

## **EYE SAFETY WITH NEAR INFRA-RED ILLUMINATORS**

As a leading manufacturer of infra-red illumination systems for CCTV, Derwent has an obligation to ensure its customers are given the knowledge to safely install and use their products. Derwent takes this obligation very seriously and based on up to date information has produced this document so that by following their guidelines, customers can have confidence that their security system is installed and used in a safe manner.

Derwent are not aware of any reported case of eye damage from the radiation from quartz/halogen or LED IR lamps used in CCTV.

Derwent has designed its UF500 lamps to allow operation at safety levels that exceed the guideline safety standards of the ACGIH.

### **Background**

Throughout history people have been exposed to high levels of infra-red radiation, in the making of steel or glass, simply being out in strong sunlight, in fact anywhere close to a hot object. Infra-red gives a heating effect, which we sometimes use to keep us warm, but too much on the skin can cause blistering. Industry is aware of the dangers of high intensity IR radiation and the risks and effects of over exposure to it are well known.

Bright natural light which contains infra-red causes the eye to blink, the iris to contract and the viewer to look away. These normal defence mechanisms do not happen when the visible part of the light has been removed. The eyes are more sensitive than the skin, over exposure for long periods may give rise to retinal damage and cataracts. These are the hazards of over exposure to IR. The exposure limits <sup>(1,2,3)</sup> and fig.1 show that filtered IR is around 100 times less hazardous than visible blue light.

Other sources of IR are lasers which give high intensity beams, these intense beams have necessitated safety regulations. These regulations encompass conventional light sources. Derwent have reviewed these regulations <sup>1,2,3,</sup> and have produced the following guidelines for the use of their products.

There are two scenarios which have to be considered with these security systems, *safety in use* which is long term and safety during *installation, testing and maintenance* which is shorter term. Details of the technical aspects which were used to arrive at these recommended minimum safe working distances are given later.

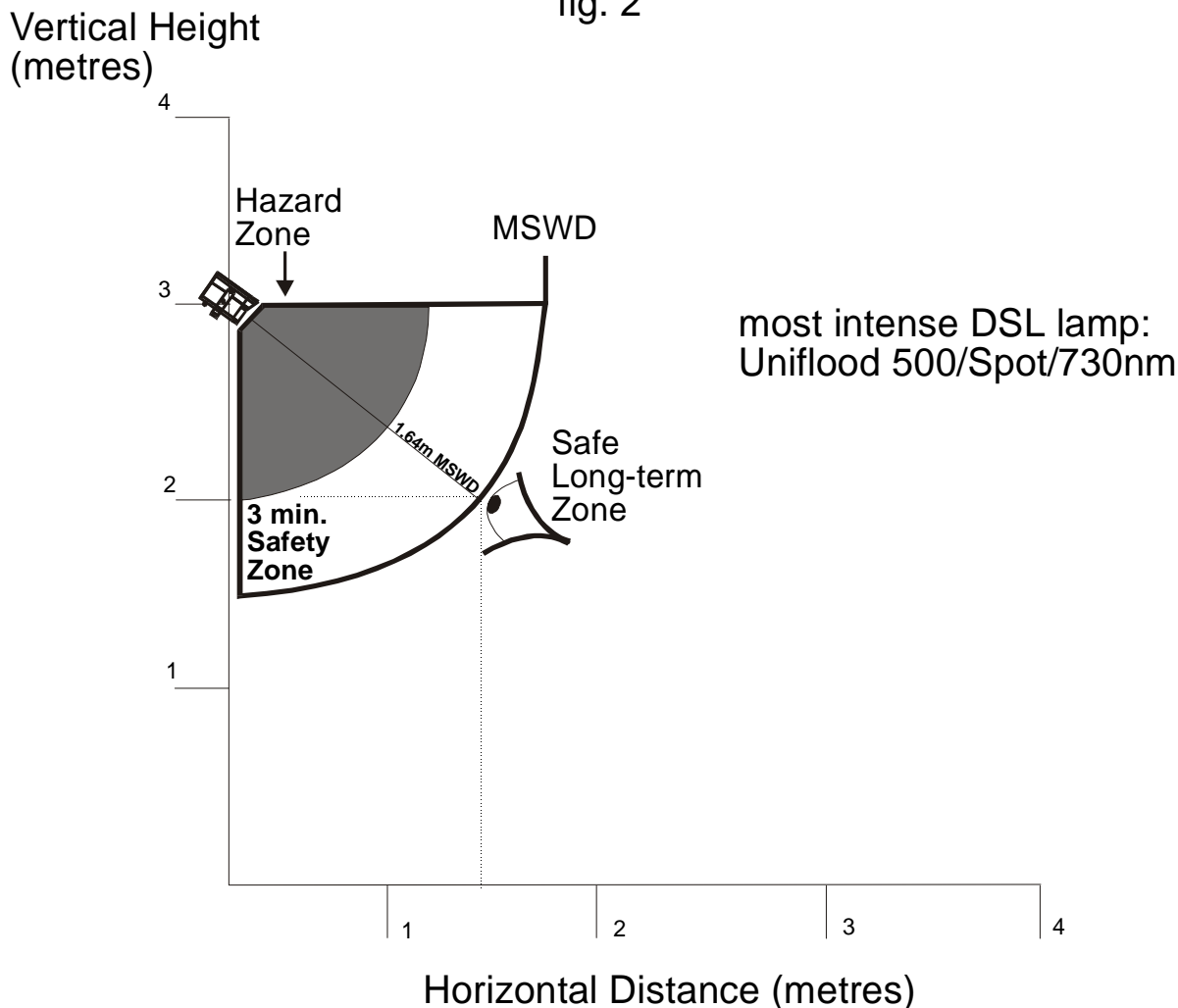
### **Safety in Use (Long Term Exposure)**

