Table of Contents

1. Introduction
2. Useful contacts
3. Access to cleanroom
4. Cleanroom policies
5. Cleanroom gowning procedure
6. Bringing items into the cleanroom
7. Use of equipment
8. Use of chemicals
9. After-hours and lone working
10. What to do in an emergency
11. Final notes
1. Introduction

The codes of practice contained within this document must be observed by all users to ensure that the University of Bristol Cleanroom Facility is operated in a safe, fair and professional manner where every effort is made to maintain low particulate levels, preserve equipment and avoid unnecessary waste of energy, water and consumables.

Given the hazardous nature of some of the processes undertaken within the clean room, it is essential that all users behave responsibly, both for the safety of themselves and other users. This document is designed to provide an overview of the practices that the managers of the cleanroom expect to be followed to ensure that, first and foremost, the risk of accidents occurring is minimized.
2. Useful contacts

Cleanroom Academic Lead: Dr Graham Marshall 88718
Cleanroom Technician: Andy Murray 46932
Technical Manager: Steve Neck 88741

To call an ambulance:
1. Dial 999. This enables the emergency medical dispatcher to give vital advice on how to deal with the situation directly to those involved with the incident while waiting for help to arrive.

2. Call Security Services on 112233 as soon as possible (or ask someone else to do this) so that they can direct the Ambulance Service to the incident or provide additional first aid support if necessary.

3. Call a first aider for additional assistance.

First Aiders – Physics Building

<table>
<thead>
<tr>
<th>Name</th>
<th>Area</th>
<th>Contact Telephone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter Barham</td>
<td>G.34b</td>
<td>(0117 92) 88711</td>
</tr>
<tr>
<td>Kim Brook</td>
<td>1.27</td>
<td>(0117 92) 88737</td>
</tr>
<tr>
<td>Dave Linnett</td>
<td>1.40</td>
<td>(0117 92) 88728</td>
</tr>
<tr>
<td>Peter Kessell</td>
<td>2.14</td>
<td>(0117 33) 18101</td>
</tr>
<tr>
<td>Adrian Barnes</td>
<td>3.17</td>
<td>(0117 92) 88701</td>
</tr>
<tr>
<td>Briony Maitland</td>
<td>3.19</td>
<td>(0117 92) 88735</td>
</tr>
<tr>
<td>Robert Duerr</td>
<td>3.20</td>
<td>(0117 92) 88717</td>
</tr>
<tr>
<td>Ann Diment</td>
<td>3.28</td>
<td>(0117 33) 88940</td>
</tr>
<tr>
<td>Ben Maughan</td>
<td>4.19</td>
<td>(0117 33) 16822</td>
</tr>
<tr>
<td>Peter Heard</td>
<td>4.21a</td>
<td>(0117 33) 11172</td>
</tr>
<tr>
<td>Jonas Rademacker</td>
<td>4.50</td>
<td>(0117 33) 17904</td>
</tr>
<tr>
<td>Keith Hallam</td>
<td>5.12</td>
<td>(0117 33) 11173</td>
</tr>
<tr>
<td>Adrian Crimp</td>
<td>Workshop</td>
<td>(0117 33) 11818</td>
</tr>
<tr>
<td>Josh Hugo</td>
<td>Workshop &amp; Maths</td>
<td>(0117 33) 11818</td>
</tr>
</tbody>
</table>

The Student Health Service provides additional emergency cover during normal working hours, call 0117 3302721.

To call the fire brigade:
1. Evacuate the cleanroom.
2. Raise the alarm.
3. Notify security of the fire by telephoning 112233 (0117 33 11223). Do not dial 999 unless there is no response from security.
3. Access to cleanroom

a. Access to the cleanroom is requested via Andrew Murray.

b. If use of the clean room is deemed necessary, prospective users will then be required to undergo induction and training. This proceeds as follows:

c. Users will be given orientation training so that they are made aware of the different systems and capabilities within the cleanroom. Also included is a general health and safety induction that will cover best practice, what to do in an emergency and general procedures and rules to prevent incidents. Users will also discuss their requirements to ascertain the specific training requirements for the systems and processes they will be using.

d. A risk assessment must be carried out by the clean room user in consultation with their principal investigator or research supervisor prior to any work being undertaken by an individual. The risk assessment must be forwarded to the cleanroom staff for clearance and amendments if necessary.

e. Training on specific systems will follow when required. This will be carried out by a competent senior user who will supervise the trainee until the trainee is deemed to be competent.

f. All users must be cleared to use the systems without supervision by cleanroom staff who will conduct a competency assessment. Users will be asked to carry out the process in full with minimal input from the cleanroom staff.

