

Engineering Physics/CEDT Safety Hazards Report

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Lab: ETB 431

October 12, 2018

1. Potential Hazards

1.1. Radiation (Laser)

ETB 431 contains a class 4 ultrafast infrared (1035 nm wavelength) fiber laser system. Lasers of this wavelength and power (40 μ J at 100 KHz) are hazardous to the human retina and can result in irreparable damage and blindness. Burning of the skin is also a notable hazard for class 4 lasers. In addition, these hazards persist despite indirect viewing of the laser such as in the case of diffuse reflections off matte surfaces. Great care must be taken to properly direct the beam path and ensure that the beam is not escaping its containment chamber.

1.2. Ablation and X-ray Hazard

The high power beams produced by the fiber laser are typically used to ablate materials. The ablation process can produce hazards as a result of high-temperature liquids, gases, and plasmas. However, the ablation area is relatively small (micrometre scale) so it is a minor hazard. Additionally, if the ablation target material is a metal, there is an increased risk of the production of ionising X-rays by characteristic X-ray emission. Radiation released in such a scenario will be sparse and controllable.

1.3. Fire

Fire is an ever-present hazard due to the presence of high-voltage electronic equipment and high-power laser beams capable of igniting particular materials.

1.4. Other

Common workplace hazards such as tripping hazards and falling equipment/bookshelves are also present. Damage resulting from such falling hazards can exacerbate those listed above.

2. Routine Operating Procedures

Ensure that all required safety training such as that given by EOHSS is completed.

2.1. Laser, Ablation, and X-ray Hazard Precautions

- 2.1.1. EOHSS provides a laser safety training course that is required for the operation of the fiber laser.
- 2.1.2. The laser manual should be reviewed prior to start-up of the laser system.
- 2.1.3. The "LASER ON" sign outside of the lab must be turned on prior to start-up.
- 2.1.4. Safety goggles must be equipped at all times during start-up and operation of the laser. These goggles must be purchased from a reputable laser safety goggle provider and be rated for the wavelength

generated by the laser system and be rated for the appropriate optical density (OD). In this case, they must be 1035 nm and OD 4 or greater. Those working within the same room of the laser must also wear goggles regardless of whether they are operating the laser. In the event that an individual refuses to wear goggles, the laser operator is to shut down the system.

- 2.1.5. Reflective clothing/jewelry should be removed.
- 2.1.6. Clothing that covers the skin is recommended to reduce laser burning hazard, closed-toe shoes should be worn for the same reason and to reduce risk of injury due to falling equipment.
- 2.1.7. The curtain inside the lab should be drawn.
- 2.1.8. Ensure the laser system is contained within a non-reflective surfaces box.
- 2.1.9. The operator should avoid bending down to the height at which the laser is being directed.
- 2.1.10. To ensure that the beam is being directed appropriately, use the IR camera viewer to locate its path.
- 2.1.11. During operation of the laser, the laser curtain must be placed over the chamber, the plexiglass shield put in place, the 3 mm copper X-ray shield placed on the ablation platform, and the matte black cover placed in front of the plexiglass.
- 2.1.12. The MSDS for the ablated material should be reviewed prior to ablation to ensure that released materials and/or gases are not hazardous.
- 2.1.13. When leaving the laboratory for extended periods, the laser voltage must be turned to zero or turned off completely.
- 2.1.14. Maintenance must be performed by qualified personnel.

2.2. Fire Precautions

- 2.2.1. Complete EOHSS fire safety training.
- 2.2.2. Do not leave hazardous ablation materials unattended.
- 2.2.3. Review MSDS of ablation material for flammable hazard.

2.3. Other

- 2.3.1. EOHSS mandatory workplace training (e.g. Slips, Trips, and Falls)
- 2.3.2. Shelves and devices surrounding laser equipment should be fixed securely.
- 2.3.3. Identify tripping and falling hazards (precariously stacked equipment)

3. Emergency Procedures

3.1. Radiation

In the event of a laser-induced injury, the equipment should be turned off immediately to prevent further injury. If the injury requires immediate attention, dial 88 from a university phone or call 905-522-4135. Otherwise, contact the supervisor and EOHSS Laser Safety Officer and an incident report must be filed with the department.

3.2. Fire

In case of fire, utilise an extinguisher if it is safe to do so. Pull fire alarm, evacuate the building, and dial 88 from a university phone or call 905-522-4135. Do not use elevators, if smoke is encountered stay low and cover mouth and nose with wet cloth. Contact your supervisor.

3.3. Other

For minor injuries, apply first aid as appropriate. For major injuries contact emergency services (88 or 905-522-4135).