In the 1990's there were some concerns about the effects of Ultra Violet light on both the eyes and the skin, so the following paper will give you an background on the type of UV to buy and the affect it will have on human beings. Our thanks go to Brian Diffey of Dryburn Hospital Co. Durham for supplying this paper.

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'Ultra Violet Black Light' is used extensively in the MSR and will make white or fluorescent items glow to around 20 times brighter than they would in normal sunlight. How bright they glow is dependent on the power of the UV Blacklight (UV) used. We normally see 4ft or 2ft fluorescent tubes used in the MSR. The following pages where created by Dr. B Diffey a consultant medical physicist at Dryburn Hospital, County Durham. Please remember that when he refers to 'lamps' he is referring to either fluorescent tubes or bulbs.

The lamps used for stimulation of visually impaired people emit UV radiation (UVR). We here lots these days about the over exposure to the suns ultra violet rays and the effect that damage to the atmospheric ozone layer may have on increasing the strength of UVR at the earth's surface. The main reason for the concern is the worrying rise in the number of people getting skin cancer that has occurred in recent years.

It is not surprising, therefore that many people working with patients with special needs in visual stimulation are concerned about the health effects of exposure to UV lamps in dark rooms and multi sensory rooms. In this article I will try to answer some of the questions you may have and hope to show you that when used properly, these lamps are really very safe and pose no risk to health.

What is Ultra Violet Radiation?

Ultra Violet radiation is a small part of what is known as the electromagnetic spectrum. Other parts of this spectrum include X Rays, visible light, infrared radiation, microwaves and radio waves. The types of radiation are differentiated by the length of their waves. X Rays being the shortest and radio waves the longest. The different wavelengths have different biological effects.

For example: We know that X Rays can be dangerous whereas infrared radiation (heat rays) and radio waves are much safer. Visible radiation, which is the light we get from the sun, is generally not harmful unless we are exposed to very bright sources.

What are the effects of Ultra Violet Radiation in Humans

Exposure to UV radiation can be hazardous. The risk varies greatly with the wavelength of the radiation and for this reason UV radiation is subdivided according to its effects on the skin and eyes into three bands: UVC, UVB and UVA.

UVC Radiation has wavelengths, which lie between 200 - 290 nanometres (abbreviated to nm - a unit of length equivalent to one thousand millionth of a metre). UVC is very harmful to the eyes and skin, but does not reach the earth's surface because the UVC rays from the sun are absorbed entirely by the ozone layer. UVC is produced by some special types of lamp called germicidal lamps, but not the sort used in the MSR or dark rooms.

UVB Radiation (290 - 320 nm) is present in terrestrial sunlight and is mainly responsible for the deleterious effects we associate with sun exposure such as sunburn and after many years' skin cancer.

UVA Radiation (320 - 400 nm) is again present in sunlight and is about 20 times as intense as the suns UVB rays. However it is much less harmful and very high doses are needed to damage the skin or eyes.

What is Fluorescence?

When certain materials are exposed to UV radiation the molecules present in the material can absorb the UV rays and Re-Emit radiation of a longer wavelength - normally visible light. This is particularly striking in materials to which optical brightness have been added such as paper, detergents and fabrics. Optical brightness are compounds which absorb radiation in the 320 - 400 nm region (UVA) and emit light or fluorescence in the 400 - 500 nm region of the visible light spectrum which corresponds to blue light.

How do Ultra Violet lamps work that are used in the Multi Sensory or Dark rooms

The UV fluorescent lamps used should look very dark purple when they are switched off. They are often called 'Black Lights'. some UV lamps such as those used in sun beds for tanning look white when they are not switched on. These should NOT be used in the MSR or dark rooms as they can be hazardous and will not produce fluorescence in clothing or paper. When the Blacklight Ultraviolet Lamps are switched on they look lilac or purple and the lamps appear to have a fuzzy edge. The reason for this is that the UVA radiation emitted by the lamps (the lamps do not emit UVB or UVC radiation) is absorbed by the lens of the eye and causes them to fluoresce with a purple light. This light falls on to the retina (the light sensitive layer at the back of the eye) in a de-focused way, which explains why the lamps appear fuzzy.

