LABORATORY SAFETY MANUAL

DEPARTMENTS OF CHEMISTRY AND APPLIED CHEMISTRY

FACULTY OF SCIENCE

2018
PREFACE

Safety is common sense and a moral and legal obligation. The university is legally and morally bound to provide a safe place where we can all work and receive education in line with our aspirations. Equally obliged is each individual to conduct him/herself and carry out every task in a sensible, responsible and safe manner not only to avoid self-harm, but harm to others, the university/tax payers’ property and to the environment.

Housing a vast array of chemicals, of various properties, from the seemingly innocuous to the acutely toxic, explosive, highly flammable and radioactive, and pressurized gases, some of them highly flammable or toxic, a chemistry department is probably the most dangerous place in any educational institution. In addition to chemicals, it houses an arsenal of instruments and equipment for teaching and research purposes, many of which are not only expensive, but can be hazards if ineptly handled. Thus, utmost care and vigilance must be maintained in our environment, and it is for this reason that generations of students in Science, Engineering and Medicine have gone through chemistry courses and “survived” to be legends in their fields and keep sending their children to universities. The same enforced vigilance is the reason why a Chemistry Department is an integral part of any university and not located on a remote site just in case something calamitous happens.

Beyond common sense, safety requires constant reminders (visual, written and oral), training and relentless monitoring/inspections environment and we are equally responsible in ensuring this. It is a joint effort so familiarize yourself with warning signs and emergency evacuation procedures posted all over the building and campus. Know where first aid boxes, eyewash and emergency showers as well as fire extinguishers are located. Stop by and read instructions on fire extinguishers to learn how to use them and what types of fires they are applicable to before the need arises. Report unsafe conditions to your supervisor or Health and Safety representatives

Enforcement can be a bane- the fire drills, inspections, warnings and mandatory regular cleanups but these save lives and everybody must and will comply. This manual forms part of official and mandatory safety. It is a living document and constantly evolves to keep up with latter-day developments but is not exhaustive and further expert training must be sought for specific tasks as the need might be. Please interrogate it and come up with suggestions to make it even better.

Yours in Safety

Edwin Mmutlane (BSc, BSc Honours, PhD)

FURTHER READING


# TABLE OF CONTENTS

PREFACE ......................................................................................................................... 1
FURTHER READING ......................................................................................................... 1

1 INTRODUCTION .............................................................................................................. 3

2 ADMINISTRATION .......................................................................................................... 4

3 HAZARDOUS CHEMICALS AND THE LAW ................................................................. 5

4 WORKING IN THE LABORATORY ............................................................................... 7
  4.1 Hazard Assessment: Material Safety Data Sheets ...................................................... 9
  4.2 Chemical Warning Signs ......................................................................................... 10
  4.3 Personal Protective Equipment .............................................................................. 11
  4.4 Fume Hood Usage ................................................................................................. 12
  4.5 Instruments ........................................................................................................... 14
  4.6 Chemical Storage ................................................................................................... 15
  4.7 Working After Hours and Overnight Experiments .................................................. 18

OVERNIGHT/UNATTENDED EXPERIMENT FORM ..................................................... 20
  4.8 Waste Handling and Disposal .............................................................................. 21

5 EMERGENCY MEASURES: EVACUATION PROCEDURE ............................................. 22

6 ACCIDENT/INCIDENT REPORTS ................................................................................. 22

7 SAFETY INSPECTIONS ............................................................................................... 24

8 TRAINING .................................................................................................................... 24

9 BASIC FIREFIGHTING ................................................................................................. 24

SAFETY INSPECTION FORM .......................................................................................... 1
1 INTRODUCTION

Once in a while, we read in the media about disasters in Chemistry Departments:

“Fire at University of St Andrews chemistry department”, Chemistry World, 10 July 2017.

“Nottingham University fire destroys new multimillion-pound chemistry building”, September 13, 2014.


These are reminders of the potential calamity that can befall any Chemistry Department, even with the strictest of Safety Measures. The majority of accidents/incidents do not make headlines and happen frequently. These are minor explosions and fires, heat and chemical burns, cuts and scrapes, eye injuries, contamination/chemical exposure through skin contact and inhalation, spills and breakages, falls and flooding by water from running taps. The potential for disaster in each of these cases can be massive and thus they must be prevented. Common causes of such are: lack of working understanding of hazards, improper or unintended use of equipment, unsafe storage and transportation of chemicals, inexperience, distractions, lack/loss of attention to task, broken, damaged glassware or equipment and sheer carelessness/complacency.

Theft is another vexatious occurrence and vigilance in monitoring who enters our facilities is required, as well as restricting access to certain areas. Even worse is the potential for arson, the consequences of which can be disastrous.

Avoid working alone at night or over weekends and public holidays- have a colleague around not necessarily working in the same lab and make sure you check on each other regularly. If you set up an overnight experiment, make sure that it is set up in a fume hood clear of anything else that might catch fire/chemically react should something go wrong. Set the temperature to the requisite minimum if heating must be used and make sure that tubes for coolant water are tightly fitted (with wires or cable ties) and that the water flow is at an appropriate level. Leave a note on the fume-hood shield with details of the experiment and do one final check before you leave. If you are the last person to leave, make a round check of the entire lab and building before you leave.

Good housekeeping is an integral part of safety. Avoid clutter, store reagents and solvents properly, according to their chemical reactivity and promptly return them to the storage cabinets after use. Promptly report any malfunctioning instruments, send broken glassware for repairs, clean up any spillages and all equipment immediately after use and dispose of waste in appropriately labelled containers. Minimize waste and recycle everything possible, keep your workspace and laboratory clean, do not keep dirty glassware in washbasins, do not litter on campus and notify UJ Maintenance (011 559 2111; email: servicedesk@uj.ac.za) of any leaking taps, blocked sinks/drains, malfunctioning lights and electrical installations.
2 ADMINISTRATION

By law, every employer who has more than 20 employees in his employment at any workplace, shall designate in writing for a specified period, health and safety representatives for such workplace, or for different sections thereof. The University, and the Faculty of Science have Health and Safety Committees, with each Department represented in the Faculty one. Additional Health and Safety reps can be appointed based on the risks at hand.