If possible the lamp and camera should always be installed where they cannot be touched by passes-by, otherwise it is not a secure system, or that passers by cannot stare at the lamp closer than the Minimum Safe Working Distance (MSWD) in Table 1. The MSWD refers to the central part of the beam which is the most intense, and under conditions of continuous viewing for up to 8 hours.

Taking the most prudent and cautious approach fig.2 shows that even an exceptionally tall person whose eyes are 2m (6ft.6ins.) above ground would have to come within 3m (4ft.3ins) of

the mounting post of a lamp mounted 3m (9ft.10ins) above ground before entering the *hazard* zone of a 500 spot. Even in the unlikely event that at the closest distance of 1m (3ft.3ins) and with the lamp shining directly downwards the observer staring upwards into the lamp for up to 3 minutes is within the safety limits.

fig. 2



**Table 1 - Derwent Products – Minimum Safe Working Distances**

Lamp Type	Minimum Safe Working Distances for up to 8 hours Viewing			
	500 Series	300 Series	500 Series	300 Series
Spot	ft.ins. 5'6"	m 1.64	ft.ins. 5'0"	m 1.5
10 Deg	ft.ins. 4'6"	m 1.4	ft.ins. 4'0"	m 1.23
30 Deg	ft.ins. 3'0"	m 0.9	ft.ins. 2'9"	m 0.81
Flood	ft.ins. 3'0"	m 0.89	ft.ins. 2'9"	m 0.8

As a rule of thumb *if you can feel the heat, don't stare or touch the lamp.*

**LED**

The Derwent range of LED illuminators have a narrow band output and can be viewed continuously at even shorter distances with a MSWD of 0.3m (12ins.)

**Installation, Testing and Maintenance (Short Term Exposure)**

Although the ACGIH guidelines can be interpreted to suggest the Derwent lamps can be safely viewed at very close distances (fig.3) Derwent discourage direct viewing at any distance below the MSWD. If the lamp is on the heat from it can be felt by passing a hand in front of the lens. A second observer at a distance greater than MSWD should be used to checked the lamp is

functioning and that the filter is acceptable for either overt or covert operation. During final adjustments a monitor linked to the camera is recommended, as described in the installation instructions supplied with the lamp. For regular maintenance at the camera head, the lamp should be extinguished. Multiple lamp systems have designed configurations so that overlapping intensities do not exceed the centre beam intensity of a single lamp at the MSWDs.

### **Technical Aspects**

The ACGIH publish the TLV (Threshold Limit Values) for various physical agents; they recommend a TLV of 10 mWcm.<sup>-2</sup> for the irradiance of near infra red radiation under conditions of viewing for longer than 16mins. For shorter times and higher irradiances the following formula can be used to find the Maximum Permissible Exposure (MPE), this is based on guidance given in ref. 1.

$$MPE = 491 t^{-0.25} Wm^{-2}$$

Where the numerical factor 491 is specific to DERWENT lamps.

Together with the inverse square law and measurements of the centre beam irradiances of Derwent lamps, this formula has been used to produce fig. 3 which gives the time/distance relationship needed to maintain safe irradiance limits. Time/distance conditions within the MSWD should be regarded as unsafe and should be avoided.

Derwent lamps have a centre beam irradiance of 10 mWcm.<sup>-2</sup> at the MSWDs which is the minimum recommended viewing distance under normal conditions. In circumstances where closer viewing has to take place then fig. 3 gives the time/distance relationship needed to maintain safe irradiance limits.

EN 60825-1 1994-1996 gives Maximum Permissible Exposure limits of the radiance on the eyes for light of various wavelengths, these MPE values have been used to produce fig. 1 which indicates that visible blue light is around 100 times more hazardous than the filtered IR light used in Derwent security lamp systems.

### **References**

- 1.American National Standards Institute (ANSI) Z136-1-1993.
- 2.European Standard EN 60825-1 1994-1996
- 3.American Conference of Government Industrial Hygienists (ACGIH) 'Threshold Limits Values' 1994.
- 4.Institute of Electrical and Electronic Engineers (IEEE) 0-7803-2627-X/95 1995 by H. Devereux and M. Smalley.

### **PLEASE NOTE**

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fig.1

### Relative hazard versus wavelength

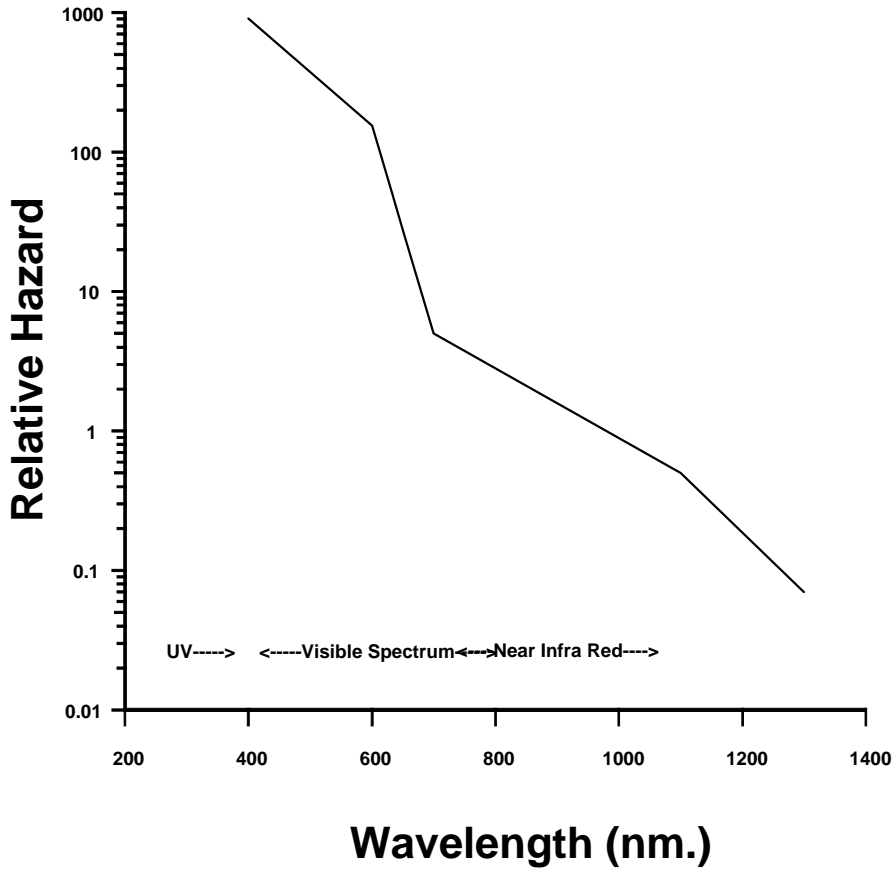


fig.3

### Minimum Safe Working Distances versus Time