When other surfaces such as clothing or paper which contain optical brightness, are exposed they emit a blue white fluorescence. Dark coloured clothing will absorb the fluorescent light so will not appear bright. Also surfaces such as walls or floors are made from materials which do not fluoresce also appear dark.

Is Blacklight UV a lamp hazardous?

In normal use the answer to this question is no. Measurements have been made of the UV radiation levels from a pair of 4 foot 'Blacklight lamps' (Phillips type TLD36W / 108) the type used in the MSR or dark rooms (see appendix for technical details). The radiation lies entirely in the UVA wave band (the least harmful part of the ultra violet spectrum). The intensity or strength of the radiation gets weaker the further away from the lamps.

The amount of radiation received from the lamps can be equated in the time spent in British summer sunshine around the middle of the day. The following table shows the equivalent sunlight for different distances from the lamps.

Normally both the trainer and patient would be 4ft or more away from the ceiling or wall mounted lamps. At this distance exposure for 2 hours gives a dose of radiation which is the equivalent to an exposure of 48 seconds summer sunshine. Despite the concern that many people have, no one could accept that such a short exposure is a serious risk to health. Even in dark rooms where more than two Blacklight lamps are used it is unlikely that the UV radiation levels would ever pose an exposure hazard to either staff or parents.

In conclusion UV Blacklight lamps used in dark rooms and MSR's for visual stimulation present no risk to either the eyes or skin if used appropriately.

Distance from Blacklight lamps	Time exposed to U.V. lamp **10 Minutes**	Time exposed to U.V. lamp **30 Minutes**	Time exposed to U.V. lamp **1 Hour**	Time exposed to U.V. lamp **2 Hours**	Time exposed to U.V. lamp **4 Hours**
6 Inches	50 Sec	2.5 Min	5 Min	10 Min	20 Min
1ft	25 Sec	75 Sec	2.5 Min	5 Min	10 Min
2ft	10 Sec	30 Sec	1 Min	2 Min	4 Min
4ft	4 Sec	12 Sec	24 Sec	48 Sec	90 Sec
8ft	1 Sec	3 Sec	6 Sec	12 Sec	24 Sec

Aromatherapy - Note of caution

Some people use aroma therapy with their pupils and one of the oils used for massage is bergamot oil. This oil contains chemical 5 methoxypsoralen, which is a potent photosensitising agent. When skin to which bergamot oil has been applied is exposed to UVA radiation a photo toxic reaction can occur resulting in the reddening and persistent pigmentation. It is sensible therefore not to use UV Blacklight lamps for visual stimulation if bergamot oil has been applied to the skin in the previous 24 hours.

APPENDIX

A technical description of the measurement of Ultra Violet radiation.

The spectral irradiance at distances varying from 10 to 300 cm from the mid point of a luminaire incorporating two 4ft Black light fluorescent lamps (Type TLD36W / 08 ; Phillips Lighting) mounted 3cm apart was measured from 300 to 400nm in steps of 1 nm using a high quality spectroradiometer (Model 742 Optitronic labs Inc, Orlando, USA) The band width of the monochromator was fixed at 1.5 nm and wavelength calibration was achieved by using a low pressure mercury discharge lamp (253.7nm and 435.8nm). The spectral sensitivity calibration of the instrument was determined before measurement by reference to a calibrated deuterium spectral irradiance standard obtained from the National Physical Laboratory in the U.K. By weighting the spectral irradiances by the reference action spectrum for erythema in human skin (1) it was possible to estimate the erythemally effective irradiance which is frequently used as a surrogate for carcinogenic effective exposure.

The spectral power distribution extended from 345nm to 400nm, peaking at 365nm. The unweighed ultraviolet irradiances (expressed in units of mW / cm2) and erythemally - weighted irradiances (expressed in units of minimal erythema dose per hour, MED / h are given below.

Distance from point of lamps cm	Unweighed U.V. irradiance mw/cm2	Erythemally weighted irradiance MED/h
10	2.6	0.21
20	1.3	0.11
50	0.55	0.045
70	0.34	0.028
100	0.21	0.017
150	0.1	0.008
200	0.06	0.005
250	0.04	0.003
300	0.03	0.002

Reference
1. A.F. McKinlay and B.L. Diffey, A reference action spectrum for ultraviolet induced erythema in human skin, CIE J .1987. 6;17-22

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