For the Chemistry Department, YOUR CONTACT PERSONS ARE:

1 DR EDWIN MMUTLANE

Chemical Safety, Storage, Waste Disposal and General House Keeping

Office: C2LAB228; Tel. No: 011 559 3431; Email Address: edwinm@uj.ac.za

2 MR CHRISTOPHER KGATSHE

General Health and Safety, Training, First Aid, Fire Fighting, Warning Systems and Evacuation

Office: C2LAB116B Tel. No: 011 559 4777; Email Address: ckgatshe@uj.ac.za

For the Kingsway Campus, RESPONSIBLE PERSONS TO CONTACT IN EMERGENCIES ARE:

**INTERNAL EMERGENCY NUMBERS**

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Tel. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Coordinator/HOD</td>
<td>Kobus de Bruyn</td>
<td>011 559 6129; 082 328 7162</td>
</tr>
<tr>
<td>Occupational Safety Secretary</td>
<td>Susan Prinsloo</td>
<td>011 559 6146; 082 303 4919</td>
</tr>
<tr>
<td>Occupational Safety Practitioner</td>
<td>Willem Kilian</td>
<td>011 559 4221; 082 808 6397</td>
</tr>
<tr>
<td>Primary Health Care</td>
<td>Sr Marietjie Bester</td>
<td>011 559 3837</td>
</tr>
<tr>
<td>Occupational Health</td>
<td>Sr Elana Venter</td>
<td>011 559 2200; 082 341 0299</td>
</tr>
<tr>
<td>Control Room</td>
<td>UJ Protection Services</td>
<td>011 559 2000/2555</td>
</tr>
</tbody>
</table>

**EXTERNAL EMERGENCY NUMBERS**

<table>
<thead>
<tr>
<th>Service</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Emergency Number</td>
<td>112 (free from cell phone); 10177 (landline)</td>
</tr>
<tr>
<td>Fire Brigade</td>
<td>011 375 5911; 10777</td>
</tr>
<tr>
<td>South African Police Services</td>
<td>10111/ 1022</td>
</tr>
<tr>
<td>Netcare Ambulance</td>
<td>082 911</td>
</tr>
<tr>
<td>NETCARE DEDICATED UJ TRIGGER NUMBER</td>
<td>010 209 8651</td>
</tr>
<tr>
<td>Milpark Hospital</td>
<td>011 480 5600/5912</td>
</tr>
<tr>
<td>Garden City Clinic</td>
<td>011 495 5000</td>
</tr>
<tr>
<td>Gas Emergency</td>
<td>011 726 3138; 011 356 5000; 011 726 4702 (after hours)</td>
</tr>
<tr>
<td>HAZMAT RESPONSE</td>
<td>073 732 0071; 083 704 3071</td>
</tr>
<tr>
<td>Poison Center (Tygerberg Hospital 24/7)</td>
<td>021 931 6129</td>
</tr>
</tbody>
</table>
3 HARZADOUS CHEMICALS AND THE LAW

Our work as chemists is principally governed by two pieces of legislation: (i) the Occupational Health and Safety Act 85 of 1993 as Amended by Occupational Health and Safety Amendment Act 181 of 1993 and (ii) the Hazardous Substances Act 15 of 1973 (HSA).

The Occupational Health and Safety Act provides for the health and safety of persons at work and for the health and safety of persons regarding the use of plant and machinery. It also protects people other than persons at work, against hazards to health and safety arising out of or relating to the activities of persons at work. In addition, it has mandated establishment of an advisory council for occupational health and safety and provides for matters connected therewith.

Section 7 instructs employers to prepare a written policy concerning the protection of the health and safety of their employees at work, including a description of the organization and the arrangements for carrying out and reviewing that policy.

Section 8 lists the general duties of employers to their employees as:

(a) the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;

(b) taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment;

(c) making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;

(d) establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he/she shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he/she shall provide the necessary means to apply such precautionary measures;

(e) providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his/her employees;

(f) as far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;

(g) taking all necessary measures to ensure that the requirements of this Act are complied with by every person in his/her employment or on premises under his control where plant or machinery is used;
(h) enforcing such measures as may be necessary in the interest of health and safety;

(i) ensuring that work is performed, and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and

(j) causing all employees to be informed regarding the scope of their authority as contemplated in section 37 (1) (b).

**Section 14** states every employee shall at work-

(a) take reasonable care for the health and safety of him-/herself and of other persons who may be affected by his/her acts or omissions;

(b) as regards any duty or requirement imposed on his/her employer or any other person by this Act, co-operate with such employer or person to enable that duty or requirement to be performed or complied with;

(c) carry out any lawful order given to him/her, and obey the health and safety rules and procedures laid down by his/her employer or by anyone authorized thereto by his/her employer, in the interest of health or safety;

(d) if any situation which is unsafe or unhealthy comes to his attention, as soon as practicable report such situation to his/her employer or to the health and safety representative for his/her workplace or section thereof, as the case may be, who shall report it to the employer; and

(e) if he/she is involved in any incident which may affect his/her health or which has caused an injury to him-/herself, report such incident to his/her employer or to anyone authorized thereto by the employer, or to his/her health and safety representative, as soon as practicable but not later than the end of the particular shift during which the incident occurred, unless the circumstances were such that the reporting of the incident was not possible, in which case he/she shall report the incident as soon as practicable thereafter.

The Hazardous Substances Act lists four classes or groups of hazardous substances, namely group i to group iv. The hazardous substances found under these groups will be found in the regulations which form part of the Act. All persons who make use of, manufacture, distribute and/or sell hazardous chemical substances must ensure that the relevant laws and regulations are in place and are complied with.