Specific equipment within the cleanroom (evaporator, sputter coater, PECVD, ICP, RIE, mask aligner, spinner and hot-plates) must be booked in advance using Google Calendar. Any problems arising from this arrangement or any other aspect shall be reported to the cleanroom technician.

Visitors and occasional users shall have access by appointment, accompanied by a member of staff.

Take note: Misuse of the systems in the cleanroom can lead to dangerous situations and downtime, impacting many research projects. These procedures are in place to minimize the risk of problems occurring and must be followed.
4. **Cleanroom policies**

1. ALL persons entering the cleanroom must sign the entry log book.

2. Personal hygiene is important when working in a cleanroom. Users should bathe frequently and in particular, ensure hands are clean – wash hands in the sink prior to entering the cleanroom.

3. Do not bring food, drinks, books, newspapers, magazines, radios or other personal items into the gowning area. Mobile phones are permitted, but may not be used in the cleanroom for personal calls or texts. Ensure that any phone is removed from any casing and wiped clean before entering.

4. Do not wear open-toed footwear.

5. Do not wear nail polish, cosmetics, excessive perfume or jewelry in the cleanroom.

6. No hoodies, outdoor wear or excessively baggy clothing should be worn. Remove these items and hang on the coat hooks provided.

7. Hair should be tied back if necessary and tucked inside head covering.

8. If you have a cold, do not enter the cleanroom.

9. Be aware of the work others are carrying out in the cleanroom. Always inform others if you are using hazardous substances.

10. Bringing items into the cleanroom:
   
   a. Any item that produces dust particles is NOT permitted in the cleanroom. This includes standard paper, cardboard, wood, pencils, retractable ball-point pens, and clothing.

   b. Any item to be brought into the cleanroom shall be wiped down with lint-free cloth soaked in IPA. Ensure that all exposed areas of the object have been cleaned. The only exception is for cleanroom notebooks and paper.

11. Always wear gloves.

12. Always wear chemically-resistant goggles or safety glasses.

13. When entering the cleanroom do not hold or wedge the door open.
14. When in the cleanroom do not move about unnecessarily. This is particularly important near fume cupboards where disturbing the airflow at the sash opening may cause fumes to enter the cleanroom environment.

15. Immediately inform Cleanroom Staff of any problems that you notice with any equipment – do not attempt any repairs.

16. Immediately inform Cleanroom Staff of any deterioration in environmental conditions, such as dust build-up, temperature change, cleanroom pressure reduction.

17. Avoid scratching your head or other exposed body parts whilst in the cleanroom. Exit the cleanroom if you start to cough or sneeze; reenter when recovered.
5. **Cleanroom gowning procedure**

1. Sign entry log book upon entry into the cleanroom.

2. Put on a pair of overshoes – the dispenser is located on the side of the lockers close to the entrance.

3. Wash hands before entering the lab. There is a sink to the right as you enter.

4. Remove unnecessary outer garments (jackets, etc.) and place in lockers.

5. Remove all cosmetics and jewelry.

6. Tie hair back if necessary.

7. Put on the hood. Make sure all hair is inside the hood.

8. Put on cleanroom coverall - keep garment entirely off the floor all the time. Make sure skirt of hood is completely inside collar of coverall.

9. Put on cleanroom boots ensuring trousers are tucked into boots. Bench is for sitting on if required – DO NOT put feet on it at any time.

