

## IOP Optical Group member update on laser safety inspections

### Summary

Concerns have been raised in recent years by IOP Optical Group members about community uncertainty over the laser safety standards and their practical implementation, as expected in HSE inspections of university laser labs. Prompted by these concerns, the Optical Group has been gathering information about the situation from members, and speaking with other organisations including national labs, laser safety consultants, and HSE themselves.

Our work here is still ongoing, but we want to provide an interim update to members, and seek your further assistance with our work. This document summarises our findings so far. The concerns and questions raised by members focused on practice in universities, so our response here also focuses on this.

One of the important findings was that some members were unaware of the 2018 update to the guidance document issued by the Association of University Radiation Protection Officers (AURPO) on safe working with lasers in a university research lab <https://aurpo.org.uk/publications/guidance>. We have confirmed that this guidance closely matches the expectations of HSE laser safety inspectors, and we advise members to treat this guidance document as the definitive one to follow. It is HSE's expectation that university radiation protection officers (RPOs) should be fully aware of this document and its significance; if this is not the case in your university and/or your RPO is imposing requirements that differ from this, then we encourage you to discuss with them what their reasons and sources of information are.

For some classes of experiment, members have concerns over how to abide by the guidance while conducting their research. There are particular challenges and uncertainties around the principle that open beam working should be a "last resort", and what constitutes "reasonably practicable" measures to enclose a laser beam in a complex experiment. To help clarify this, we now have an opportunity to bring a handful of specific (anonymous) case studies to HSE, as illustrations of challenging examples where members are unsure how to conduct their research while following the AURPO guidance. If your experiment fits into this category, please contact [jonathan.taylor@glasgow.ac.uk](mailto:jonathan.taylor@glasgow.ac.uk) to discuss this further. We are keen to ensure HSE are aware of the complexity of some of the systems our members work with, and these specific examples will feed into discussions with HSE to help clarify what is 'reasonably practicable' in terms of steps to avoid open beam working.

### Context

Concerns have been raised in recent years by IOP Optical Group members about community uncertainty over the laser safety standards expected in HSE inspections of university laser labs. 61 members from UK universities responded to our survey. The majority of respondents were PIs or PDRAs, many with 5 or more years of experience working with high-power lasers (primarily visible and infrared). The respondents included at least two departmental laser safety officers.

The responses as a whole revealed considerable anxiety and uncertainty over what HSE's expectations are for laser research labs. Many researchers reported a perception that current guidance is unfeasibly restrictive; however, many responses also revealed a lack of awareness of what the current guidance actually is. It is clear that this lack of awareness extends beyond individual respondents, and also applies to instructions researchers describe receiving from university safety advisers.

**Concerns particularly centred around open beam working** with class 3B/4 lasers; some respondents reported having been told that this is not permitted under any circumstances, while others were alarmed by rumours about the outcomes of HSE inspections at other universities. Respondents also called for access to case studies that can demonstrate best practice in challenging scenarios.

Prompted by these responses and concerns, the Optical Group committee has been gathering information about the situation from members, and speaking with other organisations including national labs, laser safety consultants, and HSE themselves. This document summarises our findings so far. This document is not intended to duplicate or contradict the detailed guidance available from definitive sources; our aim is to highlight and raise awareness of key aspects of existing national guidance and requirements, relevant to the concerns and uncertainties raised by members. By doing this we seek to promote safe working and good practice with lasers, while also equipping individual researchers to dispel myths and mis-communications around current guidance.

#### [Definitive guidance for safe working with lasers in UK research environments](#)

The 2018 edition of the AURPO "Guidance Note No. 7 – Safe Use of Lasers in Education and Research" (<https://aurpo.org.uk/publications/guidance>) should be considered to be the **definitive document** advising on safe practice with lasers in universities. It is clear that many researchers are not aware of the existence of this document, especially its latest revision in 2018.

While HSE do not "endorse" the document, and emphasise that they do not treat it as a checklist during their inspections of universities, we were able to get confirmation from HSE that they did review the document before publication. It is therefore reasonable to assume that the 2018 edition reflects HSE's position fairly closely, or they would have advised changes to it. HSE do not provide any detailed guidance of their own, beyond the very general "artificial optical radiation regulations", so we advise researchers and universities to base their safe practice on the AURPO document. Many researchers find the guidance's approach to open beam working challenging, but this does reflect HSE's position. **Researchers following the guidance should have confidence** that an HSE inspection should not find fundamental flaws in their working practices.

HSE, and the AURPO guidance document, are clear that comprehensive risk assessments must be carried out, and for class 3B and 4 lasers in particular it will likely be necessary to draw up a detailed scheme of work describing specific procedures for not just the routine operation of an optical system but also its construction/commissioning/maintenance. The hierarchy of controls laid out in the guidance document applies even during construction of an optical system, and restricting an activity to "skilled users" is not considered to be a sufficient safety control on its own. There is an expectation that users, and those compiling risk

assessments, should have a **detailed grasp of what the hazard level** is at any location in an optical setup during individual procedures (including construction), each of which may involve different beam powers and level of access to the beam. This hazard level should be compared against the maximum permitted exposure (MPE) as defined by BS EN 60825.

In terms of future evolution of guidance, it may be reassuring to know that ultimately the 2018 changes have originated (in part at least) from an evolution of personnel and expertise within HSE. We are therefore hopeful that researchers can now anticipate a period of stability and certainty, without further major policy changes on the horizon.

#### Laser safety frameworks within UK universities

Universities are expected to have robust and well-communicated frameworks and policies in place to define the administrative controls (including risk assessment templates) and generic safety training for working with lasers. This would be expected to be supplemented by research supervisors/principal investigators in the form of well-considered risk assessments and schemes of work, and local experiment-specific training consistent with these agreed schemes of work.

Leadership is expected to come from a suitably trained and competent person acting as overall Laser Safety Adviser (LSA) for the institution. This role is often filled by the university's Radiation Protection Officer (RPO). Many RPOs are not primarily optical experts (rather, their knowledge is centred on ionising radiation). UKHSA run training courses and annual conferences on laser safety, and AURPO also organise their own annual conference. These are attended by HSE, and are the main routes by which HSE expect university LSAs to be trained and kept up to date with current acceptable practice. HSE expect that all university RPOs will be familiar with the latest AURPO guidance via these routes, and that RPOs will shape the university's approach to laser safety and **cascade information to researchers** accordingly.

Universities are required to take "competent advice" on laser safety matters. Where RPOs have a background centred on ionising radiation rather than laser physics, some universities have engaged the support of external consultants to help develop the university's laser safety policies and training material. Anecdotally, this has sometimes resulted in an approach that may be more risk-averse than HSE's own expectations, but it can nevertheless be a beneficial approach to address a lack of local expertise.

Anecdotally, information on changes and clarifications of national guidance is not always well cascaded down to departmental Laser Safety Officers (LSOs) and individual labs. HSE give feedback from inspections at the annual conferences run by AURPO and UKHSA. HSE assume that RPOs engage with these conferences and subsequently cascade within their own university. It is apparent to us that this onward communication is not always working well in all universities; where that is not the case, we advise that individual researchers continue to base their own approaches to laser safety on AURPO Guidance Note #7. The Optical Group is seeking to establish improved channels of communication here that would allow LSOs and research labs to get more direct access to the key information and advice.

We are aware of situations where researchers perceive that RPOs are basing their advice on rumours rather than the definitive sources of information that are available. If RPOs are requiring precautions/restrictions that go beyond what is laid out in the AURPO document, we advise members to query this, and **seek more information** from the RPO on where they are getting their information from.

### Open beam working

In some research areas including nonlinear optics and atom optics there are specific challenges around laser safety, such as fine alignment of some components needing to be conducted at high laser powers. This brings the research activities into potential conflict with the AURPO/HSE position that open beam working should be an absolute last resort. However, **neither AURPO nor HSE rule out open beam working completely**. Rather, they require that all reasonable steps are taken to minimise the extent (in time and space) of open beam working, and that a well-justified risk assessment and scheme of work is in place to articulate why and when open beam working is unavoidable. This justification should form one part of a comprehensive risk assessment and scheme of work, and the university should support researchers in developing this, via the university's Laser Safety Adviser.

The 2018 revision of AURPO guidance note #7 introduced revisions (including the guidance on open beam working) that are causing significant changes to how some researchers are working. The changes to the guidance closely reflect HSE's position on the issue, but the changes have not always been well cascaded internally within universities to individual researchers in a timely way. For Optical Group members, a lack of awareness of the revisions to the guidance document has resulted in rumours, anxiety and uncertainty over what HSE's expectations are. We hope to improve communication and awareness about this and any future revisions.

### Case studies

We believe that the community would benefit from case studies demonstrating best practice in challenging and complex optical scenarios such as nonlinear and atom optics. Some case studies have been shared at specific events such as the UKHSA training courses; there is a perception among researchers that these case studies involve relatively simple setups compared to some complex research applications. There is a desire from the research community for more complex case studies to be shared publicly, to demonstrate best practice and illustrate how open beam working can be minimised - but retained where essential - during alignment of complex research experiments.

We have an opportunity to bring a handful of specific experimental scenarios to HSE, as illustrations of challenging examples where people are not confident about how to conduct their research while following the AURPO guidance. The AURPO guidance describes a hierarchy of safety controls, with open beam working being the last resort. In other words, all other approaches are taken where possible, but in specific well-defined situations the researcher concludes that only open beam working enables the experiment to be conducted.

In this scenario, they or their university safety officers may be concerned that HSE would not permit that, if they were to inspect the experiment. If you are in this

situation, please contact [jonathan.taylor@glasgow.ac.uk](mailto:jonathan.taylor@glasgow.ac.uk) to discuss developing an (anonymous) case study that can be discussed with HSE. The aim would be either to confirm that HSE would *not* have any major objections to the experimental procedures followed, or to get their input on what/how they would expect to see things done differently. If the latter, then that may form the starting point for a further dialogue between the community and HSE over the practicalities of implementing their expectations. Going forward we hope these anonymous case studies will become publicly available as example of best practice in terms of how the hierarchy of safety controls can be applied to a complex system.

*Jonathan Taylor and Amanda Wright, on behalf of the IOP Optical Group, June 2022*