so our bodies then take it from our bones. This is why a lack of vitamin D causes brittle bones and diseases like osteoporosis.

Negative (Harmful) Effects of UV

UV is an environmental human carcinogen. It's the most prominent and universal cancer-causing agent in our environment. There is very strong evidence that each of the three main types of skin cancer (basal cell carcinoma, squamous cell carcinoma and melanoma) is caused by sun exposure . Research shows that as many as 90% of skin cancers are due to UV radiation. Sunburn is a burn that occurs when skin cells are damaged. This damage to the skin is caused by the absorption of energy from UV rays. Extra blood flows to the damaged skin in an attempt to repair it, which is why your skin turns red when you are sunburnt. Over-exposure to UV radiation has a harmful suppressing effect on the immune system. Scientists believe that sunburn can change the distribution and function of disease-fighting white blood cells in humans for up to 24 hours after exposure to the sun. Repeated over-exposure to UV radiation can cause even more damage to the body's immune system. The immune system defends the body against bacteria, microbes, viruses, toxins and parasites (disease and infection).

Germicidal lamps are designed to emit UVC radiation because of its ability to kill bacteria. In humans, UVC is absorbed in the outer dead layers of the epidermis. Accidental overexposure to UVC can cause corneal burns, commonly termed welders' flash, and snow blindness, a severe sunburn to the face. While UVC injury usually clears up in a day or two, it can be extremely painful.

UV damage to the eyes is cumulative, so it is never too late to start protecting the eyes. UV speeds up the aging of skin, since the UV destroys collagen and connective tissue beneath the top layer of the skin. This causes wrinkles, brown 'liver' spots and loss of skin elasticity. The differences between skin tone, wrinkles, or pigmentation on the underside of a person's arm and the top side of the same arm illustrate the effects of sun exposure on skin. Usually, the top side of the arm has had more exposure to the sun and shows greater sun damage. Because photo-aging of the skin is cumulative, it is never too late for a person to start a sun protection programme. Many polymers used in consumer items (including plastics, nylon and polystyrene) are broken down or lose strength due to exposure to UV light. Many pigments (used for colouring food, cosmetics, fabric, plastic, paint, ink and other materials) and dyes absorb UV and change colour. Fabrics, furnishings and paintings need protection from UV (fluorescent lamps as well as sunlight) to prevent colour change or loss.

Potential Effects of UV Radiation on Eyes

UV radiation, whether from natural sunlight or artificial UV rays, can damage the eye, affecting surface tissues and internal structures, such as the cornea and lens. Long-term exposure to UV radiation can lead to cataracts, skin cancer around the eyelids, and other eye disorders. In the short term, excessive exposure to UV radiation from daily activities, including reflections off of snow, pavement, and other surfaces, can burn the front surface of the eye, similar to sunburn on the skin. Table 1 gives some example of occupations with potential risk of ultraviolet exposure.

Table 1. Workers at Potential Risk from Exposure to UV Radiation

Food and drinks irradiators	Outdoor workers
Salon workers and patrons	Construction workers
Lighting technicians	Contractors and surveyors
Lithographic and printing workers	Paint and resin curers
Forensic experts	Plasma torch operators
Dentists and assistants	Welders
Dermatologists and pediatricians	Agriculture, forestry, fishing
General freight truckers	Photolithography

Measurement and Discussion

Table 2. The Illumination versus day in December 1915.