10. Close all fasteners at neck, wrists and ankles.

11. Put on gloves located to left as you enter.

12. When finished in the cleanroom DO NOT leave garments on the bench or floor. Garments may be hung on the hooks provided.
6. **Bringing items into the cleanroom**

- Please ensure that all items from outside the cleanroom are wiped with water and/or IPA prior to bringing into the cleanroom.

- Wash bottles are provided in the change area.

- Currently mobile phones are permitted in the cleanroom for both added safety and for acquiring images or video. It is restated that these items must be cleaned before bringing into the cleanroom.

- Please exit the cleanroom to take personal mobile phone calls.

- Conventional card, paper, or other items likely to liberate airborne particles must not be brought into the cleanroom.
7. **Use of equipment**

- The equipment and facilities within the laboratory shall be kept in a professional manner, which reflects the condition of a precision fabrication laboratory. When not in use, instruments and tools shall be kept in their designated places.

- New users are **not permitted** to use any equipment unsupervised. New users will continue to be supervised until approved by Andy Murray.

- All users must read the Hazard and Risk Assessment form specific to the equipment before using it for the first time.

- All users must sign the Cleanroom Training Record and stating they have read and understood the Hazards and Risks associated with the equipment they will be using.

- All the equipment in the Cleanroom must be booked before use on google calendar. Bookings can only be made up to 2 weeks in advance, unless specifically requested via the cleanroom staff.

- If a user does not use the equipment within 1/2 hour of the time stated, they forfeit the booking and another user may continue to use the equipment.

  In the event that a sample from a previously booked session is still in the equipment, the current user should first notify the previous user. If the previous user cannot be contacted, the current user has the right to remove the sample. If the user wishes to keep their sample in the equipment, they must leave a note on the equipment and inform the next user.

- Do not leave samples or chemicals on top of cleanroom equipment.

- Any unidentified sample/chemical will be removed. No exception will be made.

- Equipment and facilities within the laboratory shall only be maintained by cleanroom staff. **DO NOT ATTEMPT ANY REPAIRS.** Inform cleanroom staff of any problems.
8. Use of chemicals

- **NO CHEMICALS ARE PERMITTED WITHIN THE CLEANROOM WITHOUT PRIOR AUTHORISATION.** Before ordering a new chemical, consult Andy Murray. Request a Materials Safety Data sheet (MSDS) so that a hazard and risk assessment can be completed according to COSHH regulations.

- All users **must** read the Materials Safety Data Sheet forms and complete a risk assessment before using chemicals. During this process you should ask the following questions:

1. Do I really need to use this chemical in my process or is there some less hazardous material that can be substituted?

2. Do I understand the hazards presented by the chemical or chemicals I intend to use?

3. Do I know the procedures and requirements for handling the chemical particularly with regards to personal protective equipment (PPE) that must be worn?

4. In case of a spill or exposure do I know where all the chemical safety equipment is locate in the cleanroom and how to use it?

5. Do I know how and where to properly store unused quantities of the chemical and how to transport it?

6. Do I know how to properly and safely dispose of the used chemical after use?

- Chemicals must only be used in the appropriate Fume Cabinet.

- Dispose of chemical waste appropriately – most chemicals are not permitted to be disposed of down the drain. If this is the case, dispose of by collecting in a labeled waste bottle. If none are available, use an empty 500ml or 2.5l bottle and label the new waste bottle clearly. Disposal considerations should be included in the risk assessment for your procedure and discussed with cleanroom staff.

- When your task is finished rinse all beakers, dry and place on the dishwasher.

- All samples or chemicals left unattended shall be accompanied by a note detailing the following information:
  - Name of user
  - Substance or sample type
  - Date of first use
  - Intended date of removal
  - Hazardous substance warnings
• When using hazardous chemicals such as acids, inform all users that are currently in the cleanroom and also leave a note beside your work and on the cleanroom whiteboard in the gowning area.
9. After hours and lone working

- Normal working hours are from 7.00am to 7.00pm. After-hours working refers to work undertaken outside of normal working hours.

- Permission must be obtained from your project supervisor for after-hours working.

- All procedures to be undertaken after-hours must be approved by the cleanroom manager.

- Lone-working out-of-hours is not permitted under any circumstances. Physics operate a buddy policy whereby another person must be within the area to check on you at regular intervals.

- Remember to sign the out-of-hours log book in the foyer of Physics.

- Procedures that may result in death or serious injury MUST NOT be undertaken outside of normal working hours.

- Procedures that may result in death or serious injury are only permitted to be undertaken when there are AT LEAST two people within the cleanroom.

- The PECVD and ICP etcher shall not be used after-hours due to the hazardous gases used in these systems.
10. What to do in an emergency

a. Fire

- If there is a fire in the cleanroom:
  - Sound the alarm.
  - **Do not** take off your clean suit.
  - Exit the cleanroom via the nearest escape route.
  - Exit the building via the nearest escape route.
  - Present yourself to the security staff, fire wardens and porters and explain the situation including details of any processes being carried out at the time of the alarm.
  - Contact Andy Murray.

- If the fire alarm sounds and there is no fire in the cleanroom:
  - **Do not** take off your clean suit.
  - Exit via the cleanroom entrance if possible. Otherwise exit via fire escape.
  - Exit the building.
  - Make your way to one of the assembly points located outside the front of the building.

b. Gas leak

- If the gas alarm is sounding, or you suspect a gas leak:
  - **Do not** enter the cleanroom.
  - If you are within the cleanroom, exit immediately via the nearest available exit. **Do not** take off your clean suit. Inform others of gas leak if necessary.
  - Once in a safe area, inform security (x112233).
  - Inform cleanroom technician and building safety adviser (x88711).

<table>
<thead>
<tr>
<th>Formula</th>
<th>Name</th>
<th>Dangers</th>
<th>Odor</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiH4</td>
<td>Silane</td>
<td>Poisonous, pyrophoric</td>
<td>Repulsive</td>
</tr>
<tr>
<td>NH3</td>
<td>Ammonia</td>
<td>Toxic and Corrosive</td>
<td>Pungent</td>
</tr>
<tr>
<td>Cl2</td>
<td>Chlorine</td>
<td>Highly Poisonous</td>
<td>Pungent, bleach like odor</td>
</tr>
<tr>
<td>BCI3</td>
<td>Boron Trichloride</td>
<td>Highly Poisonous</td>
<td>Pungent</td>
</tr>
</tbody>
</table>
c. Chemical spillage

- Know in advance the emergency procedures specific to the chemicals being used. This information should be specified in the risk assessment associated with the experiment or process being carried out and in the MSDS associated with the chemical(s).
- Only personnel trained in chemical handling should attempt to clean up chemical spills.

Solvents:

1. Eliminate sources of ignition or sparks.
2. Use spill mats and towels to clean up spill.
3. Transfer absorbed solvent to plastic bag and remove as hazardous waste.

Acids and bases:

1. Use appropriate neutralizer to neutralize spill, if available.
2. Use spill mats to absorb liquid.
3. Transfer solid waste to plastic bag and remove as hazardous waste.
4. Wash area with plenty of water.

- In the case of a serious spill whereby the quantity is sufficient to exceed exposure limits, inform other users present within the cleanroom, evacuate cleanroom and inform cleanroom staff.

d. Power failure

- In the event of a power failure in the cleanroom evacuate immediately.
- Inform cleanroom staff.
11. Final notes

- Contact security on ext. 112233 with emergencies.

- The staff and management of the Cleanroom have implemented all reasonable measures to ensure that the laboratory provides a safe working environment.

- All emergency procedures associated with individual processes must be identified, documented and cleared with the Cleanroom Manager and Cleanroom Staff prior to undertaking any work.

- It is the responsibility of all users, visitors, and staff to act in a safe manner at all times while in the facility.

- Operating in a safe and conscientious manner is more important than anything else. Ignorance of the rules, language difficulties, carelessness, and haste are not adequate excuses for unsafe behavior. Always concentrate on your tasks, double-check before carrying out procedures and avoid distractions.

- The Cleanroom Manager and Cleanroom Staff have immediate authority on all safety issues.

- Users violating the safety rules of the facility or endangering the safety of themselves or other users may be denied further access to the facility at the discretion of the management.