In order to ensure compliance, the manufacturer must establish which class of hazardous substance in his or her possession falls under and then abide by the rules which apply to that type of hazardous substance.

Any person who manufactures, distributes, uses or sells a group iii or iv Hazardous substance must hold a license

Hazardous substances must be kept away from food and drinks and must be stored in a locked room or cupboard except when stock is being sold or replenished.

All containers where hazardous substances are stored must be leak-proof and tightly sealed.
Any person who uses any hazardous chemical substance must have in his/her possession a copy of the Material Safety Data Sheet (MSDS). This document describes what emergency procedures should be followed in the event of any accidental misuse or spillage of a hazardous substance.

Any person who disposes of a hazardous substance or its container must ensure that such substance is not poured down a drain or placed into the ground but is instead given to a registered waste disposal contractor, who must ensure and confirm by way of a waste disposal certificate that it is disposed of at a registered hazardous waste disposal site.

Any person who contravenes any provision of this Act will be guilty of an offence and may be liable to a fine or to imprisonment for a period of up to 10 years or to both a fine and imprisonment.

Recommended actions or controls which should be implemented by the target audience to ensure compliance with the act are:

- Listing all hazardous substances used, categorise them and ensure applicable licenses or authorisations are in place.
- Conducting adequate risk assessments and make recommendations on controls to ensure correct manufacture, use, sale and/or disposal of substances.
- Ensuring Material Safety Data Sheet and Hazardous Chemical Substances lists are in place.

4 WORKING IN THE LABORATORY

Most of the Safety Rules pertaining to laboratory work are already inculcated in First Year of undergraduate studies AND MUST BE ADHERED TO AT ALL TIMES:

(1) Wearing of clean, long sleeved laboratory coats that cover the body up to the knees, buttoned up. It is desirable to purchase flameproof ones, or at the very minimum, 100% cotton- cotton burns off you while nylon and other synthetics melt and stick to you when they catch fire!

(2) Wearing of safety goggles, latex gloves and closed shoes. Long hair must be neatly tied at the back.

(3) No eating or drinking in the lab.

(4) No use of cellphones or headphones.

(5) No pranks or practical jokes.
(6) Avoiding and immediately reporting spillages where sighted.

(7) Not using broken glassware and reporting it to lab staff.

(8) Disposing of waste in appropriately labeled containers and cleaning all apparatus after the practical session.

Unlike undergraduate laboratory practicals, which are based on repeating well-established procedures, research often involves making new materials by new methods, which may pose unknown hazards. As a result, students in academic research laboratories do not always operate from an extensive experience base. This makes doing a hazard analysis of every reaction critical. It always starts with a literature search (Scifinder or Reaxys) to check if there is literature precedent to the reaction planned. This is followed by reading the MSDSs of every reagent and solvent to know how to handle them. Such information will help in deciding what other protective equipment is required, beyond just the ordinary lab coat, safety goggles and gloves. The reaction must then be discussed with the supervisor or another experienced colleague and the reaction should preferably be set up in their presence and its work-up also done under supervision. Except for very rare cases, all reactions including work-up and column chromatographic separations must be done in a well-maintained fume hood that is free of clutter!

Things are unlikely go wrong when you set up the reaction for the first time because you are naturally very cautious. Problems normally occur during repeats, due to complacency (the “I have done this many times before” attitude) or during scale-up. It is important to remember that most reactions are exothermic. Such reactions move to a heat balance within the reaction vessel where heat removal balances heat production and this balance is at a temperature above that of the vessel. Scale up alters both rates of heat removal and production. The main factors affecting the removal of heat are the size of the reactor, stirring and cooling. Heat production depends on concentration of reactants and catalysts, size and starting temperature. Although scale-up issues are normally the concern of process chemists and chemical engineers, they can lead to disastrous consequences even in research labs as the tragic death of a student at UCLA due to tert-butyl lithium has shown. Therefore, instead of setting up one reaction on a 10-gram scale, it is safer to set up several 1 or 2-gram scale reactions, one after another, tedious as it may be.

The work-up of a reaction as the first step in product isolation is also a potentially hazardous operation and extreme caution must be exercised, bearing in mind the MSDSs of the reactants. Adding water, acid or base to the reaction mixture can be exothermic and lead to the production of gases and a sudden pressure build-up. Quench your reaction in a cooling bath, carefully adding the “quenching solution” with vigorous stirring to avoid local heat buildup. Solvent extraction using separating funnels is also potentially dangerous, especially with volatile solvents such as diethyl ether (which can form explosive peroxides upon long-term exposure to sunlight and air) or dichloromethane.

---

4.1 Hazard Assessment: Material Safety Data Sheets

A Material Safety Data Sheet (MSDS), aka Product Safety Data Sheet (PSDS) is a document, legally required to be provided by the substance’s supplier, which contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product.

A Material Safety Data Sheet also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. The Globally Harmonized System of Classification and Labelling of Chemicals contains a standard, 16-SECTION specification for safety data sheets:

SECTION 1: Identification of the substance/mixture and of the company/undertaking;

SECTION 2: Hazards identification

SECTION 3: Composition/information on ingrédients

SECTION 4: First aid measures

SECTION 5: Firefighting measures

SECTION 6: Accidental release measure

SECTION 7: Handling and storage

SECTION 8: Exposure controls/personal protection

SECTION 9: Physical and chemical properties

SECTION 10: Stability and reactivity

SECTION 11: Toxicological information

SECTION 12: Ecological information

SECTION 13: Disposal considerations

SECTION 14: Transport information

SECTION 15: Regulatory information

SECTION 16: Other information.

You not only need to read and understand the information contained in the data sheet but declare in your laboratory notebook under the specific experiment, that you have done so, and sign! In addition, legally, MSDSs of all substances in every storage location must be kept with the substances at that location.

The University of Johannesburg’s intranet has a link (MSDS) under Quicklinks, giving access to MSDSs compiled by the Occupational Safety Department, of some of the chemicals in all the university’s laboratories. The list is limited but gets constantly updated. We need your help, please make an electronic collection of MSDSs of
Chemicals in your lab, and new ones as you keep buying, save them in a CD and hand it over to Dr Edwin Mmutlane.

