UNIVERSITY of CAMBRIDGE ENGINEERING DEPARTMENT
HOPKINSON LAB

WELCOME TO NEWCOMERS

Dear newcomer,

Working in the Hopkinson Lab will prove to be a very fruitful experience and both you and the lab should benefit from your presence here. These notes aim to communicate to you some of the prevailing work customs and to increase ***safety awareness***. They do not provide an exhaustive list of things someone must be careful about and do not replace the formal training package you have received or will receive from the Department. You are very welcome to discuss any of the points raised here with your supervisor, other students, our technicians or me.

A. What's so special about the Hopkinson Lab? – Why do we need extra care?

We have many combustion experiments that release heat and poisonous carbon monoxide and we perform measurements with high-powered lasers. We use gaseous and liquid fuels and various toxic gases and liquids, often originating from high-pressure bottles. We work with fluid flows, electrical machinery, dusts and aerosols. And everybody is very busy. Hence there are many potential risks for fire, explosion, burns and breathing problems, in addition to the opportunity of overlooking something important. However, we (and others) have developed over the years the necessary approach with which we can work perfectly safely in this environment. Learning this approach will hopefully become part of your learning experience at Cambridge.

Remember: in research you shouldn't trust the existing wisdom blindly and the same applies to health and safety when doing lab work. If you think that we're doing something wrong or dangerous, please tell someone and discuss it!

B. Some generalities

1. Safety first! Please never compromise safety for speed or performance. No matter what the source of pressure to you may be (e.g. to meet a deadline for a paper, to provide data for a sponsor or for a meeting with your supervisor), you should never perform laboratory work unless you feel confident that you know all the possible risks associated with your work and that you have minimized them. Working under stress is a recipe for disaster, so relax and concentrate fully before doing experiments. Be patient, careful, and think twice. Err on the side of caution.

2. Rules. For some, it may be considered smart to try to "bend the rules" and indeed, we have all felt at times that some rules may be exaggerated. Nevertheless, we have prevailing rules in the lab and we must all follow them. Eventually, you will realize their reasoning and their usefulness.

3. Do you feel competent? You are not expected to know everything. It is not clear what you already know and what you don't know and hence we must work together to

decide what exactly your training needs are. In case you feel that you have been asked to perform work for which you have not received adequate training or guidance, refuse to do it and discuss your reluctance with your supervisor or colleague. There is a lot of "learning by mistake" in research, but it is better to take small careful steps rather than big strides, especially in the beginning of your work. In my opinion, mastering the basic necessary practical skills in a combustion and fluid mechanics lab can take many months, or even years, so you should never over-estimate your capabilities. It is not shameful to ask how something is done, it is necessary.

4. You are not alone. This acts in two ways. First, you are responsible not only for your own safety, but also for the safety of others, since any dangerous actions from your part may have an impact on the others. But, secondly, all other colleagues in the lab are there to help you. More experienced students, supervisors, and technicians can give you invaluable advice and practical help and training.

C. Things to remember

SR: Strict rule (to be always observed)
CS: Common sense

Departmental safety policy. This is given in the Department's web site. ***Please spend the time to read through all these pages carefully:***

http://www.eng.cam.ac.uk/safety/

Working times. No combustion experiments are to be done outside normal hours (weekdays 9-5). These times are somewhat stricter than those of the normal Departmental policy due to the particular risks when working with flames. In exceptional cases only, discuss with your supervisor about possible extensions into the evening or the weekend. These exceptions should not become the norm, but should be individual, unique situations. Outside normal hours you can do simple jobs, data processing, reading etc. (SR)

Working alone. At all times, someone else must know that you are performing experiments. Never work behind closed doors alone (SR). Tell other students what you're doing – explain to them your experiment and let them teach you theirs, even if you're not formally involved. Take a walk through the lab before leaving in the evening to check if all is well. Give your mobile phone number to your colleagues and get theirs (CS).

Keep records. Get a logbook and write in it all your activities. Keep records of your ideas, fears, conclusions, results, practical problems, instrumentation problems. Note down things you've done wrong and things you've done right and develop the habit of going back to your records for consultation. You'd be surprised by how many things from your 1st year of your PhD you will have forgotten by the time you write-up (CS).

Planning and risk assessment. Discuss your experiments with your supervisor in detail. Plan well ahead and get advice on the specifications of tubing, fittings, materials etc. Think carefully about all eventualities, such as "what would happen if

this tube leaks?" or "what would happen if this pressure read-out fails?" "Is there a possibility of flame flashback?" "What would I do if I spill fuel on the floor?" Then, assess the magnitude of such risks: are they highly likely or very unlikely? Would you and others escape unhurt? Do you know what needs to be done in such situations? (SR)

Fire exits and emergency procedures. Familiarize yourself with the lab's fire exits. Develop a very quick shut-down procedure for your experiment that you should follow in case of emergency evacuation. The last thing we need in the case of fire in the building is an additional unattended combustion device with fuel valves left open (SR).

Gas handling. Moving high-pressure bottles; installing and operating pressure regulators; installing pipe systems and checking them for leaks; selecting the right tube, fitting and connector for the particular gas, pressure and temperature: these are examples of common activities in the lab. Make sure you know the specifications of each component and examine its suitability for your rig. Seek advice and keep records of the specifications of every product you purchase (CS). Before performing any of the above actions, make sure you have either taken the University's Gas Handling course or someone in the lab has explained these things to you in detail (SR). Our Chief Technician and your supervisor must have both inspected your pipework before you start working (SR).

Hazardous materials. This is an area of on-going concern in the lab, since we tend to keep too many unnecessary chemicals. If you need to work with a dangerous material, ensure you fill a COSHH form for it and you familiarize yourself with any risks involved. Are the materials you're ordering unhealthy, poisonous or carcinogens? How should you handle them? Should you let others handle them? Order the minimum amount necessary and discuss the details of what you purchase with the Chief Technician and your supervisor (SR).

Source of risks. Spills; pipes bursting; burns; equipment and burners not secured in place; dirty fittings on gas bottles; wrong specifications; too hot gases for the tubes provided; not adequate ventilation; unburnt fuel and partial oxidation products released in the lab; vapours; sparks from mains plugs and light switches; sparks from static electricity on ourselves; non-earthed metal frames; breathing fine dusts; tripping over cables and tubes on floor; live wires; long electrical cables on the floor; the list is endless. Read widely about experiments similar to yours, think hard, discuss with other students and supervisors. Look around the lab for good and bad examples. There is always something you haven't thought about (CS).

Ventilation. Extracting all the fumes we may produce is essential and you should never perform experiments without adequate ventilation in your area. Having a powerful exhaust in a combustion experiment is, needless to say, imperative, since any carbon monoxide produced can kill you (SR).

Protective measures. Use gloves (heat resistant, if you work in combustion), appropriate masks (which must be regularly checked and replaced), and a lab coat. In some experiments, these measures must be strictly enforced (you and your supervisor must be the judge). In all cases, wearing at least a lab coat is good practice.

Risk assessment forms. Once you have absorbed and acted on the above points, then you are in a position to start your experiments. The final, and very important, step is to put all your thoughts concerning the safe design and operation of your experiment, and all your "what if?" scenarios concerning possible eventualities, in an organized document. This is the "risk assessment form", which must be completed by you, with the assistance of your supervisor. This document should be treated as a dynamic record of the possible things that can go wrong and of your procedures and should be updated every time you change something or you come up with a new idea of what could go wrong. Speak to the LORS, other students and your supervisor and study previous risk assessment forms (SR).

Lasers. Lasers are particular hazards and special training is necessary. You are not allowed to go into rooms when the laser warning lights are on. Laser rooms can be accessed only by particular persons, the so-called registered users (SR). For details in laser training, see the Department's Web pages
http://www-g.eng.cam.ac.uk/photonics/laser/lasers.html or speak to the LORS or your supervisor.

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