Day	Illumination(mW/cm^2)
8	6.7
9	5.44
10	6.64
11	4.73
15	6.75
21	6.38
29	7.93

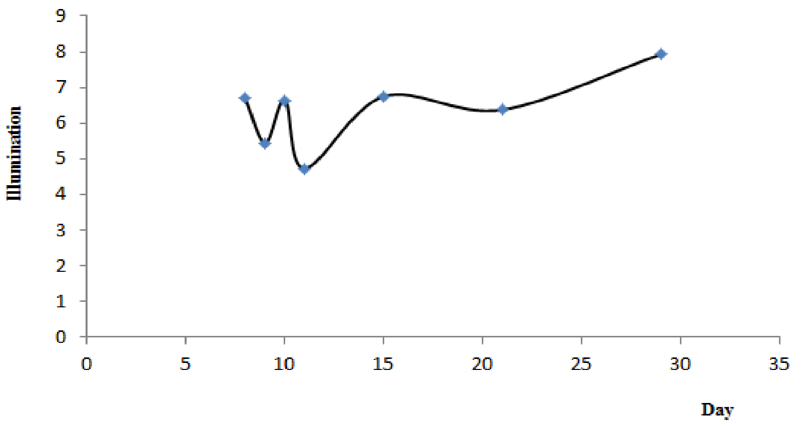

Figure 2. The Illumination versus day in December 2015

Table 3. The Illumination versus day in January 2016

Days	Illumination(mW/cm^2)
2	6
8	5.6
11	6.4
12	6.6
13	7
14	6.7
15	7

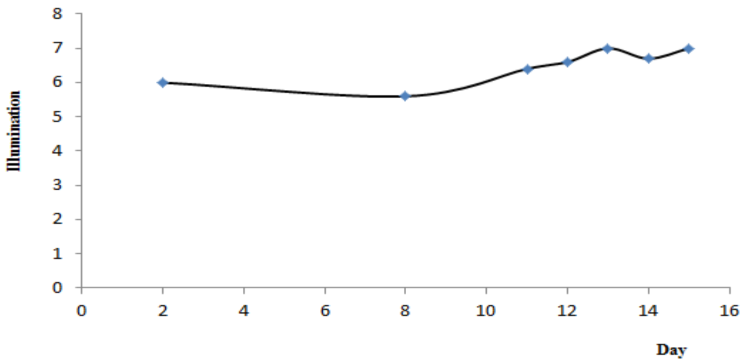

Figure 3. The Illumination versus day in January 2016

Table 4. The Illumination versus day in February 2016

Days	Illumination(mW/cm^2)
18	7.2
19	7
22	7.4
23	7.3
24	7
25	6.9
27	7.3

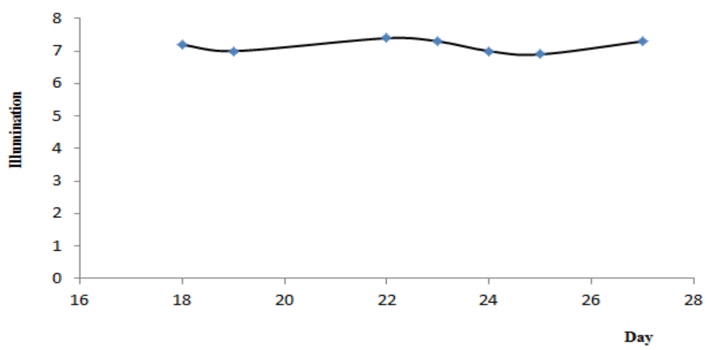

Figure 4. The Illumination versus day in February 2016

Table 5. The Illumination versus day in March 2016

days	illumination(mW/cm^2)
10	8.5
11	8.9
14	9
15	8.9
16	9.4
17	9
18	9.1

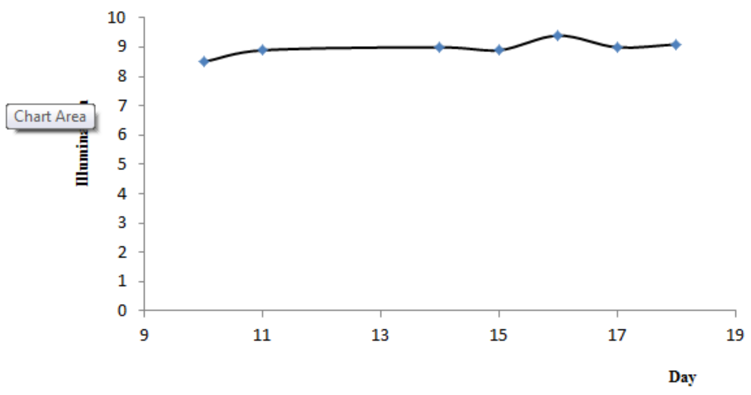

Figure 5. The Illumination versus day in March 2016

Table 6. The Illumination versus day in April 2016

days	illumination(mW/cm^2)
22	10.34
26	7.6
28	9.53
29	9.5
30	10.43

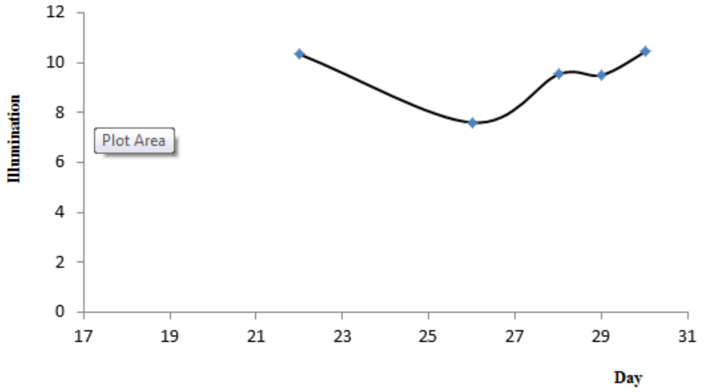