4.2 Chemical Warning Signs
The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is an internationally agreed-upon standard managed by the United Nations, set up to replace the miscellany of hazardous material classification and labelling schemes previously used around the world. Core elements of the GHS include standardized hazard testing criteria, universal warning pictograms, and harmonized Material Safety Data Sheets. The main elements of the hazard classification criteria are as follows:

**PHYSICAL HAZARDS:**

**HEALTH HAZARDS:**
(1) Acute toxicity, (2) Skin corrosion, (3) Skin irritation, (4) Serious eye damage, (5) Eye irritation, (6) Respiratory sensitizer (7) Skin sensitizer, (8) Germ cell mutagenicity, (9) Carcinogenicity, (10) Reproductive toxicity (11) Specific target organ toxicity and (12) Aspiration hazard.

**ENVIRONMENTAL HAZARDS:**
(1) Acute aquatic toxicity and (2) Chronic aquatic toxicity.

Visually, the labelling symbols are as follows, with the old symbols shown at the bottom:

4.3 Personal Protective Equipment

Proper risk assessments must be conducted to determine the risk at hand. PPE will be determined from the risk assessment to mitigate the risks identified. Section 15 of the OHS Act has reference: No person is allowed to interfere, misuse or damage safety equipment such as PPE.

A long-sleeved lab coat that covers the body to the knees, always buttoned up, as well as safety goggles, closed shoes and disposable gloves are compulsory and now the standard chemistry dress code. The lab coat must be clean: dirty, chemically contaminated lab coats are a health hazard to you and people around you. Do not enter common areas (tea room, study room, computer lab) wearing a lab coat and do open doors wearing gloves- this poses a chemical contamination risk!

In addition to the standard PPE, additional protective equipment may be required, such as a gas/dust mask, an acid proof apron for working with acids, especially HF, as well as thermally insulated gloves for handling hot or extremely cold objects/substances. Here are pictures from Sigma-Aldrich:
CAUTION:

While latex or nitrile gloves protect against a lot of reagents, they themselves are a hazard in cases of fire (they melt and stick to you when they burn) and are not impermeable to certain substances, including dichloromethane. The tragic Dartmouth College incident serves as reminder:3

Karen Wetterhahn, a specialist in metal toxicology, was a professor of chemistry at Dartmouth College and founding director of the university’s Toxic Metals Research Program. In August 1996, while transferring dimethylmercury between containers, Wetterhahn dropped one to several drops of the compound onto her left, gloved hand. During the transfer, Wetterhahn observed the standard safety protocol at the time, conducting the transfer in a fume hood, wearing eye goggles, and disposable latex gloves. Wetterhahn thought nothing of the minor spill. When she was done, she cleaned her equipment, removed her gloves, and washed her hands. About five months later, Wetterhahn began having trouble seeing, speaking, hearing, and walking.

Upon medical examination, Wetterhahn was diagnosed with acute mercury toxicity due to exposure to dimethylmercury. Despite aggressive chelation therapy, her condition continued to deteriorate, and in February 1997, Wetterhahn went into a coma. She died on June 8, 1997, only ten months after the initial exposure. The unsettling characteristic of this incident is that Wetterhahn carried out the dimethylmercury transfer appropriately and safely to the best of anyone’s knowledge at the time. Notably, the Material Safety Data Sheets (MSDS) for dimethylmercury recommended the use of rubber, neoprene, or otherwise “chemically impervious gloves” when handling the compound. The MSDS offered no additional detail on the subject. Following Wetterhahn’s death, permeation testing of disposable latex gloves revealed that dimethylmercury permeates latex, PVC, and neoprene almost immediately upon contact.4 Acknowledging the great risk associated with handling dimethylmercury as well as its lethal properties, OSHA amended its safety guidelines for the compound, discouraging its further use, unless absolutely necessary. In OSHA’s memorandum issued after Wetterhahn’s death, the agency noted the critical need for research laboratories to produce a “protective chemical hygiene plan, which includes adequate guidance on the appropriate selection of personal protective equipment and engineering controls.”5 The memorandum stressed that even “highly placed or very well qualified researchers” do not always possess the most accurate or adequate health and safety information. The memorandum goes on to underscore the need for collaborative relationships between university researchers and health and safety professionals in creating safe and effective laboratory environments.

4.4 Fume Hood Usage

A properly designed and operated fume hood reduces exposure to hazardous fumes, vapours, gases and dusts. A fume-hood confines hazardous airborne material by diluting it with a large amount of air, drawing it through an exhaust system and then expelling the air in vents locate on the roof. Proper use of the fume-hood sash can


also shield the worker from an uncontrolled reaction. Fume hoods must be inspected and tested annually to assess performance standards, but it is up to you to use a fume-hood safely:

- Perform all work involving hazardous or volatile materials in a fume hood.
- Check that the fume-hood is operating correctly before you start work. To check the air-flow a strip of paper, tissue, or ribbon can be taped to fume-hood sash.
- Avoid cross drafts and disruptive air currents in front of the fume hood. Ensure that windows and doors near the fume-hoods are CLOSED.
- Always keep work at least 15 cm in from the opening of the fume hood
- Use the sash as a safety shield when boiling materials or conducting an experiment with reactive chemicals.
- Always keep sash as low as possible.
- As the sash is lifted, flow is increased so that the face velocity of air over a given cross section of the sash opening is constant. In summer especially, this will mean that hotter make-up air is drawn into the lab.
- When the fume hood is not in use, ensure that all materials are in sealed containers.
- Connect all electrical devices outside of the hood to avoid sparks, which may ignite a flammable or explosive chemical.
- Prepare a plan of action in case of an emergency, such as a power failure, especially when using extremely hazardous chemicals or acids.
- For long-term experiments fill out the overnight/unattended experiment form and post on sash of fume hood.
- DO NOT place your face or head inside the hood. Keep hands out as much as possible.
- DO NOT use a fume hood as a storage area, they should contain only working volumes of chemicals.
- DO NOT use fume hoods to vent or dispose of hazardous materials through air dilution.
- DO NOT overcrowd or clutter the fume hood. Overcrowding creates vortices and dead spots; vortices may cause hazardous material to flow back out of the fume hood causing exposure; dead spots may allow ignitable concentrations of flammable and combustible materials to accumulate.
- DO NOT place equipment in the hood that stops the sash from closing. A safer local exhaust ventilation method may exist and should be pursued.
- DO NOT modify fume hood or erect shelves in a fume hood for chemical or equipment storage.
- DO NOT place power boards, or other spark producing sources inside the hood.
4.5 Instruments

