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Title : CINTRA SOP on Handling of High Powered Lasers		
Audience : Faculty, staff and students handling high powered lasers in laboratories within CNRS International-NTU-Thales Research Alliance		

1. Aim

This SOP is to ensure all persons at work within CNRS International-NTU-Thales Research Alliance (CINTRA) are not exposed to any radiation when using a high powered laser.

2. Scope

This SOP covers all CNRS International-NTU-Thales Research Alliance workplaces where a person needs to handle any high powered laser equipment.

3. Definitions

CINTRA– refers to the CNRS International-NTU-Thales Research Alliance

High Powered Laser – refers to Class 3b and Class 4 lasers as listed in the Radiation Protection (Non-Ionising Radiation) Regulations

LSR – refers to Laboratory Safety Representative

NEA – refers to the National Environment Agency

Laser work - work which involves the use, handling or operation of any high powered lasers

Laser worker - any individual who is engaged in or is employed for part or whole of his working time to do radiation work

WRAS – Workplace Risk Assessment System which is the NTU web based risk assessment application used for the conduct of workplace risk assessment.

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4. Responsibilities

4.1 **Reporting Officer** – is the person whom the laser worker reports to for work. In the scenario of a research staff and students working in a school, the Reporting Officer is usually the Principal Investigator. The Reporting Officer shall take all reasonably practicable means to ensure the safety of the laser workers. Reasonably practicable means include, but not limited to, conduct risk assessment, ensure safe work procedure is established, equipment possess a valid N2 licence, construct proper enclosure or shielding for safe operation of laser, users possess a valid N3 licence to use the equipment and provide appropriate personal protective equipment (e.g. laser safety goggles).

4.2 Equipment Owner

The high powered laser equipment owner shall ensure:

- a) The equipment possess a valid N2 licence and renew the licence from time to time;
- b) Ensure the NTU Laser sticker is applied and pasted on the high powered laser;
- c) Maintain the high powered laser as per recommendation from the manufacturer;
- d) Ensure risk assessment and safe work procedure are established prior to the operation of the high powered laser;
- e) Ensure briefing or training is done to the users before authorising such use;
- f) Ensure only persons with valid N3 licence to operate the high powered laser;
- g) Update any required information to CINTRA Safety Committee upon request or when cease the use of such high powered laser.

4.3 Laser Worker

- a) Attend all required training before operating the high powered laser. These include taking the online e-learning courses (Non-ionizing Radiation: Introduction to NIR & Local Regulations and Laser Safety Training modules) and understanding the operation of the equipment through briefing or equipment training.
- b) Ensure he/she possesses a valid N3 licence issued by NEA to operate that particular high powered laser equipment. Co-operate with REPORTING OFFICER or LSR on the licence application and renewal process.
- c) Understand the risks involved and implement all safety practices as indicated in the risk assessment, safe work procedures and operating manual.
- d) Report any abnormalities or issues to the LSR, REPORTING OFFICER or equipment owner.

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4.4 **Laboratory Safety Representative (LSR)** – is the person employed or appointed by the Centre to ensure safety practices are carried all the times at their respective workplaces. The LSRs working in laboratory with high powered lasers are required to have general safety knowledge and know the types of laser work carried out in their respective workplaces.

The LSR is responsible to:

- 4.4.1 apply for a license for permit to house the high powered laser in the laboratory
- 4.4.2 maintain a register of all high powered lasers and all licenses required under the Regulations. This register (Appendix 1) shall be updated and send to CINTRA Safety Committee quarterly.
- 4.4.3 ensure only authorised persons with valid N3 licence operate the high powered laser equipment by tagging authorised persons with valid N3 licence to individual N2 equipment. This list must be readily available beside each high powered laser or displayed on the door of the room enclosing these high powered lasers
- 4.4.4 After the issue of this SOP, all request for the purchase of new high powered lasers should have the following safety requirements in place before such requests is approved:
 - Protective Housing
 - Safety Interlock (where possible)
 - Emission Indicator
 - Protective Eyewear of the right wave-length and optical density for the particular laser
 - Operated by authorised N3 Licensee who have completed the safety modules in Non-Ionising Radiation Safety.
 - On-Off Switch
 - Stable Mounting
 - Hazard Sign Displayed