Figure 6. The Illumination versus day in April 2016

Table 7. The Illumination versus day in March 2016

days	**illumination(mW/cm^2)**
19	3.9
20	5.5
23	5.7
24	9.1
25	7.3
26	8.6
27	9

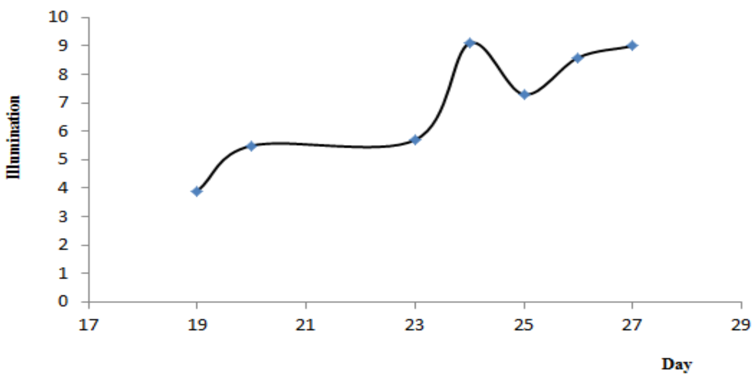

Figure 7. The Illumination versus day in March 2016

Table 8. The Illumination versus month in December 2015-May 2016

Month	Average illumination (mW/cm^2)
Dec-15	6.37
Jan-16	6.47
Feb-16	7.16
Mar-16	8.97
Apr-16	9.71
May-16	7.68

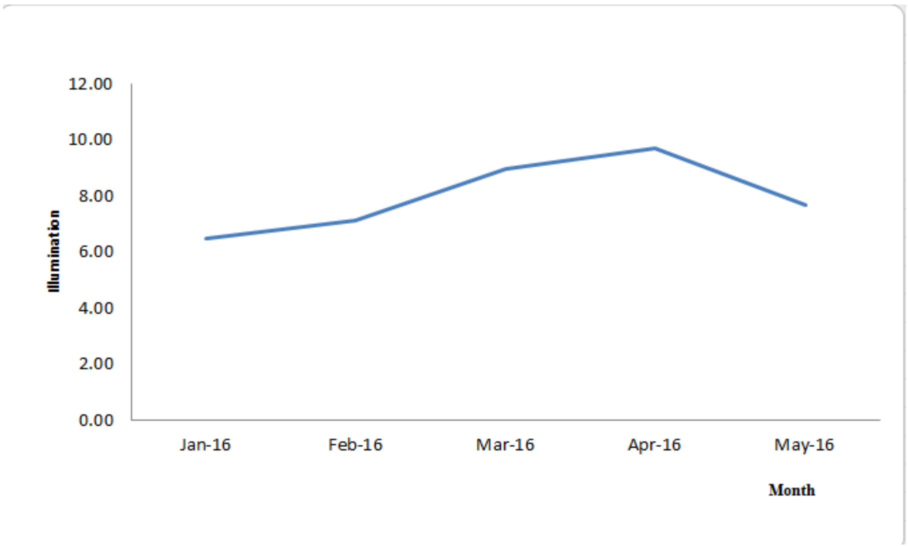

Figure 8. The Illumination versus month in December 2015-May 2016

Conclusion

This Research, after outlining the goals and philosophy of radiation protection and the basis for exposure limits, goes on to review, in some detail, absorbed dose, equivalent dose, radiation weighting factors, and effective dose. Committed equivalent dose and committed effective dose are also introduced. Risk estimates for radiation exposure are presented and then the dose limits are enunciated.

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