The Department is equipped with a multitude of equipment and instruments, some for routine use, others for specialized analyses/reactions.

Routine equipment includes balances, magnetic heater stirrers, rotary evaporators, high vacuum pumps, etc. You need to know how to operate these correctly and take good care of them because they are quite expensive to repair/replace.

Analytical instruments include NMR spectrometers, IR spectrometers, GC-MS and Single Crystal x-ray diffractometer, graphite furnaces, etc. Use of these requires special training and there are instrument scientists responsible for them.
Specialized equipment includes Parr reactors for high pressure work, a glove box and anhydrous solvent dispensers.

For every equipment/instrument, there must be a Standard Operating Procedure (SOP); a set of step-by-step instructions to help users who are not necessarily experts to carry out routine operations efficiently, with quality outputs and uniformity of performance whilst eliminating the possibility of accidents. Supervisors/Instrument Scientists are responsible for compiling these, which can be extracted from the users’ manuals provided by the manufacturers.

4.6 Chemical Storage

ALL CHEMICALS MUST BE STORED IN SUCH A WAY THAT:

- Risks involved in storing incompatible materials together are minimized
- Dangerous, violent reactions, such as the generation of flammable or toxic gases are prevented.
- In the event of fire, toxic smoke is avoided.

For safety reasons, all products to be stored must be classified in the storage class relevant to their specific hazard characteristics. (not just alphabetically!) A chemical can only be classified in one storage class. Chemicals having more than one hazardous property are assigned to a class based on a ranking system for the hazards involved. This guarantees that chemicals with the same or similar properties can be treated similarly with regard to the necessary safety measures, in particular, fire and explosion protection.

STORAGE CLASSES ARE (CHECK THE MSDS OF EACH SUBSTANCE TO ASSIGN A STORAGE CATEGORY!):

1    Explosive substances
2A   Gases
2B   Aerosols
3    Flammable liquids
4.1A Flammable solids (explosive)
4.1B Flammable solids and desensitized substances
4.2   Substances prone to spontaneous combustion
4.3   Substances that form flammable gases in contact with water
5.1A Strong oxidizing agents
5.1B Oxidizing substances

5 Merck Store Card: Mixed Storage of Chemicals
5.1C Oxidizing substances (Ammonium nitrate)

5.2 Organic peroxides and self-reactive substances

6.1A Combustible, acutely toxic substances

6.1B Non-combustible acutely toxic substances

6.1C Combustible toxic substances or those with chronic effects

6.1D Non-combustible toxic substances or substances with chronic effect

6.2 Infectious substances

7 Radioactive substances

8A Combustible corrosive substances

8B Non-combustible corrosive substances

9 Various hazardous substances

Mixed storage of products of differing storage classes is permitted only if they require identical temperature and the same extinguishing agents can be used.

Segregated storage (same area/room but physical separation with walls, non-combustible substances of class 9, or fire proof cabinets) within one area may be necessary if certain products are in the same storage class but have special properties. This is also the case for substances in different storage classes.

THE FOLLOWING RULES APPLY:

1 A risk assessment is necessary.

2 Combustible liquids, with the exception of flammable liquids, may be stored in storage areas in which there are no more than 50 full compressed gas cylinders, of which a maximum of 25 contain flammable, oxidizing or toxic gases. Provided the storage area for compressed gas cylinders is separated by at least a two-meter-high wall made of incombustible material. Alternatively, there must be at least 5 meters’ distance between the gas cylinders and combustible substances.

3 Up to 150 compressed-gas containers containing flammable, oxidizing and inert gases may be stored together. In addition, 15 compressed-gas cylinders with toxic and highly toxic gases may be stored with them at the same time.
Gas cylinders in the laboratory must be secured upright, to walls with chains/clamps/robust belts to prevent falling, and each must be fitted with an appropriate regulator. The must be transported in cylinder trolleys and no empty and additional full cylinders should be stored in the lab.

Materials that ignite easily or cause fire to spread quickly, such as packaging material, must not be stored together with toxic or flammable liquids.

Products which do not react with one another in the event of an incident may be stored together, but segregated by large gaps between containers, separate containment barriers or storage safety cabinets.

Flammable liquids must not be stored in ordinary domestic refrigerators but in fridges and freezers specifically designed or modified for the purpose, i.e. those that have all ignition sources removed. The Department is in the process of phasing out all domestic refrigerators with those specifically for chemical storage. Chemicals stored in refrigerators should be in line with storage categories above and must be sealed and appropriately labelled, including the name of the person who stored the material. Food and drink must not be stored in a refrigerator used for chemical storage.

PROTECTIVE MEASURES:

- MSDS of each substance in the storage area must be stored in the same area
- Workers must wear suitable protective clothing
- There must be a strict ban on naked flames, unshielded lights and smoking. There must be significant separation/difference between the ceiling lights and the top most shelf where substances are packed.
- Stored goods must be handled carefully to prevent damage to packaging and spillage.
- Escape routes, emergency exits and access routes for the emergency services must be kept free and unobstructed at all times.
- Suitable fire extinguishers (ABC powder type), first aid boxes and eyewash bottles must be close at hand.
- Written permission must be obtained before any welding, or the use of power tools such as drills, grinders, etc.) is undertaken.
- There must be a strict ban on smoking, eating or drinking where chemicals are stored.

