

Energy Lab
Room 476, James Watt South Building

CODE OF PRACTICE

The adoption and practice of good safety procedures is of paramount importance for both the health and safety of fellow workers, and for the integrity of the fabric of the Energy Laboratory.

1. Lab Safety Management Responsibilities

- 1) **Everyone** has a role in protecting the health and safety of both other lab users and themselves, and thus should be familiar with the **School's Safety Manual**.
- 2) **Academic Supervisors** take full responsibility for the health and safety of their own group's research activities, and consequently must ensure their staff and students are familiar with both the content of this **Code of Practice** and the **School's Safety Manual** and apply its requirements.
- 3) No research activities shall be carried out in the Energy Lab, Room 476 James Watt South Building, without the prior permission of the **Lab Guardian**. The role of the Lab Responsible Person for the Energy Lab is specified in **Appendix A**, in accordance with the **School's Safety Manual**.
- 4) No work shall be carried out until a **Risk Assessment** has been conducted by the research staff/students, **approved by their Supervisor** and the **Director of Safety**, and acknowledged by the **Lab Guardian**.
- 5) An **electronic copy** of the approved Risk Assessment shall be sent to the Lab Guardian to be kept as record (note that this can be done using the online risk assessment system). A hard copy of the approved risk assessment shall be displayed next to the relevant research rig and equipment for inspection. The procedures of the preparation of Risk Assessment are summarised in **Appendix B**.
- 6) **All lab users** should make themselves aware of the **general safety procedures** highlighted in the School's Safety Manual and of the location of safety equipment in the lab.

These are:

In case of emergency, dial telephone number: **4444 (internal), 0141 330 4444 (external)**

Emergency exits are located in the lab or via the main building

The **fire extinguisher** is located in the main corridor level 4

First Aid kits are in the Janitors box on Level 3 and in the Tuck lab on level 4

- 7) Work outside normal office hours (including weekend working) requires the permission of your supervisor. This can be given by an e-mail trail for audit purposes in the event of an accident and can be for multiple or extended periods of time. If permitted, the out-of-hours working book located in the foyer of the JWS building must be signed and the time recorded on arrival and the time of departure. Potentially dangerous operations **must never** be undertaken out-with normal hours **unless a second responsible**

person is present. (Please read the safety regulations in the School's Safety Manual for more details.)

2. Practice of General Activities

- 1) The experimental area must be **kept tidy and clean**. This is **NOT** the responsibility of the cleaners. Good housekeeping must be maintained by the lab users and be monitored by the responsible person of each area (see Appendix C).
- 2) **Food and drink are not permitted in the lab.**
- 3) The **walkways** and **marked out** sections of the floor leading to the fire exit must remain clear. Under no circumstances should lab equipment be stored in the route from your place of work to the fire exit route. If things are possibly impeding your exit then you should either move them, contact the person who placed them there, or inform both the Lab Responsible person and your supervisor.
- 4) Access to switch boxes and valves must remain clear and must not be blocked by equipment.
- 5) Dedicated storage cupboards and areas must be used. Windowsills should not be used as storage areas.
- 6) **Laboratory doors should remain shut** at all times to ensure security and fire safety. This includes the rolling door at the end of the lab.
- 7) Equipment must be placed in appropriate locations to safe-guard its integrity, minimise potential damage and to allow other researchers access to it.
- 8) Once experimental work has been completed and the experimental setup is no longer required, the **experimental area must be cleared** in preparation for other experiments and researchers.
- 9) If it is necessary to remove equipment from the lab, permission must be given by your supervisor and the Lab Guardian. If necessary, seek assistance with moving heavy items.
- 10) If equipment breaks down or is not working, report the fault to your supervisor and the responsible person (see Appendix D) immediately.
- 11) A fault with the fabric of the room, such as a lighting failure, should be reported through the Maintenance Request portal found on the Estates and Commercial Services webpage, <http://www.gla.ac.uk/services/estates/>.

3. Covid-19 measures

- 1) Guidance from the HSE, UK Government and Scottish Government to manage the risk related to Covid-19 pandemic must be applied to the Energy Lab. These include physical distancing, frequent hand washing and hygiene measures, cough etiquettes and face covering in enclosed public space. Considerations for codes of practice and risk assessment for the James Watt School of Engineering can be found here (Insert link)
- 2) Physical distancing within the Energy Lab means a maximum capacity of (1?) person working in the upper area and (1?) person in the lower area.
- 3) Demand to use the lab will be managed by the Lab Guardian in collaboration with the Safety Coordinator. Collaboration will be required between lab users, supervisors, Pls

and the lab guardian to establish a rota where necessary. Impact on the overall capacity of the James Watt South building will be reviewed by the Technical Services Manager.

- 4) Lab users must wash their hands regularly and wipe workstation surfaces, materials, and equipment at the start of their work and before leaving.
- 5) Emergency support (First Aiders and Fire Area Officer) might be constrained due to Covid-19 restriction on building capacity. Task risk assessments need to be reviewed to include the above measures and to review with personnel through the risk assessment, which work can be safely undertaken with reduced access to emergency support. A Covid-19 risk assessment template can be found here (https://www.gla.ac.uk/media/Media_723618_smxx.docx).

4. Practice of Hazardous Activities

- 1) **Electrical connections** between different devices or equipment should be safe. If in doubt, speak with technicians in the Electrical Workshop (JWS Room 619).
- 2) To minimise **trip hazards**, extension cables should be plugged into the closest socket and avoid crossing pathways. If crossing a pathway is totally unavoidable then, only as a temporary measure, the cable must be secured to the floor and covered with a suitable (commercially supplied) floor cable cover, cable protector, floor cable tidy to prevent tripping hazards. However, leads crossing pathways at the top or bottom of stairways is not allowed, even as a temporary measure – they should be routed at least 2 m (i.e. two paces) away from these areas.
 - i. Once equipment is not in use, it must be turned off and any extension cables used should be tidied to a suitable location.
 - ii. Leads and plugs should ONLY be used on the allocated item of equipment and should NOT be switched between equipment
 - iii. All equipment plugged into university outlets must be PAT tested (contact the electrical workshop for testing).
- 3) To minimise the risk of **falling objects**, no equipment or lab materials should be kept on top of cupboards and file cabinets, particularly those next to the edge of the upper floor.
- 4) Fire hazards:
 - i. All **flammable materials** (gases, liquid and solids) should be stored and handled in accordance to the School's Safety Manual and relevant SEPS guidelines.
 - ii. All equipment or experimental rigs using flammable materials should be certified and have adequate measures for preventing fire hazards.
 - iii. All users of flammable gases should be trained.
- 5) Explosion hazards when using compresses gases:
 - i. All gas cylinders should be secured to prevent falling.
 - ii. All pressure vessels should be certified by a professional manufacturer.
 - iii. All pressure vessels should have measures to preventing over-charging, such as relief valves.

- iv. You should seek support from technicians when moving gas cylinders.
 - v. All users of compressed gases should be trained.
- 6) **Only F-gas** qualified individuals can charge or discharge the system when using Freon refrigerants.
- 7) Ear protection and laser safety spectacles should be used when appropriate.
- 8) If you are unsure how to correctly use an item of equipment, seek assistance from an appropriate responsible person(s) (see Appendix D).

Appendix A duties of the Lab Guardian of Energy Lab (JWS 476)

According to the School's Safety Manual, the **Lab Guardian is responsible for implementing safety policies in Energy Lab on a day-day basis.**

1. Considering the particularity of Energy Lab, the specific duties of its Lab Guardian is listed as below:

- 1) to maintain the Code of Practice (CoP);
- 2) to ensure the lab users keep their area in tidy and clean condition;
- 3) to ensure each activity (experimental rig/equipment) has a Risk Assessment before work commences;
- 4) to coordinate actions according to the School's Director of Safety's report / instructions following inspections;

2. The appointment of the Lab Guardian

- 1) The Head of SPE Research Division, in consultation with the academics of the lab, appoints the Lab Guardian of Energy Lab.
- 2) The Lab Guardian of Energy Lab reports to the Head of SPE Research Division.
- 3) The Lab Guardian of Energy Lab rotates among the academics of the Lab yearly, and starts on 1st of January of each year.

Appendix B: Procedures of the preparation of the Risk Assessment

1. PDRAs and PG/UG students are responsible for formulating Risk Assessments on a day-day basis. For potentially hazardous activities, in addition to assessing the risks, the risk assessment form should include a standard operating procedure/method statement (and/or instrument manual) as an appended document.
2. Whilst the preference is for the persons undertaking the practical work to make their own risk assessments, it is permissible to use the on-line multi-user risk assessment forms for activities that will be undertaken by groups of people. However, in this case, each person involved in the practical work must sign the multi-user form online and a strict regime of user training should be in place that encompasses both the risks associated with the work as well as the practicalities of undertaking it.
3. Academic supervisors should assist the PDRAs and PG/UG students in preparing the risk assessment (this would typically be the case for less experienced PDRAs and PG/UG students). They should **ensure** foreseeable risks have been identified and adequate mitigation measures have been provided to reduce them as far as possible.
4. The academic supervisors should then approve the risk assessment form online (or ask for further information to be added); the Lab Responsible should also acknowledge (on-line) that the risk assessment has been completed, to indicate that as far as they can see, this activity does not conflict (in safety terms) with other activities in the lab. The Lab Responsible can also ask for further clarifications/additions concerning the procedures involved to be made, if necessary.
5. After the risk assessment has been approved/acknowledged by the supervisor and Lab Responsible/Lab Guardian, the School's Director of Safety approves, seeks further clarifications, or (exceptionally) rejects the risk assessment if there are clearly hazards that cannot be sufficiently mitigated.
6. An e-copy of the **approved** Risk Assessment should be sent to the Lab Responsible by the PDRA or PG/UG student that originated the assessment (n.b. pdf's of the online form can be made by using the Print to PDF option available in most browsers)
7. A hard copy of the approved Risk Assessment and standard operating procedure should be kept or displayed next to the relevant experimental rig or equipment.
8. The Lab Responsible approves the start of activity after receiving the **approved** Risk Assessment.
9. If there is any substantial change to the people or research activity as stated in the Risk Assessment, it **MUST** be revised accordingly, and pass procedures 1-7 as above.

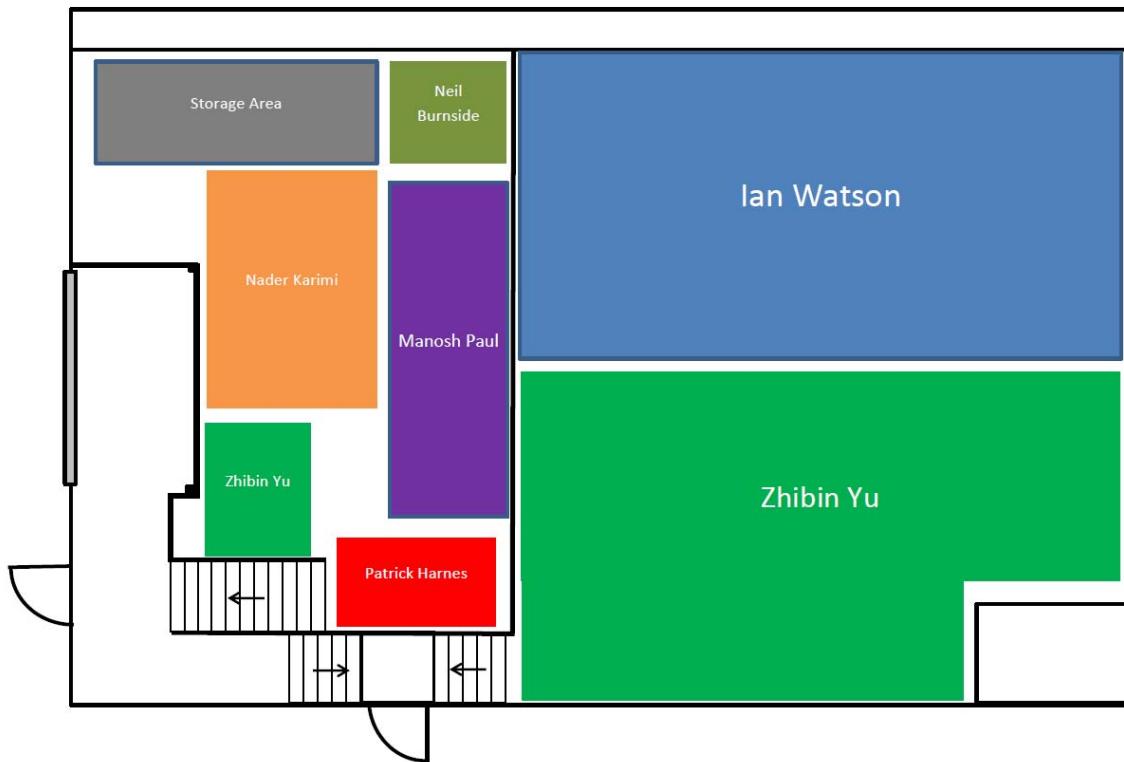
Appendix C: Responsible Person of Areas in the Energy Lab

It is acknowledged that the allocation of space in the Energy Lab evolves due to staff changes, the start of new projects, and the closure of old projects. Therefore, this document needs to be updated regularly to capture such changes.

The current allocation of the space within the Energy Lab is shown in the Figure below. Each academic is responsible for the activities within the allocated area.

The current responsible people include:

- **Zhibin Yu**
- **Ian Watson**
- **Manosh Paul**
- **Patrick Harkness**
- **Gioia Falcone**
- **Andrea Cammarano**
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Appendix D: Responsible person of equipment and rigs

This document records the responsible person for the research activities and equipment within the Energy Lab. If there is any issue arising, please contact the relevant responsible person, and also inform the Lab Guardian in the same time.

D.1 Heat pump, refrigeration, and power generation rigs (Prof. Zhibin Yu)

- 1) The ORC/heat pump system contains controlled substances under the Kyoto Protocol, **only F-gas qualified individuals can charge or discharge the system**. Contact Prof. Zhibin Yu for assistance.
- 2) The system is filled with a fluorescent dye to indicate system leakage, Contact Prof. Zhibin Yu immediately if any dye is visible on, or around, the equipment.
- 3) Compressed gas cylinders containing
 - i. R134a
 - ii. R245fa
 - iii. Compressed air
 - iv. Mixed refrigerant recovery cylinder

are currently stored in the lab, R134, R245fa and mixed refrigerant recovery cylinders are only to be used for charging and discharging of the ORC and heat pump system (**F-gas qualified individuals only**).

D.2 Biomass gasification and Pyrolysis (Dr Ian Watson)

These experiments will produce harmful gases, operate at high temperatures, with potentially high internal pressures.

- 1) Protective gloves must be worn at all times during gasification experiments
- 2) Eye protection must be worn at all times during gasification experiments
- 3) Ventilation mask must be worn during biomass preparation and experiments to avoid inhalation of harmful products e.g. tar and CO, H₂, CH₄ and CO₂ gases which may be present if leakage from the system occurs. (note, the system is designed and constructed in such a way that such leakage should not occur)
- 4) CO gas sensors **must be ON** to detect potential gas leakages – the system should be immediately shut down and made safe if these are triggered. Users and other lab occupants should leave the area and an investigation of the cause of the sensor alarm should be made when safe to do so (seeking specialist assistance if necessary).
- 5) Ensure that the pressure release/safety valves are operational on any sealed system that may be operated at vacuum or high pressure and is not open to the atmosphere.
- 6) Extractor fans **must be switched on** before any experiments on the gasifier or pyrolysis rigs and for a sufficient period (15 mins or greater) after the experiments have finished until all fumes have been removed for the laboratory area.



- 7) High temperature resistant gloves must be worn when handling the hot equipment during experiments, including the rig itself, downstream filters, condensers liquid collection vessels or instrumentation systems.
- 8) Adequate **ventilation must be assured** while working with any UV sources that may produce ozone.
- 9) Wear appropriate safety equipment: Face, respiratory, eye, and hand protection when operating the UV system, the gasifier or any pyrolysis system.

D.3 Vibration and drilling (Dr Patrick Harkness)

- 1) The stability of the rig, stack, or sonde should be checked before each test. Any hazards relating to entrapment of hair or clothing by the auger should be properly mitigated e.g. by tying back hair, wearing a hair net, removing dangling items of clothing/jewelry or covering them with a lab coat. No body parts or hand tools should contact the moving parts (or enter the sweep of the moving parts) when the system is electrically live, or has the potential to become live. An emergency stop procedure for the equipment should be available and active.
- 2) The drill cycle, if noisy and extended, should be discussed with other lab users before beginning work. Ear defenders should be worn.
- 3) Dust management, if required by the drill cycle, should be considered. A dust mask should be worn.
- 4) Ongoing drilling cycles should not be left unattended, even when under stable autonomous control.
- 5) Test blocks are heavy. Respect all guidance regarding lifting and handling (the SEPS manual handling guidance indicates the limits for lifting/lowering weights to different heights and for people of different stature; in general, seek assistance when moving weights greater than 7-10 kg).
- 6) The rig, stack, or sonde should be electrically grounded. No hot work (except low-risk electrical soldering, heat shrink activities, and similar) is to be carried out in the lab environment.
- 7) This is general advice. Each drill system requires its own risk assessment.