

Working safely with UV

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2) Introduction

Ultra violet (UV) light is a non-ionising radiation with a wavelength of 100-400nm, UV lights sources are used in laboratories to visualise DNA (transilluminator), degrade nucleic acids (pre-PCR station), typically sources emit in the region of 280nm to 400nm.

Whilst the 100-280 nm wavelength band is designated as UV-C, which is used for germicidal purposes, a number of factors limits its efficacy:

- **Penetration** –In the dynamic air streams of Microbiological Safety Cabinet (MSC) microorganisms beneath dust particles, plastics, and work surfaces are not affected by the UV light because it cannot penetrate particles so far from the UV source². Even the flat surfaces inside a biosafety cabinet are not perfectly flat at the microscopic level. This unevenness creates “microshadows” where microorganisms can stay safely tucked away³.
- **Temperature and humidity** – The germicidal effects of UV light drop off precipitously when relative humidity is above 70%. The optimum temperature for the UV lamp to be effective is 25°C. Temperatures below this range result in reduced efficacy, and air movement can exacerbate this.
- **Cleanliness** – Dust and dirt block the germicidal effectiveness of the UV lamp, so weekly cleanings are necessary.
- **Age** – Check UV lamps every six months to assure proper function, as the amount of germicidal wavelength emitted decreases with bulb age and hours of use.
- **Overuse** – UV lights are routinely left on overnight or longer in an effort to decontaminate workspaces, but this practice can result in the germicidal wavelength no longer being produced by the bulb and also plastic equipment becoming brittle (pipettes left in MSC under UV light are particularly affected)

- **Overreliance** – You should not rely on a biosafety cabinet UV light as the sole decontaminating agent. Surface disinfection should be performed before and after every cabinet use.

For these reasons and other concerns, the **Safety Office (NSF) does not recommend the use of UV lights in MSCs.**

Retrofitting any equipment (e.g., UV lights) into a cabinet may alter the air flow characteristics, invalidate the manufacturer warranty, and is not recommended.

If UV light is necessary in a Safety Cabinet then an application must be made to obtain **approval** from the University Safety Office prior to the purchase of a suitable UV-fitted MSC and a full risk assessment must identify the required precautions to mitigate risks. Please contact the Laboratory and Facilities Manager for further information.

3) Risks

Long-term exposure to UV can lead to cataracts, opacity of the eye lens and skin cancer.

The most significant risk in the laboratory is from short periods of intense exposure, which can lead to serious damage to the skin and eyes.

The main risk of UV is therefore from direct exposure to the light source.

4) Safer alternatives

Alternative **systems of visualisation**, such as blue LED light fluorescence should be considered. They have the advantage that although filter glasses are generally worn to remove background light and enhance contrast there is no more hazard than any other bright visible light source.

5) Safety requirements

As per University Policy S04/11¹, precautions must be in place to prevent and reduce the risk of exposure to users and colleagues.

Equipment that operate with an interlock must never be over-ridden.

Where the UV is used as light source (i.e. cutting a gel), the user must wear labcoat, gloves and a UV face shield to protect the face and neck.

- The face shield must be angled so as to cover both the face and neck during any manipulation,
- If there is any chance that UV light can shine under the face shield, then UV spectacles or goggles should also be worn to protect the eyes,
- Gloves should be pulled up over lab coat cuffs to protect arms/wrists,
- Follow manufacturer's instructions,
- Equipment must not be left on unattended and should not be left on for long period of time (risk of over-heating).

This applies to all equipment operating with UV light. Any fault must be reported immediately to the Facilities Teams.

Users must have been trained for the correct use of UV light.

6) Risk Assessment

A suitable and sufficient risk assessment must be in place where groups use UV light. It is the responsibility of the supervisor to ensure that all new starters are trained on the safe use of the equipment but also are made aware of the risks and are supervised until judged competent to work autonomously.

Having a UV card emergency details is considered best practice so that in case of an exposure, this can be provided to the medical team treating the injured person.

7) Emergency procedure:

- Eye exposure: turn equipment off if possible to do so, cover both eyes with eye dressing and immediately attend the Oxford Eye Hospital emergency department on LG1, West Wing. Telephone in advance to forewarn of the arrival on **01865 234567**. Give medical staff in attendance information about the wavelength of UV used.
- Skin exposure: Effect of exposures will not be felt immediately. Treat skin as per sunburn injury.

>> Report all incidents or near misses to Institute Safety Officer and complete an accident form promptly using the online reporting system:

<https://oxforduni-remoteforms.info-exchange.com/Incident>

8) References

¹ University Policy Statement S4/11 Non Ionising Radiation
https://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/healthsafety/documents/USPS_0411.pdf

² The trouble with UV light in your biosafety cabinet
<https://www.ehs.washington.edu/about/latest-news/trouble-uv-light-your-biosafety-cabinet>

³ Biosafety Cabinet UV Light Pitfalls <https://bakerco.com/communication/latest/biosafety-cabinet-uv-light-pitfalls/>

Annexe 1

Emergency action:

- Turn equipment off if possible to do so.
- Call for help, warn first aider of hazard if the equipment is still on.
- Cover both eyes with eye dressing and immediately attend the Oxford Eye Hospital emergency department on LG1, West Wing.
- Telephone in advance to forewarn of the arrival on **01865 234567**.
- Give medical staff in attendance information about the wavelength of UV used.

In case of UV exposure, show this card to the medical staff in attendance

UV wavelength and power: _____