4.7 Working After Hours and Overnight Experiments

Academic research demands putting in extra hours and thus working until late and on weekends and public holidays is normal. This inherently poses a danger of things going wrong in the absence of other people to help you. The danger is not only an experiment going wrong in your hands, but perhaps you might get incapacitated and have no one to rescue you. It is thus imperative to let someone else know of your presence and the two of you must check on each other frequently.

WHEN YOU WORK OUTSIDE NORMAL HOURS:

- Have a phone handy (a cell phone with airtime to make a call and or send a message!).
- As the only person in your laboratory and probably one of the few in the building, take a walk around the entire building when most people have left and know who else is around in the building and what they are doing.
- Make sure that the main entrances are locked to keep intruders out, and that all emergency exits are unobstructed. Emergency exits must be unobstructed at all times but you need to make sure of that yourself!
- You must already be aware of the location of fire extinguishers, first aid boxes and emergency showers and eyewash stations.
- Check every fume hood in your lab to make sure that you are aware of every overnight experiment in your lab. The person responsible for that overnight/unattended experiment must have filled the overnight experiment form below, providing all the details regarding the (balanced) chemical equation, reaction temperature/pressure and a succinct hazard assessment based on the MSDSs of each reactant, solvent and reaction products and by-products if known.

IF WATER SUPPLY TO THE BUILDING IS INTERRUPTED:

- Stop all experiments (yours and others) that require heating, record the time and leave a note for the colleagues whose experiments you had to stop.
- Check in other labs where you have access or notify a lab supervisor (the contact details of each must be available for emergency notification).
- Wrap up your own work and prepare to leave. Although your own experiment might not require water, working it up might not be possible and even more importantly, you will not be able to wash your hands after handling chemicals or even worse have an emergency shower should you need one!

IF POWER/ELECTRICITY SUPPLY IS INTERRUPTED:

- Emergency power supply by university generators will kick in after a few seconds, allowing critical instruments to continue operating. Such instruments are plugged into red power sockets everywhere in the building.
- For all other equipment, make sure you switch them off. For vacuum pumps, make sure you release the valve to release the vacuum and let air get into the system otherwise the lubricant oil...
of the pump will be sucked in the vacuum line as “nature” tries to equalize the internal pressure with the ambient one, potentially ruining the pump!

- Check in other labs where you have access or notify a lab supervisor (the contact details of each must be available for emergency notification).

FOR EACH OVERNIGHT/UNATTENDED EXPERIMENT:

- The form below must be completed in full, signed and a copy thereof pasted on the fume hood where the experiment is set up. Before you leave, make sure that the reaction has already started at the set temperature, with the coolant water for those where it is necessary, flowing at a moderate rate. Please note that the water supply pressure in the building varies based on the number of users present and automatically rises after-hours due to less use. Thus, when you set up a reaction at reflux whilst many people are around, the water flow rate must be set to the barest minimum (just enough to ensure condensation).

- Make sure that all tubing to condensers, including that on rotary evaporators, is tightly secured with cable ties/flexible wires and that there are no leaks!

- Avoid using heating mantles in unattended experiments. For reactions requiring heating baths, make sure that the temperature setting is to the barest minimum just to allow gentle reflux and do not immerse the whole reaction vessel in bath- just it bottom, leaving room for thermal expansion of the heating medium.

- The experiment must be set up in a fume hood that is free of any reagent/solvent that might react/catch fire in the event of anything going wrong.

- *Remember, you cannot leave until the experiment has started and everything looks fine!*  

OVERNIGHT/UNATTENDED EXPERIMENT FORM

DEPARTMENT OF CHEMISTRY: UNIVERSITY OF JOHANNESBURG

NAME OF RESEARCHER:

HIGHEST QUALIFICATION: DATE OF EXPERIMENT:

DURATION OF THE EXPERIMENT (starting and termination time):

BALANCED REACTION EQUATION (you must give reactants, solvent, products and by products!):

DETAILS OF THE EXPERIMENT (Does the reaction need heating/cooling, continuous water flow, continuous stirring, inert gas?):

SPECIFIC REAGENTS: What exactly did you add, in what state (solid, liquid, gas or in solution), at what concentration and what is the volume of the reaction solvent?

MSDS OF EACH READ AND UNDERSTOOD (YES OR NO?):

SPECIFIC HAZARDS:

WHAT SHOULD BE DONE IN CASE OF EMERGENCY?

SIGNATURE OF RESEARCHER:

EXPERIMENT AUTHORIZED BY (NAME AND SIGNATURE OF SUPERVISOR):
4.8 Waste Handling and Disposal

COLLECTION OF LABORATORY WASTE

Laboratory waste should be collected for disposal in separate containers according to the type of chemical involved. Containers can for example, be labelled according to the schedule below, using the letters A-K. In doing so, it must be ensured that the chemicals collected in any one category cannot react with each other. At least a check should be made for acid or base content and neutralization done.

A  Halogen free organic solvents and dissolved organic substances
B  Halogen-containing organic solvents and dissolved halogenated substances. *Do not use aluminium containers!*
C  Solid residues of organic chemicals (including filter papers)
D  Salts in solution (adjust the pH of the contents to 6-8.
E  Toxic inorganic residues and salts of heavy metals and solutions
F  Toxic, flammable compounds
G  Mercury (broken thermometers) and inorganic mercury salt residues (Elemental mercury must be taken up with Chemizorb®
H  Metallic salt residues (precious- each metal should be collected separately, with recovery in mind)
I  Inorganic solids, including filter papers
J  Separate collection of glass, metal and plastic waste material
K  Separate containers for sharp objects.

The containers must be made of durable material, unbreakable and able to withstand the contents. High Density Poly-Ethylene is preferable and appropriate sizes must be used to avoid storage for long periods before disposal. The containers should be kept closed to prevent escape of harmful vapors and be stored in a well-ventilated area.