5. Risk Assessment

The Principal Investigator shall approve the risk assessment via the WRAS for any work that involves the use of high powered laser performed by his research staff/students. Risk assessment shall be reviewed when changes are made to the way the activity is to be carried out or as per the requirements stated in the SOP on Risk Management.

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6. High Powered Laser Safety

All high powered lasers must operate within the conditions, safe limits and any other requirements stated in the Radiation Protection (Non-ionizing) Regulations 2001 and the manufacturer's manual.

Although the basic safety requirement and practices are stated in the Regulations, it is strongly recommended that the supplementary of other safety resources like the apparatus operational manual, and general practice stated in related safety books, articles and journals be referred to.

Below are some examples of the safety practices for high powered lasers:

- Enclose and prevent unauthorized access to the room using high powered laser
- Area to be enclosed with laser safety curtain and an indicator to be present outside the room to warn others when laser is in operation
- Enclosed the laser path where possible and ensure no shining or reflective items are around especially if the operation involved "open laser" such as during alignment setup
- NEVER, EVER LOOK INTO ANY LASER BEAM, no matter how low power or "eye safe" you may think it is.
- Wear the correct wavelength and O.D. goggles and ensure goggles are in good condition. Defaced goggles with missing or unidentifiable wavelength/O.D. label should not be worn. All persons in the room must put on the laser goggles when the laser is to be operated.
- The most common injury using lasers is an eye injury resulting from scattered laser light reflected off of mountings, sides of mirrors or from the "shiny" surface of an optical table. The best way to avoid these injuries is to always wear your goggles and NEVER LOWER YOUR HEAD TO THE LEVEL OF THE LASER BEAM! The laser beam should always be at or below chest level.
- Always use "beam stops" to intercept laser beams. Never allow them to propagate into the laboratory. Never walk through a laser beam. Some laser beams of only a few watts can burn a hole through a shirt in only a few seconds.
- Laser workers should be instructed on potential eye hazards and the importance of limiting unnecessary exposure.

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- Binoculars or aiming telescopes should not be used to view direct beam or reflected beam from mirrors unless the beam intensities are greatly below the safe levels. If necessary, a filter having sufficient optical density should be placed in the optical path of telescope for such situations or adequate laser protective eye wear is worn by the operator.
- If you suspect that you have suffered an eye injury, notify your lab staff or Principal Investigator immediately. Your ability to recover from an eye injury decreases the longer you delays treatment.

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Appendix 1 - Register of Authorized N3 Laser Workers in CINTRA

Name of Laboratory:		Location:	
Name of LSR:		Date:	

To qualify as an authorized user, the person must possess a valid N3 license and completed both e-learning courses (Introduction to NIR & Local Regulations and the Laser Safety Training modules)

^Place a tick (v) to tag the N3 Licensee to the N2 Licensed High Powered Laser Equipment

*Place a tick (v) to indicate the N3 Licensee has completed the required Safety Training Modules

S/No	Name of authorized user	N3 License No.	Date of Expiry	*Introduction to NIR, Course code: OHS2NRR01	*Laser Safety Training Course code: OHS2NRL01	N2 Licence No ^							
1													
2													
3													
4													
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Version History

This Table below reflects the summary of changes made to the document. The full change information is indicated with yellow highlight in the document content.

Revision	Section	Details of Change	Created by	Effective Date	Approved By
00	-	Initial Release	Dr. Xu Zhilin	01 Aug 2017	Dr. Dinh Xuan Quyen
01	-	Checking forms. No change.	Dr. Xia Nan	15 Mar 2021	Dr. Dinh Xuan Quyen