TREATMENT/NEUTRALIZATION OF LABORATORY WASTE

It may be necessary to deactivate waste material before storing it, by converting it into harmless secondary product treatment does increase the material to be disposed of and even more importantly, neutralizations are chemical reactions which can be violent and exothermic! General safety rules and MSDSs must be strictly followed. It is prudent to try the neutralization reaction on a small scale first, in an appropriate vessel, to get an indication of what happens.
5 EMERGENCY MEASURES: EVACUATION PROCEDURE

WHEN THE SIREN/FIRE ALARM RINGS, DO NOT PANIC:

- Switch off all appliances
- Open all doors (the building’s windows are welded shut and cannot be opened)
- Collect your valuables
- Leave the room quickly but in an orderly fashion
- Assist injured persons or those with disabilities.
- Follow the emergency exit signs:
- DO NOT USE THE LIFT/ELEVATOR, USE THE STAIRS
- Fire Marshals and First Aiders must assist with evacuation and provide first aid until emergency response arrives.
- Assemble at Assembly Point 14 in the C-Parking area
- Stay at the assembly point for the roll call and only leave the assembly area when told to do so.

6 ACCIDENT/INCIDENT REPORTS

On the next page is a sample of the form that must be completed to report all incidents not involving personal injury that requires medical attention. Injuries must be reported to the immediate supervisors. HOD, Occupational Safety Department and the Occupational Health Department. Proper assessment of the accident needs to be conducted by the Supervisor, Health and Safety Representative and the Occupational Safety Department. Whenever an employee meets with an accident arising out of and in the course of his/her employment resulting a personal injury for which medical treatment is required, or death, a form obtainable from the Department of Labour will be completed by the Employer in line with the Compensation for Occupational Injuries and Diseases Act of 1993.8

An incident report provides details on: (1) what happened, (2) when it happened, (3) where it happened, (4) how it happened, (5) who it happened to, (6) who reported it, (7) everyone who was involved and (8) any damage or injury that incurred.

As an accurate record of events, the incident report: (i) provides documentation for follow-up (ii) provides information to be used in the investigation should there be a need and (iii) it is used to identify areas of risk.

7 SAFETY INSPECTIONS
These are necessary to monitor compliance and as part of the requisite vigilance and constant reminders. They will be scheduled at least twice a year and announced well in advance, but it is important to do the right thing all the time, rather than just before inspection. There will be regular spot checks for compliance all the time, including on the use of PPE, and sanctions will be imposed!

The scheduled Safety Inspections will be done the Departmental Health and Safety officers together with one or two other Health and Safety Practitioners, from within the university, or from outside. Please take a look at the Safety Inspection Form at the end of this document to see what it is that we’ll be paying attention to.

There will also be fire drills, which will not be announced and must be taken as seriously as real emergencies themselves. These are meant to ensure that everyone knows how to exit safely as quickly as possible if a fire, smoke, carbon monoxide or other emergency occurs. The building's fire alarm will be activated, and the building evacuated as if the emergency had occurred. The evacuation will be timed to ensure that it is fast enough, and problems with the emergency system or evacuation procedures can be identified and remedied.

8 TRAINING
Since laboratory work is inherently risky and staff and students work outside normal hours, every post-graduate student must undergo Basic First Aid training. This is done by an outside contractor, with a certificate issued upon completion of the course. Two intakes are arranged annually by the Department, at the beginning of each Semester.

9 BASIC FIREFIGHTING
Most fires start small, and can be prevented from becoming disasters upon quick thinking and action. The best method of stopping a fire is to prevent it in the first place. The actions taken to control a fire during the first few minutes will determine whether it can be contained or not. A few people in the Department have undergone basic fire training but may not be around after hours when incidents occur. The question is what to do without risking your own life.

If a fire start in your area, shout for help while trying to do something about it yourself, making sure that your escape route is clear in case the fire gets out of control. Activate the alarm.
There are three main components to a fire; the reductant (fuel or combustible material), heat or spark and the oxidant (oxygen). Fire is a chemical (redox) reaction and can spark other chemical reactions (the fourth element) to become self-sustaining and spread rapidly.

A fire can be extinguished by taking away any of the three components. The most common fuels contain carbon along with combinations of hydrogen and oxygen. Heat is the energy component of a fire. When it comes into contact with a fuel, it provides the energy necessary for ignition, causes the continuous production and ignition of fuel vapours or gases so that the combustion reaction can continue, and causes the vaporization of solid and liquid fuels.

There are six classes of fire, based on the combustible material:

- **Class A**: SOLIDS such as paper, wood, plastic etc.
- **Class B**: FLAMMABLE LIQUIDS such as paraffin, petrol, oil etc.
- **Class C**: FLAMMABLE GASES such as propane, butane, methane etc.
- **Class D**: METALS such as aluminium, magnesium, titanium etc.
- **Class E**: ELECTRICAL FIRES, which can cause any of the other classes.
- **Class F**: Cooking OIL & FAT etc.

Based on these classes, specific fire extinguishers are available throughout the building and are inspected/serviced annually. Make sure you stop by one and read the label to see what the active/fire extinguishing agent is, as well as operation instructions before you need to use it (see below)!

Water is the most commonly used fire extinguisher and does so by cooling, which removes heat because of its high heat capacity, able to absorb massive amounts of heat as it converts to water vapour. Without heat, the fire eventually “dies” Water also extinguishes a fire by smothering it. In addition, as water gets heated to vapour, it dilutes the oxygen in the air above the fire, thus removing one of the elements that the fire requires to burn. Water cannot be used to extinguish fires involving fuels that are immiscible with it (organic solvents). Because many flammable organic solvents are less dense than water, the water simply flows and spreads the
fuel whilst it continues burning above the water and can ignite other material! In addition, water cannot be used in fires due to metals (alkali and alkali-earth) as they violently react with water to liberate hydrogen gas, which itself is highly flammable!

Chemical foams also smother the flame and extinguish it, and so does a fire blanket, which consists of a sheet of a fire-retardant material which is placed over a fire to smother it.

Other fire extinguishers use compressed carbon dioxide especially for fires involving live electrical wires. The carbon dioxide chokes the fire and thus extinguish it. Since the carbon dioxide is compressed, the container gets cool as it is suddenly released.

The last method is chemical flame inhibition, achieved by applying dry chemical or halogenated agents that interrupt the chemical chain reaction and stop flaming. This method is effective on gas and liquid fuel; because, they must have flame to burn.

**DO NOT CONTINUE TO FIGHT A FIRE IF:**

- it is dangerous to do so,
- there is a possibility that your escape route may be cut off by the fire or smoke,
- the fire continues to grow despite your efforts,
- there are gas cylinders threatened by a fire.
- If you must withdraw, close windows and doors behind you whenever possible.

Do NOT use a fire extinguisher to put out a fire involving burning gas. Turn off the gas supply if it is safe to do so, or leave such fires to the fire brigade.

**HERE IS A QUICK STEP-BY-STEP (P-A-S-S) GUIDE TO USING THE PORTABLE FIRE EXTINGUISHER (SEE THE LABEL):**

- **Pull the pin**
- **Aim the hose at the base of the fire**
- **Squeeze the handle**
- **Sweep the extinguisher back and forth dousing the fire.**

---

SAFETY INSPECTION FORM

DEPARTMENT OF CHEMISTRY

BUILDING C2LAB

LABORATORY/FACILITY NUMBER:

HEAD OF THE LABORATORY/FACILITY:

NUMBER OF PERSONS WORKING IN THE LABORATORY/FACILITY:

1. GENERAL STATE OF THE LABORATORY/FACILITY AND CLEANLINESS

<table>
<thead>
<tr>
<th>1.1 Is the area clean and neat: free of litter, dust on surfaces and spillages?</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Are there enough rubbish bins, showing regular emptying and no evidence of food and drinks brought into the laboratory?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Is there indication of commitment to recycling of clean paper and glass?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Are the walls intact, paintwork in good condition, ceiling boards in place?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Are the water- and gas-pipes and taps not badly corroded, leaking, sinks not blocked and free of dirty glassware?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Is there sufficient lighting, adequate air conditioning/airflow and the work area comfortable?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. EMERGENCY MEASURES

<table>
<thead>
<tr>
<th>2.1 Are emergency exits clearly marked and unobstructed?</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Are emergency signs in place and clearly visible?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Are emergency lights installed and</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.4 Are there fire/smoke detectors?

2.5 Are there portable firefighting equipment, with service dates?

2.6 Is there an emergency shower in working condition, and an eyewash bottle and first aid box with contents up to date, in close range?

<table>
<thead>
<tr>
<th>3. FUME HOODS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO OF FUME HOODS:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.1 Are the fume hoods in good working condition, with sufficient air flow and sashes movable, not broken, and the alarms working?</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2 Are the fume hoods clean, free of clutter and clamps/reaction manifolds in good condition?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Is there a fume hood dedicated for waste collection/overnight reactions use or specific reactions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.4 Are all condensers fitted with tight-fitting tubes to prevent leaks?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. CHEMICAL STORAGE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4.1 Are chemical bottles intact, with labels and correctly stored according to class/reactivity and compatibility, with enough separation/drip trays?</th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 Are there no chemicals haphazardly located in the laboratory?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Is there an up-to-date chemical inventory, with amounts correlating with what is recorded?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Are MSDSs filed and stored with the chemicals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>Are gas cylinders secured to walls with chains/robust belts to prevent falling, and is every cylinder fitted with the appropriate regulator?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>Are gas lines regularly inspected for leaks and empty cylinders taken to the gas store promptly? How are the cylinders transported to and from the laboratory/facility?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 5. INSTRUMENTS: LIST ALL INSTRUMENTS HERE:

<table>
<thead>
<tr>
<th>INSTRUMENT</th>
<th>ASSET NUMBER</th>
<th>RESPONSIBLE PERSON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 5.1 | Are the instruments in good working condition, each with a maintenance/service book? | Yes | No | Comments |

| 5.2 | Are there Standard Operating Procedures in place? |

| 5.3 | Are the instruments adequately protected from sunlight, drafts and correctly connected to the power supply with no risk of sparks? |
### 6. ELECTRICAL INSTALLATIONS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.1</strong> Are all power supply points in working order and not overloaded?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>6.2</strong> Are there extension cords used in some places, secure and out of the way?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6.3</strong> Are there emergency power points, with only critical equipment attached to them?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6.4</strong> Are fridges for cold chemical storage of the appropriate specifications, chemicals stored in them correctly stored according to class, MSDSs in place and the contents in line with the inventory?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6.5</strong> Are the occupants of the lab/facility aware of where the distribution board is, and which switch to flick in case of an emergency?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7. WASTE DISPOSAL

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.1</strong> Are waste containers clearly labelled according to waste category?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>7.2</strong> Are the containers made of appropriate material resistant to the contents?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7.3</strong> Are the containers in a well-ventilated area, closed and on drip trays?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7.4</strong> Is waste regularly removed by a disposal company and new containers provided?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>7.5</strong> Are there efforts to minimize waste and recycle solvents?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. GENERAL COMMENTS AND RECOMMENDATIONS

Inspection reports must be forwarded to the HOD and Safety Practitioner. Deviations need to be discussed at the safety meetings and action plans formulated and followed up on.

INSPECTION CONDUCTED BY:

1. Name and Surname  
   Signature and Date

2. Name and Surname  
   Signature and Date

3. Name and Surname  
   Signature and Date

Head of Department’s Signature and Date:

ACKNOWLEDGEMENT BY THE LABORATORY/SECTION HEAD OF THE RECEIPT OF THE INSPECTION REPORT AND COMMITMENT TO TAKING CORRECTIVE MEASURES

Signature:  
Date: