



**Trinity College Dublin**

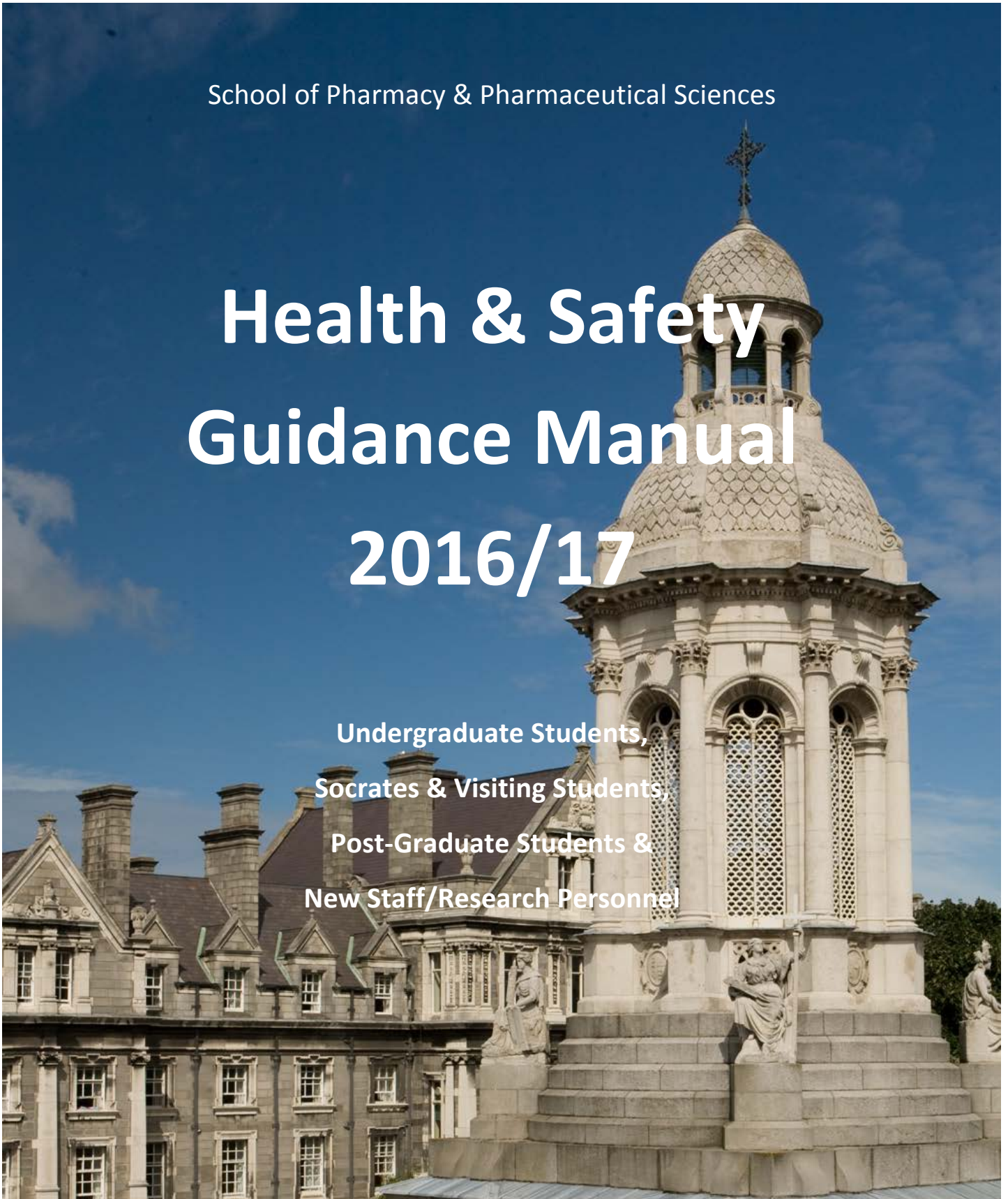
Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

School of Pharmacy & Pharmaceutical Sciences

# Health & Safety Guidance Manual 2016/17

Undergraduate Students,  
Socrates & Visiting Students,  
Post-Graduate Students &  
New Staff/Research Personnel



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# Health & Safety Policy

## 1 Statement of intent and objectives

### 1.1 Statement of Intent

The School recognises and will ensure compliance with the requirements of the Section 20 of the Safety, Health and Welfare at Work Act 2005, associated legislation made under the Act and the College Safety Statement and College Policies and Codes of Practice documents.

All reasonable steps will be taken to ensure that no person's – be it staff, students or others – health, safety and welfare is put at risk by, or as a result of the activities of the School.

Adequate resources will, as far as is reasonably possible, be made available in relation to health, safety and welfare matters.

All affected will receive the necessary, and up to date, information, instruction and training and adequate levels of supervision for them to undertake activities in a safe manner.

Both proactive and reactive approaches towards health, safety and welfare will be taken.

Thorough consultation will take place with staff, Safety Representatives and student representatives on health, safety and welfare in order to ensure the effectiveness of this and the College Safety Statements.

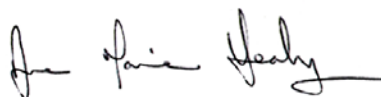
This local Statement will be kept up to date through regular review and, if necessary, revision.

### 1.2 Objectives

By achieving all of the above the School will ensure that it meets its objectives for health, safety and welfare of:

- a) Establishing a safe environment for all;
- b) Establishing and maintaining safe working procedures for staff and students;
- c) Encouraging health and safety as an integral part of work by all staff and students;
- d) Developing and maintaining a safety consciousness and a safety culture in all within the School; and
- e) Conforming to the requirements laid down in the Safety, Health and Welfare at Work Act 2005, any further provisions made under the Act, other applicable legislation and the College Safety Statement, College Policies and Codes of Practice documents.

Signed:  
of School



Professor Anne Marie Healy, Head

Date: 12 September 2016

# ACTION IN THE EVENT OF FIRE

School of Pharmacy & Pharmaceutical  
Sciences

## ON DISCOVERY OF FIRE


RAISE THE ALARM, by breaking the nearest break glass or call point

LEAVE the building using nearest route, closing doors behind you

NOTIFY Building Security at 1999 (PANOZ) 3999 (TBSI)

PANOZ- REPORT to your Assembly Point at 'E'- to the sides of the Science Gallery or to the designated "safe areas in the case of fire" Refuge Point beside the lifts

TBSI-REPORT to your Assembly Point at 'G'- to the sides of the Institute on Cumberland St South and Sandwich Street

 <p>The image shows two signs. The top sign is green with a white wheelchair icon and the text 'Refuge Point'. The bottom sign is blue with a white exclamation mark icon and the text 'Keep clear'.</p>	<p>In the event of a fire alarm the access area for both lifts in the Panoz Institute act as refuge area with emergency communication system.</p>
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## ON HEARING THE FIRE ALARM

LEAVE the building using nearest route, closing doors behind you

REPORT to your assembly point as above

DO NOT TAKE RISKS

DO NOT RETURN to the building for any reason until authorised

DO NOT USE LIFTS, with the exception of wheelchair users who proceed to refuge areas described above.

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## EMERGENCY EXITS

CHECK AND FAMILIARISE yourself with the nearest exit(s) from your building, break glass units and the location of your Assembly Point. KEEP EXIT ROUTES CLEAR at all times

## FIRE EXTINGUISHERS

KEEP ACCESS CLEAR, report any faults and only use if trained to do so

## GOOD HOUSEKEEPING

Keep your area clean, tidy and clutter free. Remove rubbish regularly and report any electrical faults to Building Security at 896-3999

## When You Go To Any Building In College:-

(Lecture theatre, laboratory, library, restaurant, bar etc.)

- Find out how to get out in an emergency.
- Look for the fire safety equipment.
- Know where the nearest alarm call point is.
- Read the hazard information signs – fire, Chemical, biological, radiation, laser etc.

Access Safety information by using the link in the safety area of the Schools website <http://pharmacy.tcd.ie/Safety/>

**Chemical safety** Download smartphone app for iPhone or Android search for Labcup.

Host [tcd.ie.labcup.net](http://tcd.ie/labcup.net)

Login PHA-student

Password pharmacy

**Know the College Emergency Number: Ext. 1999 (01-896 1999 from a mobile phone) for safety and personal security concerns.**

## CONTACTS

Fire Wardens

Panoz Institute:

Technical Officers

TBSI:

Vanesa Martinez

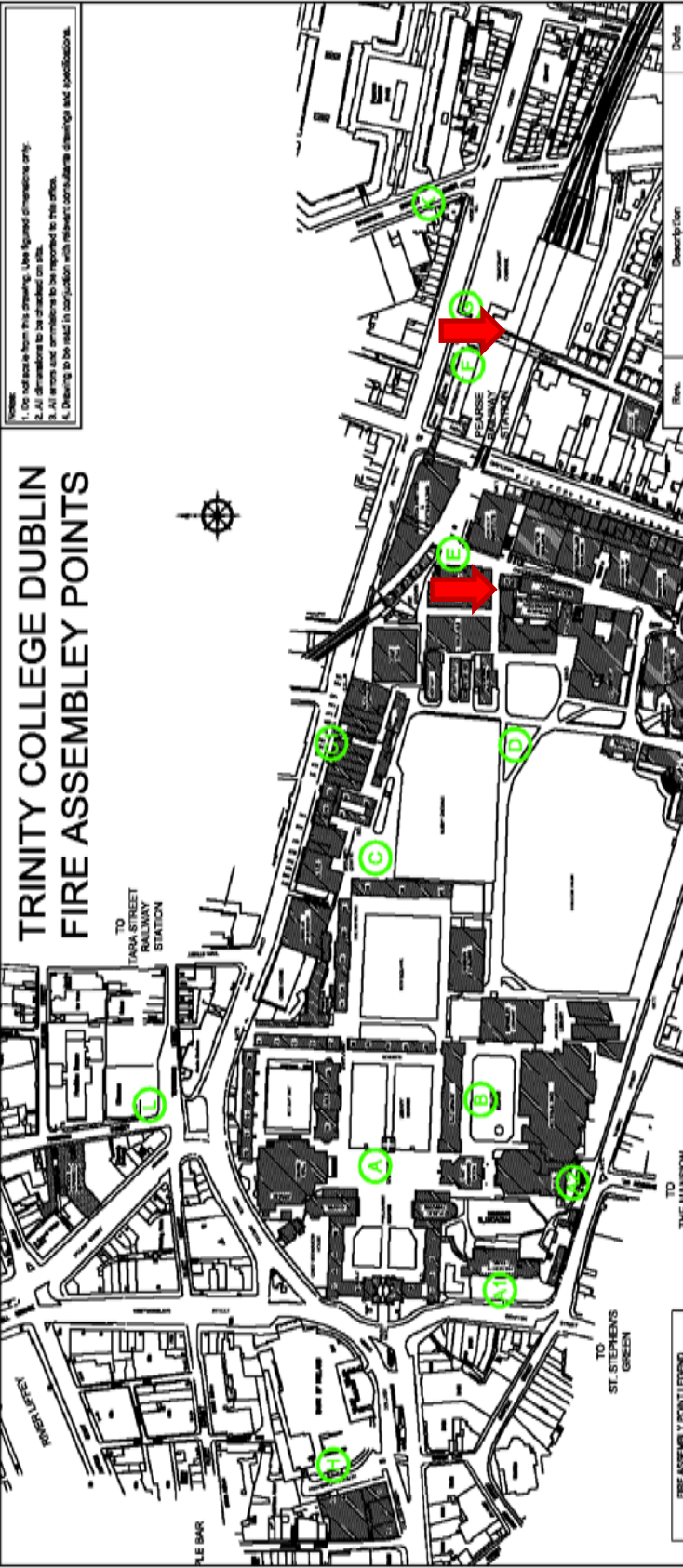
Maria Piggot

Building Security at 1999 (PANOZ) 3999 (TBSI)

College Fire / Safety Officer (Mr. K. Flynn) ext. 3545

# TRINITY COLLEGE DUBLIN FIRE ASSEMBLY POINTS

Notes:  
 1. Do not scale from this drawing. Use figured dimensions only.  
 2. All dimensions to be obtained on site.  
 3. All errors and omissions to be reported to the office.  
 4. Drawing to be read in conjunction with relevant consultants drawings and specifications.



- FIRE ASSEMBLY POINT LEGEND
- (A) THE CAMPUS
  - (B) PROBYN'S HOUSE FORECOURT
  - (C) TRINITY COLLEGE EAST CAMPUS
  - (D) FELLOWS SQUARE
  - (E) THE BUSHY GROUND CAR PARK
  - (F) FERRIS STREET (EXIT GATE)
  - (G) THE PLANT FRENCH
  - (H) BETWEEN LUPKINSELLY AND TRISTAN BOGERS
  - (I) GOLDSMITH HALL COURTYARD
  - (J) 57th CLAMBERLAND STREET CORNER
  - (K) FORESTER PLACE/SCHOOL POSTCODE
  - (L) DANFORTH HOTEL
  - (M) WESTLAND SQUARE (NEAR CAMPUS)
  - (N) BROWNE SQUARE FORECOURT

Director of Buildings' Office  
 West Chapel  
 Trinity College  
 Dublin 2

Phone: (+353) 01 896 2222  
 Fax: (+353) 01 896 3769  
 Web: <http://www.tcd.ie/buildings>  
 Email: [crw@tcd.ie](mailto:crw@tcd.ie)

Project:	Fire Observations 2008
Client/Author:	Trinity College Dublin Main Campus Fire Observations Fire Assembly Points
Scale:	As to Scale
Drawing No.:	506-FO-004
Building Name:	Trinity College Dublin
Sheet No.:	506

CAD File: 311007.dwg  
 Sheet No: 506-FO-004

# School of Pharmacy and Pharmaceutical Sciences

## Health & Safety Guidance Manual

### Introduction

The purpose of this document is to provide foundation information, for new staff and post-graduate students and for all Junior Freshmen and visiting students, taking School of Pharmacy and Pharmaceutical Sciences courses, on how to work safely in laboratories or on field trips in situations which are potentially hazardous.

The guidelines set out must be understood and observed but observation is not enough. You must foster a responsible attitude and remain alert and aware at all times.

**Common sense is your best ally in ensuring both your own and your fellow workers' safety.**

Remember that most, if not all, experiments are potentially hazardous. Therefore, never work unsupervised or alone while performing laboratory or field work. If you are a student, you must always await specific instruction before undertaking experimental or field work of any kind. Specific instructions may be provided by the academic staff supervisor, demonstrator or technician in the laboratory or from your laboratory manual, *etc.*

**In the interests of safety, any student who fails to obey regulations or instructions from academic or technical staff, including demonstrators, may be excluded from the laboratory or field trips as appropriate. College disciplinary procedures may be invoked to deal with student or staff violations of regulations.**



## **Safety, Health & Welfare Information for Students and Staff**

Trinity College is committed to providing a safe and healthy educational, recreational and residential environment for all staff and undergraduate and post-graduate students. This document summarizes the essential information staff and students need to know to achieve and operate within that environment. Please, take a few moments to read this document carefully. Additional advice, rules and regulations will be provided at School/Course level as appropriate. Further information or advice on any aspect of Health & Safety, Fire Safety or Environmental Protection can be obtained from the College Safety Officer at Ext.1914.

Please, do also visit the College Health, Safety & Welfare website (<http://www.tcd.ie/Buildings/Safety/safetyhealthandwelfare.php>) and the Safety Pharmacy website (<http://pharmacy.tcd.ie/Safety/>) for further information

### **Emergency Services**

All emergencies: fire, gas leaks, serious injuries, hazardous chemical spills, and other serious potential hazards must be reported immediately to a member of staff, or in their absence to the Security Centre on Ext. 1999 if using a mobile phone 01-896 1999 (24 hour service).

### **All fire alarms & practice drills must be observed by leaving the building promptly**

All accidents, dangerous occurrences (incidents) and breakages must be reported to a member of staff as soon as possible. All students must be supervised by a member of staff whilst engaged in educational activities. Working alone is not allowed under any circumstances. Study within buildings occupied by members of staff counts as supervision.

There shall be no misuse of any plant or equipment provided. This includes first aid kits, fire extinguishers, fire exits, fire alarm break-glass units or personal protective equipment. Means of escape from buildings (fire doors, corridors and staircases) must never be obstructed or locked shut from the inside. Severe penalties will be imposed if any fire alarm or escape provisions are interfered with.

### **Smoking is not allowed in any College building and there are also designated tobacco free zones in campus**

<https://www.tcd.ie/collegehealth/promotion/smoking/>

## Fire Safety

On hearing the fire alarm bell (a continuous ringing bell) staff and students must:

- (1) Leave the building promptly, closing doors behind them.
- (2) Report to the designated assembly point (see map page 5)

On discovery of any fire staff and students must:

- (1) Raise the fire alarm by breaking the nearest break-glass unit (red wall-mounted call-points)
- (2) Leave the building promptly
- (3) Inform a member of staff or the Security Centre on Ext. 1999 or 01-8961999 (PANOZ) and Ext. 3999 (TBSI) or 01-8963999
- (4) Report to the designated assembly point or to the designated Refuge Points

Any attempt to extinguish the fire should only be made after the alarm has been raised, and only if you have a clear escape route, it is safe to do so, and **if you have been trained in the use of fire extinguishers**. All staff and students are asked to familiarise themselves with the location of relevant break-glass units and all exit routes in their most used buildings.

### Personal Security

There is a risk of theft of personal belongings in the City Centre and in College. Staff and students, therefore, should be alert to this risk. Bicycles should be left locked in visible, secure public areas or in any of the College bicycle parks. Specific security advice can be obtained from:

Head of Security (Chief Steward): Mr. Michael Murray, ext. 2648  
[michael.j.murray@tcd.ie](mailto:michael.j.murray@tcd.ie)

Deputy Head of Security: Mr. Tony Dalton, ext. 1144  
[andalton@tcd.ie](mailto:andalton@tcd.ie)

## **Safety in the School of Pharmacy and Pharmaceutical Sciences**

The nature of the School brings students into contact with potentially hazardous chemicals and equipment. Therefore, Health & Safety rules in these areas are particularly important to maintain a safe working environment. Staff and Students in these areas must:

- (1) Read all School laboratory manuals and/or safety manuals as supplied and visit the Safety Pharmacy website (<http://pharmacy.tcd.ie/Safety/>) and the Pharmacy Labcup Chemical data base, ask supervisor for details.
- (2) Perform all instructions as directed by members of staff
- (3) Not interfere or misuse any plant, equipment, chemicals, or materials supplied
- (4) Wear eye protection at all times when working in a science based laboratory
- (5) Wear laboratory safety coats at all times when working in a laboratory. The coat must conform to the current National Irish Safety Organization (NISO) specification and follow the TCD Laboratory Coat Policy (A 'Howie' type coat with elasticated cuffs and full chest protection).
- (6) Observe all displayed safety rules
- (7) Report all defects in plant, equipment and materials to a member of staff
- (8) Never dispose of any laboratory wastes (chemicals etc.) unless authorized by a member of staff
- (9) Report any symptoms of ill health immediately to a member of staff or the School Safety Officer

## General precautions for work in all laboratories

Cuts and abrasions must be covered by a waterproof dressing; in the case of skin rashes, and such-like, suitable gloves should be used. Long hair should be tied back. Eating, drinking, smoking or applying cosmetics is prohibited. Do not lick envelopes, stamps or your fingers or bite your nails whilst working in the laboratory. Wash your hands after spilling reagents or other materials on them and always, in any case, upon leaving the laboratory.

- **Watch where you are going!**
- **Do not rush** or carry sharp items around the laboratory
- **Do not "act the fool"** in a laboratory. It is a very dangerous practice.

Accidents caused by tripping, slipping and falling are among the most common of all in laboratories. Never rush about: watch for obstructions left lying on the floor.

**Avoid cluttering** benches, floors and walkways with your personal effects - a bag and coat are not permitted in laboratories.

You must **never** conduct an experiment or a step or procedure unless you **know exactly what you are doing** and have received the necessary instruction, advice, equipment, safety devices or personal protective equipment. If in any doubt then you should always ask for advice from your instructor or demonstrator or supervisor. Safeguarding your own or others' safety is mainly a matter of using your knowledge to perform the experiment or steps safely and your imagination to anticipate how and where hazards can arise.

**In the event of a spill and/or a breakage**, a person in charge must be informed immediately, even in the case of the most trivial breakages. This must **always** be done if mercury is spilt, for example, when a thermometer is broken.

## **Accidents and Dangerous Occurrences (Incidents)**

**All accidents and incidents, however trivial, must be reported immediately to the academic staff member in charge or the School Safety Officer and will be recorded on an appropriate form by the Safety Officer in the School or Unit where the event took place (Appendix I).**

In the case of accident or injury, you may need to take some immediate action, on your own behalf or on behalf of someone else. However, you must never place yourself in danger in an attempt to assist an accident victim. Subsequent action is the responsibility of the school staff member present. The staff member will, in the event of an injury, ensure that you obtain first-aid treatment in the school/unit, or at the College Health Centre, ground floor, Houses 47/52 (phone ext. 1556), or ensure that an ambulance is called and that you are referred to the "on-call" accident hospital. You should not be taken to hospital by taxi or in a private car. In the case of referral to the College Health Centre you must be accompanied by a staff member.

A number of staff within the School are trained as first aiders. They are responsible for administering first aid to staff, students and others (visitors, etc.)

**First aiders** at the School of Pharmacy are: Dr. Carlos Medina, Ray Keaveny and Brian Talbot. Should the local first aiders be unavailable then the emergency services can be contacted on Ext. 1999 or 01-8961999 (PANOZ) and Ext. 3999 (TBSI) or 01-89633999.

**SAVE THOSE NUMBERS ON YOUR MOBILE PHONE AS A CONTACT!!**

### **Emergency Services**

**In the event of an incident requiring emergency assistance, the fire/emergency services or medical assistance: Contact the College Security Officer. The Duty College Security Officer can be reached by dialing extension 1999 on all telephones. All requests for Emergency Services must be made through the Duty Security Officer.**

## IMPORTANT CONTACTS

<b>Title/Function</b>	<b>Present Holder</b>	<b>Email</b>	<b>Tel #</b>
<b>Emergency</b>			<b>1999</b>
First Aid Personnel	Dr. Carlos Medina Mr. Brian Talbot Mr. Trevor Woods	<a href="mailto:carlos.medina@tcd.ie">carlos.medina@tcd.ie</a> <a href="mailto:talbotb@tcd.ie">talbotb@tcd.ie</a> <a href="mailto:woodst@tcd.ie">woodst@tcd.ie</a>	2823 2842 2833
Head of School	Dr. Anne Marie Healy	<a href="mailto:healyam@tcd.ie">healyam@tcd.ie</a>	2819
School Chemical Safety Officer	Mr. Ray Keaveny	<a href="mailto:rkeaveny@tcd.ie">rkeaveny@tcd.ie</a>	2814
School Biological Safety Officer	Dr. Maria Santos-Martinez	<a href="mailto:santosmm@tcd.ie">santosmm@tcd.ie</a>	4281
School Radiological Safety Officer	Dr. Andrew Harkin	<a href="mailto:aharkin@tcd.ie">aharkin@tcd.ie</a>	2807
Chief Technical Officer	Mr. Ray Keaveny	<a href="mailto:rkeaveny@tcd.ie">rkeaveny@tcd.ie</a>	2814
Head of Safety & Safety Risk Management	Mr. Tom Merriman	<a href="mailto:tom.merriman@tcd.ie">tom.merriman@tcd.ie</a>	1914
College Specialist Hazardous Chemicals	Dr. Michael Bridge	<a href="mailto:mbridge@tcd.ie">mbridge@tcd.ie</a>	1264
Assistant Safety Officer / Biological Safety	Mr. Frank Mangan	<a href="mailto:frank.mangan@tcd.ie">frank.mangan@tcd.ie</a>	3965
College Specialist Bio-Hazards	Dr Joseph McPartlin	<a href="mailto:joe.mcpartlin@tcd.ie">joe.mcpartlin@tcd.ie</a>	3270
College Specialist Bio-Safety and Genetic Manipulation Officer	Dr. Ronnie Russell	<a href="mailto:rrussell@tcd.ie">rrussell@tcd.ie</a>	1194
Safety Officer / Fire Safety	Mr. Karl Flynn	<a href="mailto:karl.flynn@tcd.ie">karl.flynn@tcd.ie</a>	3545
Safety Officer / Radiological Protection	Ms. Gillian Gunning	<a href="mailto:gillian.gunning@tcd.ie">gillian.gunning@tcd.ie</a>	2887
College Specialist Laser Safety	Mr. Christopher Smith	<a href="mailto:chris.smith@tcd.ie">chris.smith@tcd.ie</a>	3649
Head of Security  (Chief Steward)	Mr. Michael Murray	<a href="mailto:michael.j.murray@tcd.ie">michael.j.murray@tcd.ie</a>	2648
College Health Centre	Dr. David McGrath	<a href="mailto:dmcgrat@tcd.ie">dmcgrat@tcd.ie</a>	1556

An **AED (Automated External Defibrillator)** is available and situated in the ground floor of Panoz Institute beside the stairs.

In an emergency in Panoz Institute, please contact persons trained to use this life-saving equipment immediately:

	Tel.
Assoc. Prof. Neil Frankish	2825
Mr. Trevor Woods	2833
Asst. Prof. Maria Santos	4281
Asst. Prof. Astrid Sasse	2814
Mr. Brian Talbot	2842



## **General College Policy on Health & Safety**

The Board of the College has appointed a College Safety Committee and a College Safety Officer to advise it on general matters of policy relating to safety; to supervise, develop and integrate the College safety system; to foster co-operation with staff and student representatives on safety matters; and to assist in ensuring compliance with health and safety legislation and regulation. Ultimate responsibility for safety in College rests with the Board of the College. A copy of the comprehensive College Safety Statement is available from the College Safety Officer, Director of Buildings Office, West Chapel or on <http://www.tcd.ie/Buildings/Safety/safetystatement.php>.

It is important to note that the College Safety Statement is always in draft format, being a constantly evolving and changing document, however, the basic safety management principles, in general, will remain the same.

More details on Health and Safety Organization and Management in the College and in The School of Pharmacy and Pharmaceutical Sciences can be found on <https://www.tcd.ie/Buildings/Safety/safetystatement.php#Consultation> and in the Appendix II.

### **“You are your own Safety Officer”**

You will become responsible for the safety of yourself and your classmates or work colleagues. This extends to the classes after yours, as you could carelessly leave behind hazards injurious to them, e.g. broken glass, infectious bacteria, toxic and dangerous chemicals etc. Your responsibility is in line with standard practice as you will find it when entering employment. There can be no excuses when you are provided with equipment, training and instructions necessary for the work in hand. You have a legal duty under the Safety, Health and Welfare at Work Act, 2005, to act responsibly so as not to endanger others.



## **Personal Health & Susceptibilities Relevant to Laboratory and Field-Work**

It is up to you to keep yourself fit and healthy while you are in College. Sports facilities and medical facilities are financed from your capitation fees and should be used to best advantage.

If, however, you suffer from any of the following medical conditions:

Colour Blindness	Epilepsy	Asthma
Fainting episodes	Haemophilia	Allergies
Diabetes	Immunodeficiency	Balance Disorders
Skin Diseases	Hearing Disorders	Visual Impairment

and/or you know that you are pregnant then you should:

- (1) Inform your own doctor that you are working in laboratory or undertaking a laboratory-based course or field work;
- (2) Inform your tutor (students only);
- (3) Complete the "Basic Health Assessment for Field or Laboratory work" Questionnaire (Declaration B);
- (4) Make an early appointment to consult with the College Health Centre (House No. 47, Tel: 01-8961556).

They will advise you of any risks involved and may make certain recommendations to you to ensure that you are not placed in potentially hazardous situations. Arising from this assessment you may need to be closely supervised.

If you should become pregnant at any stage in your career in College, then you will need to consult with the College Health Centre and inform your local safety officer(s) as soon as pregnancy has been confirmed.

### **Illness**

If you feel unwell during a class or in your workplace then inform the academic staff member in charge of the class or your supervisor. If you feel unwell after the class or your work is over and you seek medical advice, then be sure to mention that you have been working in a laboratory. Your doctor needs to know this so that he or she can arrive at a proper diagnosis.

### **Field Courses & Fieldwork**

The planning and supervision of off-site educational activities should be carefully planned prior to the event. A formal written risk assessment must be carried out in advance and recorded. Students must follow all instructions issued by members of the School of Pharmacy and Pharmaceutical Sciences.

## Precautions specific to certain types of laboratories

### Teaching Laboratories

**You must always wear a suitable laboratory coat.** Students will not be allowed to attend a practical if they do not have a laboratory coat. The laboratory coat must be worn closed and should cover clothing and be knee length. No Hoodies (with the hood hanging out the back of the neck of the coat) or other bulky clothing items are permitted (as they can restrict movement and prevent full closure of lab coat).

If your laboratory coat has an acid spill or microbial contamination, it is best removed from behind by a 'buddy' and turned inside out in the process.

**Safety spectacles** must be worn in all chemistry laboratories. You must carry on your person a pair of safety spectacles whilst you are in any laboratory and you must wear **eye protection** at all times when anything is being heated or shaken either at your bench or at adjacent ones, and in addition when instructed to do so (e.g. when handling irritant or toxic reagents). If you wear spectacles already, you are recommended to use goggles of the "Pulsafe" kind which go over ordinary spectacles. Wearing contact lenses may constitute an additional hazard.

Gloves must be worn when handling wet biological materials. When gloves are required for handling hazardous chemicals, they must be compatible with the intended use.

Shoes should have non-slip soles, and should cover the feet. Open toed sandals, flip-flops, high heels, ballet-style, crocs and canvas shoes/runners are not allowed.

Long hair **MUST** be properly tied back and adequately restrained.

No loose hanging jewelry is permitted in the lab.

Almost all **chemicals are hazardous** if used improperly, but some are especially so. Very hazardous chemicals include: concentrated acids, volatile organic liquids, carcinogens.

Read the **Hazard Warning Symbols** and **Risk and Safety Phrases** information where provided on stock reagent bottles or containers. Obey special handling instructions printed on each bottle or container (see Appendix IV). Safety Data Sheets (SDS) are available, from suppliers or compendiums, for all hazardous chemicals.

## **Use of pipettes and other glass apparatus**

Cuts and lacerations from broken glass comprise the most frequent injury received whilst working in laboratories.

Handle glass Pasteur pipettes with care - they are fragile and dangerous and must be disposed of only into "Sharps" containers or glass boxes. Plastic Pasteur pipettes should be used whenever possible.

The use of pipette aids/fillers/pumps is an acknowledged safety practice to avoid mouth contact with chemicals and biological materials. However, when a glass pipette is being inserted into a pipette filler, the pipette may break resulting in laceration to the hands of the operator. Hold the pipette close to the top when attaching the bulb. Do not force it on if it doesn't want to go on - use another pipette or another pipette filler.

## **Heating liquids in a test tube**

This is often the cause of accidents. Before starting the procedure, warn colleagues about the hazard. Eye protection must be worn. Hold the test tube in a wooden "clothes peg" type holder; do not use a metal crucible tongs. A piece of paper folded over several times may also be used. Heat the tube gently without shaking and point it away from yourself and others. Heating sodium hydroxide solution is especially difficult as it tends to bump suddenly. It is wiser to use a boiling chip to prevent such problems.

## **Acid on the skin**

Concentrated sulphuric acid - wipe off the bulk of the acid with a cloth and then wash off the acid with a large volume of water from the tap. Other acids or alkalis may be washed off directly.

## **Irritant material in the eye**

The injured person should bend forward with the head tilted so that the injured eye is at a lower level. Water from the eye bath is then squirted into the injured eye. Try to persuade the person being treated to open his/her injured eye (SEVERE PAIN MAY PREVENT THIS). Call the College Emergency number 1999 or 01-8961999 if using a mobile and request an ambulance service to transport the victim to hospital for evaluation and further treatment.

## **Chemical substance in the mouth**

Wash out the mouth with large quantities of water. Immediately inform the staff member in charge.

## **Cryogenic liquids:**

All individuals using cryogenics should be trained and attend the College course: "Safe Handling of Cryogenics such as Liquid Nitrogen"

Cryogens present many hazards and failure to follow safety procedures could result in physical injury and even death!

- Ultra cold temperatures leading to serious burns to the skin and eyes
- Flammability/oxygen enrichment. Fire and explosion are hazards associated with cryogenics. Keep all organic materials and other flammable substances away from contact with cryogenics.
- High pressure gas, resulting in over-pressurization of containers and transfer hoses
- Ice plug formation in vessels/systems
- Displacement of oxygen/asphyxiation (liquid nitrogen)

#### Try to avoid cryogenic burns

Ensure all containers are secured when filling. Do not overfill containers. Never make direct contact with cryogenic liquids. Wear suitable personnel protective equipment when handling any object. Transfer or pour cryogenics slowly.

### **Research Laboratories – Appendix III; Appendix IV and Pharmacy Safety Guideline Summary at <http://pharmacy.tcd.ie/Safety/>**

#### **Chemicals:**

An audit of hazardous chemicals must be carried out and documented for each laboratory. This will require that researchers compile a spreadsheet listing all chemicals used in the laboratory. This listing is required by the HSA to be kept in a central location for use by the emergency services if necessary. This information is available in the Pharmacy Labcup Chemical data base, ask supervisor for details.

#### **Safety Data Sheets:**

A common file of SDS for all new chemicals should be created in each laboratory. SDS for all solvents and any particularly hazardous chemicals should be downloaded and included in a common file. SDS can be obtained from: the Pharmacy Labcup Chemical data base, ask supervisor for details. The SDS information supplied with each new chemical delivered should be included in this file.

#### **Risk assessment:**

Identify common hazardous laboratory procedures, i.e. hydrogenation, reflux, distillation, etc. Produce a risk assessment for each procedure and create a common file in each laboratory for the risk assessments of these common procedures i.e. RA 1-distillation. RA 2 –Hydrogenation etc. To avoid duplication researchers in all laboratories should get together to identify the common hazardous procedures. For all *new chemical procedures*, each researcher is required to complete a detailed risk assessment checklist as outlined on the Risk Assessment Form (see Appendix III).

## General precautions for work in laboratories

### Laboratory Wastes

#### Waste solvent:

The Waste Solvent Store opening hours are the same as the solvent store: Monday-Wednesday-Friday 9.30-10.00am, East End 4/5, Fourth Floor and 11.00-11.30am, TBSI, B2.62

- **Chlorinated** and **Non-chlorinated** solvent waste may be deposited during these times without prior arrangement.
- All Solvent wastes must be transported in an **approved safe carrying can**. These are available for purchase from the facility.
- It is important that the solvent cans are **not overfilled** and the **Flame Arrestor** in each can must be regularly checked for integrity.

#### "Sharp" waste:

Sharp waste must be contained in rigid UN yellow boxes and bins. Sharp waste includes:

- Contaminated glass
- Used Needles/ Syringes
- Scalpel Blades
- Broken instruments which are sharp
- Soft waste **should not** be deposited into **Sharps Bins**.
- Once waste receptacles are filled, they can be presented to the facility for disposal, and a replacement obtained.

#### Waste silica:

- Waste silica should be disposed of in a plastic container with a screw cap.
- The container may not be more than 2 l capacity.
- When 75% full the silica should be carefully wetted, the lid sealed, and disposed of in the compactor.
- Not more than one full container in each laboratory.
- Disposal (weekly) of the waste silica will be checked.

#### Cytotoxic waste:

- Containers with cytotoxic waste should be disposed of in a cytotoxic waste box (rigid yellow boxes with **purple lid**).
- Such containers should not be allowed to accumulate

### **Liquid clinical waste:**

- Containers with blood, plasma etc. should be disposed of in a clinical waste box (rigid yellow boxes with **yellow lid**)
- Such containers should not be allowed to accumulate
- A clinical waste box is available in the teaching laboratory
- A new box should be obtained from the hazardous waste facility, if large volumes are used.
- High level surface disinfectant for glassware or equipment is available from the technical staff.

### **Contaminated "soft" waste:**

Clinically contaminated "soft" waste must be contained in **UN Clinical Waste Bags**. Soft waste includes:

- Soft fabric
- Gloves Clinical wipes
- Contaminated dressings
- Disposable garb

The Biohazard Waste Store opening hours are Monday-Wednesday-Friday 12.00-12.30, TBSI B2.05 and 14.30-15.00, 4th Floor East End 4/5

### **Broken glass:**

- Un-Contaminated glass waste must be placed in a designated receptacle.
- When full the glass must be placed in a strong cardboard box, which is sealed and disposed of in the compactor.
- Contaminated glass waste (i.e. containing hazardous residues) must be classified according to its prior contents, before packing and disposal. For details please contact the hazardous waste facility.

### **Other waste:**

- Hard plastic pipette tips and Eppendorf vials and cuttings from Silica plates and gloves are disposed of in a separate box.
- It is important that the box is not overfilled.
- When full the boxes are sealed and placed in the compactor.

## Each laboratory should have available

- A 7.5l chlorinated solvent carrying can and a 7.5l Non -chlorinated solvent carrying can.



- A UN rigid UN yellow Box.



- A UN Clinical Waste Bag.



- A designated box for gloves, hard plastic pipette tips and Eppendorf vials and cuttings from Silica plates
- A designated box for broken glassware
- A plastic container with a screw cap for waste silica

## Use of General Safety Equipment

### Pipette Fillers

**Mouth pipetting is banned.** When pushing a pipette into a pipette filler, always hold the pipette and the pipette filler as close to the point of junction as possible. Use a cloth to hold the pipette (unless otherwise instructed). Push the pipette in gently; do not screw it in. Failure to observe proper precautions may lead to serious injury if the pipette snaps and broken glass is rammed into your hands.

### Fume Cupboards

Containers found in a fume cupboard must not be removed from it unless this is specifically indicated. Any operations which give off harmful gas, aerosol or vapour must be performed there. Make sure that the fan is on and that the front window of the fume cupboard is no higher than chest level (50 cm maximum opening). Avoid sudden movements of your hands within the cupboard and of your body outside the cupboard (turbulence must be avoided). The work base of the unit must not be cluttered; otherwise the airflow will not scavenge the toxic vapours.

### Use of Personal Protective Equipment (PPE)

You may have to use additional safety equipment such as disposable gloves, face-shields, remote handling devices, screens, (to protect against implosion of glassware used in vacuum work) respirators, disposable aprons and overshoes *etc.*, Your instructors, demonstrators or supervisors plus your practical manual (or other protocols) must be consulted as appropriate.



## Common Hazards in Laboratories

The list of potential hazards that may be present in laboratories is too extensive to print in this manual but fire and electrical hazards are present in all laboratories.

### Fire

Smoking is prohibited in all College buildings. Always be conscious of the need to prevent a fire from occurring. Keep flammable solvents away from sources of heat and ignition. Switch electrical equipment off at the socket after use. Be particularly careful not to leave bench lamps or microscope lamps on in close contact with the bench surface - this can lead to scorching and hence to fire. Study the notices which are posted telling you what to do in the event of fire. **Make a note of the location of emergency exits so that if a fire breaks out you know how to get out!**

Be especially careful when handling highly flammable solvents such as diethyl ether, acetone, petroleum ether, *etc.* Use only the minimum quantity at the bench and keep the stock container closed when not in use.

Sources of ignition include gas geyser pilot-lights, thermostats on water baths, switches arcing, plug-tops arcing on removal from socket, static discharge from synthetic fibre clothing as well as naked flames from Bunsen burners. Natural gas burns with a silent and colourless flame so that you may not be aware that a Bunsen burner is lit. Remember that a fully aerated Bunsen flame is invisible in sunlight. Watch out that you do not set fire to your clothing if you come too close to the burner. Matches and/or tapers should not be used to light Bunsens - use a gas lighter so that a smouldering match lying in a waste bin does not subsequently start a fire. Do not have round-flasks on a bench or shelf exposed to sunlight - the flask may act as a lens and lead to a fire starting on wood or paper in close proximity.

### If a Fire Starts - Take the Following Action

- **In a test tube** – know in advance how to extinguish an experiment based on the chemicals in use. Remove test tube from the heat source if appropriate. Remove oxygen by covering with a suitable cover, pyrex dish.
- **In a beaker** - cover as above. Do **NOT** use water or an extinguisher unless the fire extends beyond the vessel (DANGER OF KNOCKING OVER VESSEL). You may use sand from fire-buckets if provided.
- **On the bench or floor** - get the nearest **fire blanket** and cover the fire to exclude air. Do **NOT** use water.
- **On somebody's clothing** - push the person onto the ground and smother flames with a **fire blanket**. If your own clothes catch fire, roll from side to side on the ground until someone helps you.

**Note the location (and method of operation) of fire blankets and fire extinguishers - choice of correct appliance is vital. Do not use fire extinguishers unless you have been trained in their use.**

## **Electricity**

Most of the equipment you will be using operates off 220 volts, 50 Hz a.c. mains supply. Some of the equipment you will operate may be high-voltage apparatus.

You will need to be vigilant in your use of electricity. Disconnect portable equipment from the supply point whilst making changes in so far as is practicable. Do not override safety interlocks designed to protect you from shock.

Get into the habit of approaching electric apparatus, especially new or unfamiliar equipment, in a tentative manner before firmly grasping it or holding onto it. It is better to brush the back of your hand against the piece of equipment rather than to grasp it. If it is "live" then your hand will be repelled and you may only receive a relatively mild shock.

### **Take the following action in the event of Electric Shock:**

- **Cut off power to the apparatus** either locally by means of a socket switch or plug

**OR**

- **Push or pull the victim away from the apparatus** by means of an insulated piece of furniture - plastic chair, wooden stool etc.,
- **Apply immediate resuscitation procedures** to the victim if he/she is unconscious and **obtain medical assistance**. At the very least, **place the victim in the recovery (safe-airway) position** to maintain an airway

## Emergency Evacuation of Laboratories, Lecture Theatres and Buildings

Emergency evacuation of a laboratory and building may be signalled by Alarm Bell; Public Address System or in Person by Instructor/Demonstrators

### NOTE

- 1 the **escape routes** from your laboratory, lecture theatre;
- 2 the **number and location of the exits** from the ground floor; and
- 3 the **route to** and the **location** of the assembly point or the designated “safe areas in the case of fire”

### Upon hearing Alarm Alert for fire, bomb, or escape of toxic gas etc.....

- 1 **Collect** the minimum of your personal effects which lie within easy reach but do not waste time or endanger yourself.
- 2 **Walk** via the nearest escape route to an exit door. Do not rush, push or shove past others.
- 3 **Do not stand around outside building** (danger of glass, shrapnel and blocking the egress of others *etc.*) - walk to the **assembly point** assigned to the particular building: map in page 5

ASSEMBLY Point **PANOZ: ‘E’**- to the sides of the Science Gallery or to the designated **Refuge Point** beside the lifts.

ASSEMBLY Point **TBSI: ‘G’**- to the sides of the Institute on Cumberland St South and Sandwich Street.

- 4 **Attend** for roll call by forming a class or Laboratory or Unit affinity group (your Lab. Bench Group) along with your instructor and demonstrators or colleagues. Account for absent or missing persons to your instructor or the Safety Officer.

Safety Officers and Fire Wardens for each School or building have been appointed. Follow their directions in the event of a fire or other emergency evacuation procedure.

**Appendix I**

**ACCIDENT/INCIDENT REPORT FORM**

This form must be completed by the School/Department Head, Chief Technician, or Departmental Safety Officer as soon as possible after any accident has occurred. This is a requirement under the College's Employer & Public Liability policies. In the case of staff injuries, the original form should be retained by the Department, and copies sent to (1) Departmental Safety Officer, (2) Mr. T. Merriman, West Chapel (Secretary to the College Safety Committee), and (3) Ms P. Gray, West Chapel (for insurance purposes).

**Name:** ..... **Staff**  **Student**  **Other**

**Department:** .....

**Job Title:** ..... **Hours of Work:** .....

**Date & Time of Alleged Accident:** .....

**Place/Building Name:** .....

**Grade of Accident:**                      **Minor**       **Moderate**       **Severe**

**Brief Particulars:** .....

(Continue overleaf if necessary)

**Nature of Injury:** .....

(If to limb or eye, state whether left or right) .....

**What action was taken to treat**  
**Or minimize injury or damage?** .....

In cases of moderate or severe accidents please state the names & addresses of any witnesses:

(1) .....

(2) .....

**Are you satisfied that an accident occurred**  
At the time, date and place stated? Yes  No

Was the person authorized to be in that place  
at that time for the purpose of his/her work? Yes  No

What was the person doing at the time of the accident? .....

**Was this something authorized or permitted to be**  
Done for the purpose of his/her work? Yes  No

To whom was the accident reported? .....

When was it first reported? .....

Signed: ..... Date: .....

\*Minor = Onsite treatment; Moderate = First aid and referred for medical attention; Severe = Ambulance called.

Print Name: .....

## Appendix II

### Health and Safety Organisation and Management in the College and The School of Pharmacy and Pharmaceutical Sciences

The Board of the College determines overall policy on Health and Safety matters through the College Safety Committee and the College Safety Officer (Mr. Tom Merriman, West Chapel, Ext. 1914). But at local level the organisation and management is coordinated by each Faculty through its own Safety Committee and the Faculty Safety Representative and performed at School level by the Head of School and the School Safety Officers.

The Board and each School, unit or area publish a 'Safety Statement' under the terms of 'The Safety, Health and Welfare at Work Act, 2005'. **In the case of staff the appropriate local safety statements should be read in conjunction with this Faculty Health and Safety Guidance Manual** because together they form the basis of the general 'Safety Statement' of this Faculty. Their scope is extended further by reference to individual schools/unit safety advice contained in various regulations, codes of practice, advice notes, briefing sessions, workshops, personal instruction *etc.*, which you may be issued with during the course of this or subsequent years in College.

#### Legal Framework for Health and Safety Matters

The legal general framework for health and safety matters in Ireland is provided by The Safety, Health and Welfare at Work Act, 2005, and a range of S.I.<sup>s</sup>, but note that other specific statutes and regulations have force in the control and regulation of certain hazards and activities (e.g. explosives, drugs, ionizing radiation, *etc.*).

#### Mandatory Health and Safety Introductory Briefing Sessions

All **new entrants** will be given mandatory introductory talks on health and safety practices relating to particular Practical Classes. Additional instruction will be given during laboratory sessions early in the term. Take these seriously and learn to develop an attitude of vigilance and hazard awareness when working in laboratories or on field work. If for any reason you miss these sessions, contact the relevant School Safety Officer.

**New Postgraduate students** will receive health and safety briefings and the H&S declaration forms from their Supervisors. Please, visit the Safety Pharmacy website (<http://pharmacy.tcd.ie/Safety/> for more information). They must be registered with the School prior commencing any lab work.

#### Staff Safety Representatives

A Staff Safety Representative has been elected to look after the interests of all personnel (not students) who work in the Faculty as provided under the 2005 Act. You should feel free to consult with the Safety Representative (see page 5) about any safety concerns.

## Appendix III

### UNIVERSITY OF DUBLIN

### TRINITY COLLEGE

#### School Of Pharmacy and Pharmaceutical Sciences

#### Safety Information for Postgraduate Students

The Management of Health & Safety at Work Regulations and other Regulations as well, require us to "suitably and sufficiently assess the risks to the health and safety of employees to which they are exposed whilst they are at work". This means that we must make "risk assessments" for every work activity carried out by, in particular, students and other researchers (Section 19 of the Safety, Health and Welfare at Work Act 2005). For more information, see <http://www.tcd.ie/Buildings/Safety/safetystatement.php>.

#### Hazards and Risks

Hazard" and "risk" are words which are synonymous in common use but in the technical jargon of Safety Management have different meanings:- the hazard presented by a substance or activity is its potential to do harm (rock-climbing is a hazardous activity) and risk from a substance or activity is the likelihood that it will cause harm in the circumstances of actual use or that the hazard will be realised (rock-climbing may be of low risk if the proper equipment is used and the rules are followed).

The aim of making a "risk assessment" is to identify the hazards associated with an activity, to assess the seriousness of these hazards and to formulate systems of work, training or other methods (controls) to reduce the associated risks to a minimum or at least to an acceptable level. This procedure has to be carried out by someone who is experienced and fully familiar with the activity *i.e.* a "competent person".

#### The Risk Assessment Procedure

##### We are required to:-

1. Identify **hazards** associated with activities or situations,
2. Somehow or other quantify the **associated risk**,  
(How likely is that any hazard will be realised? How severe will the consequences be? How often does exposure to the hazard occur?)
3. Identify **who** is at risk,
4. Identify the **control measures** to be used to reduce the risk to a "reasonable" level,

5. Quantify the **residual risk**.
6. **And then:**

### **Record the assessment. Implement the control measures**

#### **The following practice should be adopted for Risk Assessments:**

- **Identify:** i.e. which activity is to be assessed? Has it been done before or can it be broken down into tasks that have already been assessed? If there is no existing Risk Assessment, you will have to do it yourself.
- **Carry out the procedures 1), 2) and 3) above i.e. identify the hazards, quantify the risks and identify who is at risk.** This is where you have to put in the work, reading around the subject and so on. The conclusions here may be subjective but you must be clear about the person or persons you are considering and their likely level of ability or competence. There is a possibility of using sliding scales of likelihood for the hazard being realised (unlikely, likely, very likely, certain) and for the severity of any injury (slight (Elastoplast), moderate (stitches), severe (hospitalisation), death) and frequency of exposure.
- **Formulate control measures.** These will include:-
  - physical or engineering controls (e.g. sturdy, custom built trolleys for moving gas cylinders, the provision of fixed racks for cylinders when they are in use) and this will allow you to spot any possible deficiencies in the physical provisions of laboratories,
  - protective equipment to be worn (e.g. safety glasses, lab. coats),
  - procedures to be followed (e.g. solvent bottles to be transported in proper carriers) and
  - any training that is required.
- **Attempt to Quantify the Residual Risk.** The Risk Category classification suggested in the CVCP Note of Guidance on "Health and Safety Responsibilities towards Postgraduate and Undergraduate Students".  
([http://www.tcd.ie/Buildings/Safety/biosafety\\_website/PDF/Hazard%20identification%20and%20risk%20assessment.pdf](http://www.tcd.ie/Buildings/Safety/biosafety_website/PDF/Hazard%20identification%20and%20risk%20assessment.pdf))
- This process of categorisation is not simple. It calls on our own expertise and experience, our knowledge of the abilities of our students and our knowledge of how far any reasonable control measures to be used are going to be effective and it decides who gets to do what.



- **A:** Those in which work may not be undertaken without close senior supervision, i.e. the Adviser must be present e.g. use of conc. HF. Tasks in this category would never be assigned to Undergraduates.
- **B:** These are tasks which must never be started without the Supervisor's advice and specific approval. Subdivide this:
  - **Bp:** i.e. relevant to Postgraduates, e.g. work with cyanides, and
  - **Bu:** i.e. relevant to Undergraduates e.g. use of flammable, explosive or toxic gases.
- **C:** These are tasks which carry some risks (other than A or B) where care must be observed but it is considered that workers can be trained, to be competent in the procedures involved. E.g. transport and use of compressed gas cylinders, use of liquid nitrogen and other cryogenics. Tasks in this category form a large part of the "background" of daily business and fall outside of category D.
- **D:** General Laboratory Practice. This includes all tasks and procedures covered in Undergraduate Teaching Laboratory and in which all persons due to carry out research work are reasonably expected to be competent. This would include the use of glassware, concentrated acids and bases, some heating equipment etc. Existing Assessments cover most of these activities.
- **E:** Those tasks that, even without training, carry minimal risk e.g. projects in theoretical chemistry. **No written risk assessment is required for these tasks.**  
**Err on the conservative side.**
- **Write all this down.** This is a legal requirement but more than that. Performing a Risk Assessment is not simply an end in itself. Rather it is a tool to help us to protect the health and well-being of our students and workers. As such, what is written down in the Risk Assessment document should be included as part of the training. The document should be fully available to, in fact required reading for, researchers to enable them to realise the hazards associated with the tasks they are to perform and to see what must be done or what they must do to protect themselves. The Risk Assessment document should be as full as possible and include within it a description of recommended operating procedures, if relevant, action to be taken in an emergency and any suitable references. So in fact this recording becomes part of the next stage.

- **Implement the Control Measures.** E.g. provide the trolleys and racks and carry out the training including reading the full text of the Risk Assessment.
- **Finally.** If you think that the Assessment you have just made will be of use to others, make it available and have it included in the School of Pharmacy list of risk Assessments.

**Note that it remains the responsibility of individual Supervisors/Advisers to check the correctness and appropriateness of these risk assessments especially with regard to the level of skill and competence of the researcher.**

**School of Pharmacy and Pharmaceutical Sciences**

**Trinity College Dublin**

**General Project Risk Assessment**

**Project  
reference:**

**This form should be completed by the Research Supervisor initiating the project. The assessment is normally valid for the length of the project but must be reviewed annually and supplemented whenever there is a significant change in the nature of the work to be performed.**

**Name of the Research Supervisor**

**Name of the Research  
Worker\***

**Lab. No.**

**\*Status: Undergraduate, New Postgraduate, Postgraduate, Postdoctoral or Visitor (highlight as appropriate).**

**Project Title:**

Give a brief description of the work to be undertaken including the nature of materials and techniques to be used. Is a Standard or a Special COSHH Assessment required?

--

**Special Hazards:**

Indicate any **special** hazards associated with the work e.g. from use of biological material especially any of human origin, from use of Category 1 or Category 2 carcinogens (whose **use must be justified**), from use of material of high toxicity or hazardous instability or from any other physical or chemical source.

If any such hazards are expected, indicate which safety resources within the School of Chemistry are to be used to deal with these hazards.

If no such safety resources exist within the School of Chemistry indicate how the expected hazards are to be dealt with.

If no special hazards are anticipated write "none" in the box below.

**Date**..... **Review Due**

**Date**.....

## Appendix IV

### Hazard symbols

### Risk & Safety Phrases

Classification, Labelling and packaging (CLP) under is set of criteria and rules used to determine if a chemical can cause harm to human health and the environment and involve the identification and evaluation of the physical properties of the chemical, along with its health and environmental effects and communication of those hazards on a label. The label is the first and often the only information on the hazards of a chemical that reaches the user, which could be a consumer or a worker.

**Under the EU CLP regulation the following changes are taking place to the label:**

- 1. Hazard (H) statements replace risk (R) phrases**
- 2. Precautionary (P) statements replace safety (S) phrases**
- 3. Hazard pictograms replace danger symbols**

## Chemical Hazards

### Flammable Hazards



**Old**      *Extremely Flammable F+*  
*Highly Flammable F*



**New**      *Flammable Liquids 1.2*  
*Flammable Liquids 3*

The most common fire hazard in the laboratory is a flammable liquid or the vapour produced from such a liquid. For a fire to occur requires:

- an oxidising atmosphere (usually air),
- flammable gas or vapour at a concentration within the flammability limits of the substance and
- a source of ignition.

Under normal circumstances, oxygen or air will always be present and the best way to prevent a fire is to keep the vapour or gas away from sources of ignition. Some specific properties of flammable materials are:-

**Flash Point.** The flash point is the lowest temperature at which a liquid has a sufficient vapour pressure to form an ignitable mixture with air near the surface of the liquid. Many common organic liquids have flash points below room temperature e.g. acetone (-18° C) or diethyl ether (-45° C).

A Flammable Liquid is one with a flash point of less than 55°C, a Highly Flammable Liquid is one with a flash point of less than 21°C (a Highly Flammable solid is one which is spontaneously combustible in air at ambient temperature or one which readily ignites after brief contact with a flame or one which evolves highly flammable gases in contact with water or moist air) and an Extremely Flammable Liquid is one with a flash point less than 0°C and a boiling point of 35°C or less.

**Ignition Temperature:** The ignition (sometimes called auto-ignition) temperature of a substance is the minimum temperature required to initiate or to cause self-sustained combustion independent of the heat source. A spark or flame is not necessary for ignition when a flammable vapour reaches its auto-ignition temperature. For diethyl ether this is 160° C and the material can be ignited by a hot plate.

**Lower and Upper Explosive Limits:** These limits define the range of concentrations in mixtures with air (or oxygen depending on definition) that will propagate a flame and cause an explosion. The lower values of these limits are normally well above levels legally allowed as ambient in laboratories and workplaces but can easily be exceeded following a spill.

**Sources of Ignition:** The most common sources of ignition in the laboratory are flames and heating elements but there are a number of less obvious electrical sources such as refrigerators, heat-guns, stirrers etc. It also must be remembered that vapours from a flammable liquid may be more dense than air and may spread over bench and floor surfaces to sources of ignition which are apparently remote.

**Flammable Gases:** Leakage or escape of flammable gases can produce a serious explosive hazard in a laboratory. Acetylene, hydrogen, ammonia, hydrogen sulphide, propane and carbon monoxide are especially dangerous. Hydrogen leaking from a high-pressure cylinder can ignite spontaneously and the resulting flame can be almost invisible and so extremely dangerous.

**Pyrophoric materials:** Pyrophoric materials are those that ignite spontaneously in air below, about 45 deg.C. Consequently the main hazards arising from the use of such materials involve fire, either from direct contact with the pyrophoric material or as a result of secondary fires following ignition. The most commonly used materials are alkyl lithiums, trialkylaluminium reagents and alkylboranes. t-BuLi is the most pyrophoric of the Li reagents but n-BuLi is also pyrophoric as a concentrated solution i.e.~ 10M. These reagents are supplied in solution, in alkane, arene or ether solvents, the pyrophoric hazard increasing with concentration.

**Spontaneous Combustion:** Some materials are prone to inflame spontaneously with no source of ignition. Normally this is the result of exothermic autoxidation within a large mass where heat cannot escape.

**Reference:** Extensive lists of flammable materials and their properties can be found in "Hazardous Chemicals Handbook" by P.A. Carson and C.J. Mumford, Butterworth-Heinemann Ltd., 1994.

### Reactive Hazards



**Old Oxidising O**



**New Oxidising Liquids 1.2**  
**Oxidising Liquids 3**

**Oxidising Agents:** Oxidizing agents are chemicals that bring about an oxidation reaction. The oxidizing agent may provide oxygen to the substance being oxidized (in which case the agent has to be oxygen or contain oxygen) or receive electrons being transferred from the substance undergoing oxidation (chlorine is a good oxidizing agent for electron-transfer purposes, even though it does not contain oxygen). The intensity of the oxidation reaction depends on the oxidizing-reducing potential of the material involved. Fire or explosion is possible when strong oxidizing agents come into contact with easily oxidizable compounds, such as metals, metal hydrides or organics. Because oxidizing agents possess varying degrees of instability, they can be explosively unpredictable.

### Examples of Oxidizing Agents

Gases	Fluorine, chlorine, ozone, nitrous oxide, oxygen
Liquids	Hydrogen peroxide, nitric acid, perchloric acid, bromine, sulphuric acid
Solids	Nitrites, nitrates, perchlorates, chromates, dichromates, picrates, permanganates, hypochlorites, bromates, iodates, chlorites, chlorates, persulphates.



Old explosive E



New Explosives 1.1 – 1.3

Explosives 1.4

## Explosives

Explosives cause sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden adverse conditions. Heat, light, mechanical shock, detonation, and certain catalysts can initiate explosive reactions. Compounds containing the functional groups azide, acetylide, diazo, nitroso, haloamine, peroxide, and ozonide are sensitive to shock and heat and can explode violently. Full lists of explosive atomic groupings and potentially explosive compounds are given in "Hazardous Chemicals Handbook" by P.A. Carson and C.J. Mumford, Butterworth-Heinemann Ltd., 1994.

**Peroxide Forming Compounds:** Generally, organic peroxides are low-powered explosives that are sensitive to shock, sparks, and heat. Some organic compounds such as ethers, tetrahydrofuran, and dioxan can react with oxygen from the air forming unstable peroxides. Peroxide formation can occur slowly under normal storage conditions -limited access to air and exposure to light. These accumulated peroxides can violently explode when exposed to shock, friction, or heat especially when concentrated and heated by distillation. Bretherick ("Hazards in the Chemistry Laboratory") points out the particular danger from peroxide formation by di-isopropyl ether.

**Water Reactive Compounds:** These compounds react with water or moisture in the air releasing heat or flammable, toxic gas. Examples include alkali metals, alkaline earth metals, carbides, hydrides, inorganic chlorides, nitrides, peroxides, and phosphides. Lists are included in "Hazardous Chemicals Handbook" by P.A. Carson and C.J. Mumford, Butterworth-Heinemann Ltd., 1994.

**Toxic Hazards from Mixtures:** Toxic gases may be evolved following the mixture of some chemicals e.g.

Chemical A	Chemical B	Product
<ul style="list-style-type: none"> <li>• Arsenical materials</li> <li>• Azides</li> <li>• Cyanides</li> <li>• Hypochlorites</li> <li>• Nitrates</li> </ul>	<ul style="list-style-type: none"> <li>• Any reducing agent</li> <li>• Acids</li> <li>• Acids</li> <li>• Acids</li> <li>• Sulphuric Acid</li> <li>• Copper, brass, any heavy metals</li> </ul>	<ul style="list-style-type: none"> <li>• Arsine</li> <li>• Hydrogen Azide</li> <li>• Hydrogen Cyanide</li> <li>• Chlorine or hypochlorous acid</li> <li>• Nitrogen Dioxide</li> </ul>



<ul style="list-style-type: none"> <li>• Nitric Acid</li> <li>• Nitrites</li> <li>• Phosphorus</li> <li>• Selenides</li> <li>• Sulphides</li> <li>• Tellurides</li> </ul>	<ul style="list-style-type: none"> <li>• Acids</li> <li>• Caustic alkalis or reducing agents</li> <li>• Reducing agents</li> <li>• Acids</li> <li>• Reducing agents</li> </ul>	<ul style="list-style-type: none"> <li>• Nitrogen Dioxide</li> <li>• Nitrous fumes</li> <li>• Phosphine</li> <li>• Hydrogen Selenide</li> <li>• Hydrogen Sulphide</li> <li>• Hydrogen Telluride</li> </ul>
---	--	--

**Reactive Hazards from Mixtures:** Many chemicals may react violently on mixing accidentally or intentionally. A full list of "incompatibles" follows.

Chemical	Incompatibles
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulphuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminium or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulphur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon	Calcium hypochlorite, all oxidizing agents

(activated)	
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulphur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulphide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
<b>Chemical</b>	<b>Incompatibles</b>
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulphide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen

Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulphuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulphide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen: flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulphuric and other acids
Potassium perchlorate (see also chlorates)	Sulphuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulphuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulphides	Acids
Sulphuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

## Corrosive Hazards



**Old Corrosive C**



**New Skin Corrosion 1A, 1B, 1C**

*Corrosive To Metals1*

**Corrosives** (liquids, solids, and gases) are chemicals that cause visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. Corrosive effects can occur not only to the skin and eyes, but also to the respiratory tract through inhalation and to the gastrointestinal tract through ingestion. Corrosive liquids have a high potential to cause external injury to the body, while corrosive gases are readily absorbed into the body through skin contact and inhalation. Corrosive solids and their dusts can damage tissue by dissolving rapidly in moisture on the skin or within the respiratory tract when inhaled.

Specific corrosive chemicals include strong acids and bases, dehydrating agents, non-metal chlorides, halogens and other compounds that hydrolyse to acids.

## Chemicals Harmful to Health other than Reactive, Corrosive or Flammable.



**Old Harmful Xn**

Toxic T  
Sensitization

Mutagenicity,

Toxicity,

Organ Toxicity



**New Aspiration Hazard,**  
Respiratory

Germ Cell

Carcinogenicity,  
Reproductive

Specific Target

**Injury** can be caused by chemicals only if they reach sensitive parts of the body at a sufficiently high concentration and for a sufficiently long time (high enough exposure).

**Exposure:** is a function of the amount (or concentration) of the chemical involved and the time of its interaction. Effects may vary depending upon the nature of exposure - continuous or repeated short intervals- and may depend on the substance's ability to accumulate in the body and on the "victim's" age and/or state of health.

**The potential to cause damage or toxicity** can vary enormously from substance to substance e.g. LD50 values (the single dose that can be expected to kill 50% of a population) can vary from 7000mg/kg of body weight for Ethanol to 0.02mg/kg for Dioxins.

**The injury** depends on the properties of the potentially toxic substance, the exact nature of the exposure circumstances and the health of the person at risk.

### **Entry or Exposure Routes**

Major **routes** of exposure are through the skin (topical), through the lung (inhalation) or through the gastrointestinal tract (ingestion). In general, inhalation is likely to cause more damage than ingestion, which, in turn, is more harmful than skin exposure.

#### **Skin Absorption.**

This is the least likely route of penetration since the natural thickness of the skin plus its natural coating of grease and sweat provide some protection against chemicals. However, some materials are capable of penetrating intact, healthy skin e.g. aniline, hydrogen cyanide, some steroid hormones, organic mercury compounds, nitrobenzene, organophosphate compounds and phenol. Phenol itself can be lethal if absorbed for a sufficient time through a few square centimetres of skin and inappropriate protective clothing e.g. incorrect gloves may cause absorption rate to increase.

The natural protection of the skin may also be bypassed through cuts, abrasion or puncture wounds e.g. needle-stick injury.

#### **Inhalation.**

Gases and vapours, aerosols and fumes are readily inhaled and may cause harm (including asphyxiation) anywhere in the respiratory system and may also be absorbed into the bloodstream but inhalation of particles depends upon their size and shape -the smaller the particle, the further into the respiratory tract it can go.

**Large particles** are filtered off in the nose.

**Smaller particles**, or those breathed in by mouth, settle on the walls of the upper respiratory tract or throat and are coughed up and either ejected or

swallowed. If swallowed, they may enter the gut and cause damage as if they had been ingested.

**The smallest particles** of dust and fibres can be inhaled down into the lungs where they can cause local damage, sometimes by interaction with the cells in the lungs which normally remove bacteria. These particles may also be absorbed into the bloodstream.

### **Ingestion.**

Airborne particles that are eventually swallowed are the most likely source of ingested chemical. Otherwise, ingestion of potentially toxic substances is likely to be accidental on contaminated food, drink or make-up. Once absorbed through the stomach or intestine, the route to excretion may be complex and damaging.

### **Adverse Effects**

**Adverse Effects** may be **local** or **systemic**.

**Local Effects** occur at the site of exposure e.g. corrosives and often irritants.

**Systemic Effects** occur at a **target organ** or at site remote from the point of contact following absorption and distribution around the body.

Some substances produce both effects e.g. lead tetraethyl damages the skin on contact and is absorbed and transported to the central nervous system where it may cause further damage.

**Adverse Effects** may also be **acute** or **chronic**.

**Acute Effects** are immediate such as the effect from inhaling chlorine.

**Chronic Effects** are much slower, often cumulative following repeated exposures. Chronic effects can be the most difficult to avoid because damage may not become evident for many years.

**Adverse Effects** may also be **reversible** or **irreversible**.

**Reversible Effects:** damage can be repaired by the body's natural processes.

**Irreversible Effects:** cannot be repaired e.g. dead nerve cells cannot be replaced.

**Adverse Effects** may be **psychological** as well as purely **physical**.

### **Response of the Body**

#### **Irritation**

- **Respiratory:** Chemicals can irritate the nose and upper respiratory tract causing sneezing, coughing and, in some cases, bronchitis. They may also damage lung tissue.

- **Skin and Eyes:** Chemicals on skin often cause dermatitis (a rash). Solvents can de-grease the skin causing it to become red and sore. Corrosive material such as strong acids and bases can be irritants in dilute form but cause severe burns when concentrated. Eyes are particularly vulnerable and damage can be permanent.

### Sensitisation

- **Respiratory:** Some chemicals can cause sensitisation leading to asthma. Once sensitised, even minimal exposure can cause a severe allergic response.
- **Skin:** Sensitisation can occur through contact with a chemical and the skin. As before, once sensitised, minimal contact can cause an allergic response causing severe itching and other discomfort.

### Long-term Effects

- The most serious of long-term effects is cancer, a disorder of cell growth. Here the effect of exposure may not be evident for many years.

### Reproductive Disorders

- Possible effects are loss of fertility in both men and women, heritable genetic damage or harm to the unborn child.

### Carcinogens: Introduction and Sources of Information



**Old** Very Toxic T+

Toxic T



**New** Acute Toxicity 1,2,3

**Cancer** is a disorder of cells in the body. It begins with a group of cells that fail to respond to the normal control mechanism and continue to divide without need. The new growths are called tumours or neoplasia and may be either "benign" or "malignant". A "benign" tumour is one that remains localised whereas "malignant" tumours invade neighbouring tissues, enter blood vessels, lymphatic vessels and other spaces and can be carried to other areas of the body to form new tumours called "secondaries" or "metastases".

**Cancer** carries with it a high risk of premature death.

**Cancer** may arise from various causes, one of which is the adverse effects of certain substances on the cells of the body either directly or via their metabolites. While it is often difficult to prove a causal link between exposure to a certain chemical and subsequent cancer, there exists evidence to incriminate a number of compounds and other are under more or less strong suspicion. Several organisations and bodies provide lists of known or "suspect" **carcinogens**, classified into different categories and some of these are covered here.

### Cryogenic liquids:



Old



New Aspiration hazard

Cryogenics present many hazards:

- Ultra cold temperatures leading to serious burns to the skin and eyes
- Flammability/oxygen enrichment. Fire and explosion are hazards associated with cryogenics. Keep all organic materials and other flammable substances away from contact with cryogenics.
- High pressure gas, resulting in over-pressurization of containers and transfer hoses
- Ice plug formation in vessels/systems
- Displacement of oxygen/asphyxiation (liquid nitrogen)

Avoid cryogenic burns!

Ensure all containers are secured when filling. Do not overfill containers. Never make direct contact with cryogenic liquids. Wear suitable personal protective equipment when handling any object. Transfer or pour cryogenics slowly.

### COSHH

Under the UK Control of Substances Hazardous to Health (COSHH) Regulations, a **carcinogen** is defined as:

- Any substance or preparation which if classified under the CHIP Regulations, would be required to be labelled with the Risk Phrases R45 "may cause cancer" or R49 "may cause cancer by inhalation".



CHIP itself divides carcinogens into three categories:

**Category 1** - substances known to be carcinogenic to humans. There is sufficient evidence to establish a causal association between human exposure to the substance and the development of cancer.

**Category 2** - substances that should be regarded as if they are carcinogenic to humans, for which there is sufficient evidence, based on long-term animal studies and other relevant information, to provide a strong presumption that human exposure may result in the development of cancer.

**Category 3** - substances that cause concern owing to possible carcinogenic effects but for which available information is not adequate to make satisfactory assessments.

**Categories 1 and 2**, if purchased from a supplier will carry the "toxic" (T) symbol and the Risk Phrase R45 (may cause cancer) or R49 (may cause cancer by inhalation).

**Category 3**, if purchased from a supplier carries the "harmful" (Xn) symbol and the Risk Phrase R40 (limited evidence of carcinogenic effect).

## US Sources

There are several of these:

### **National Toxicology Program (NTP)**

**The 11th Report on Carcinogens** (Adobe Acrobat reader required).

Substances categorised as:

- Group 1: Known to be Carcinogenic.
- Group 2: Reasonably Anticipated to be Carcinogenic.

### **International Agency for Research Into Cancer (IARC)**

Classified as:

- Group 1: Carcinogenic to humans
- Group 2A: Probably Carcinogenic to humans
- Group 2B: Possible Carcinogenic to humans.

### **American Conference of Government Industrial Hygienists (ACGIH)**

Classified as:






- Group A1: Confirmed human Carcinogen
- Group A2: Suspect human Carcinogen.






## Occupational Safety and Health Administration (OSHA)



















### Lists and Links

- [COSHH and CHIP based list](#)
- [OSHA](#)
- [Health Canada](#)
- [Los Alamos National Laboratory list](#)
- [Carcinogenic Potency Project](#)
- [Oxford University list](#)
- [Royal Society of Chemistry](#)
- [British Columbia Cancer Agency list](#) - more than just laboratory chemicals

### Pictograms, Hazards and Precautionary Statements

Term	Meaning	Label
<b>Acute Toxicity</b>	A chemical that causes an adverse health effect following a single exposure (e.g. skin contact with insecticides, accidental ingestion of a chemical)	
<b>Chronic Toxicity</b>	A chemical that causes an adverse health effect following repeated exposure which can occur following a relatively short exposure ( weeks) or longer term exposure ( years)	
<b>Irritant</b>	A chemical that causes reversible damage to skin, eyes or airways	
<b>Skin Sensitiser</b>	A chemical that can cause an allergic reaction of the skin following skin contact (e.g. wood dust or adhesives)	
<b>Respiratory Sensitiser</b>	A chemical that can cause an allergic reaction in the airways following inhalation of the chemical (e.g. glutaraldehyde)	

	or isocyanate)	
<b>Corrosive</b>	A chemical that causes irreversible damage to skin, eyes or airways (e.g. strong acids and strong bases such as concentrated hydrochloric acid or concentrated hydroxides)	
<b>Carcinogen</b>	A chemical that causes or can potentially cause cancer (e.g. breathing in asbestos fibres, skin contact with used motor oils)	
<b>Mutagen</b>	A chemical that can cause permanent damage to genetic material in cells, which can possibly lead to heritable genetic damage or cancer (e.g. UV rays from the sun, benzene)	
<b>Teratogen</b>	A chemical that causes birth defects ( e.g. thalidomide)	
<b>Reproductive toxin</b>	A chemical that affect male or female reproductive systems, their ability to reproduce and/or led to birth effects (e.g. lead, carbon monoxide, organic solvents.	

<b>Current</b>		<b>New*</b>		
Indication of Danger & corresponding symbols (CPL) From Directives 67/548/EEC & 1999/45/EC		Signal words & corresponding pictograms (CLP) From Regulation EC 1272/2008		
Indication of Danger	Symbol	Class/Category	Signal Word	Pictogram
Explosive E		Explosives 1.1-1.3 Explosives 1.4	Danger Warning	
Extremely Flammable F+ Highly Flammable F		Flammable Liquids 1,2 Flammable liquids 3	Danger Warning	
Oxidising O		Oxidising Liquids 1,2 Oxidising Liquids 3	Danger Warning	
No Match	No Match	(NEW) Gases under pressure, compressed gases	Warning	
Corrosive C		Skin Corrosion 1A,1B,1C Corrosive to metals 1	Danger Warning	
Very Toxic T+ Toxic T		Acute Toxicity 1,2,3	Danger	
Harmful Xn Irritant Xi		Acute Toxicity 4 Skin Irritation 2	Warning Warning	
Harmful Xn Toxic T	 or 	Aspiration hazard Respiratory sensitization, Germ cell mutagenicity, Carcinogenicity, Reproductive toxicity, Specific target organ toxicity	Warning or Danger	
Dangerous to the environment N		Hazardous to the aquatic environment 1	Warning	

\*This is a non exhaustive list and is for illustrative purposes only. The user should refer to the Regulation (EC) 1272/2008 for more detailed information

CLP now uses **Hazard (H) statements**, which are:

Hazard (H) Statements	
H200-H299	Physical hazard
H300-H399	Health hazard
H400-H499	Environmental hazard

CLP now also uses **Precautionary (P) statements**, which are:

Precautionary (P) Statements	
	Examples
100 General	P102 "Keep out of Reach of Children"
200 Prevention	P201 "Obtain special instruction before use"
300 Response	P310 "Call a poison centre"
400 Storage	P410 "Store in a well ventilated place"
500 Disposal	P501 "Dispose of container to..."

A number of "leftover" EU Risk Phrases are now preceded with EUH codes and known as supplemental hazard information, for example:

Risk Phrases	Supplemental Hazard Information
R1	EUH001 "Explosive when dry"
R66	EUH066 "Repeated exposure may cause skin dryness or cracking"
R59	EUH059 "Hazardous to ozone layer"

## **List of Hazard (H) statements** (replacing Risk (R) phrases)

### **Physical hazards**

H200: Unstable explosive

H201: Explosive; mass explosion hazard

H202: Explosive; severe projection hazard

H203: Explosive; fire, blast or projection hazard

H204: Fire or projection hazard

H205: May mass explode in fire

H220: Extremely flammable gas

H221: Flammable gas

H222: Extremely flammable material

H223: Flammable material

H224: Extremely flammable liquid and vapour

H225: Highly flammable liquid and vapour

H226: Flammable liquid and vapour

H227: Combustible liquid

H228: Flammable solid

H240: Heating may cause an explosion

H241: Heating may cause a fire or explosion

H242: Heating may cause a fire

H250: Catches fire spontaneously if exposed to air

H251: Self-heating; may catch fire

H252: Self-heating in large quantities; may catch fire

H260: In contact with water releases flammable gases which may ignite spontaneously

H261: In contact with water releases flammable gas

H270: May cause or intensify fire; oxidizer

H271: May cause fire or explosion; strong oxidizer

H272: May intensify fire; oxidizer

H280: Contains gas under pressure; may explode if heated

H281: Contains refrigerated gas; may cause cryogenic burns or injury

H290: May be corrosive to metals

### **Health hazards**

H300: Fatal if swallowed

H301: Toxic if swallowed

H302: Harmful if swallowed

H303: May be harmful if swallowed

H304: May be fatal if swallowed and enters airways

H305: May be harmful if swallowed and enters airways

H310: Fatal in contact with skin

H311: Toxic in contact with skin

H312: Harmful in contact with skin

H313: May be harmful in contact with skin

H314: Causes severe skin burns and eye damage

H315: Causes skin irritation

H316: Causes mild skin irritation

H317: May cause an allergic skin reaction

H318: Causes serious eye damage

H319: Causes serious eye irritation

H320: Causes eye irritation

H330: Fatal if inhaled

H331: Toxic if inhaled

H332: Harmful if inhaled

H333: May be harmful if inhaled

H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335: May cause respiratory irritation

H336: May cause drowsiness or dizziness

H340: May cause genetic defects

H341: Suspected of causing genetic defects

H350: May cause cancer

H351: Suspected of causing cancer

H360: May damage fertility or the unborn child

H361: Suspected of damaging fertility or the unborn child

H362: May cause harm to breast-fed children

H370: Causes damage to organs

H371: May cause damage to organs

H372: Causes damage to organs through prolonged or repeated exposure

H373: May cause damage to organs through prolonged or repeated exposure

### **Environmental hazards**

H400: Very toxic to aquatic life

H401: Toxic to aquatic life

H402: Harmful to aquatic life

H410: Very toxic to aquatic life with long lasting effects

H411: Toxic to aquatic life with long lasting effects

H412: Harmful to aquatic life with long lasting effects

H413: May cause long lasting harmful effects to aquatic life

## List of Risk (R) phrases

R01	Explosive when dry.
R02	Risk of explosion by shock, friction, fire or other sources of ignition.
R03	Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R04	Forms very sensitive explosive metallic compounds.
R05	Heating may cause an explosion.
R06	Explosive with or without contact with air.
R07	May cause fire.
R08	Contact with combustible material may cause fire.
R09	Explosive when mixed with combustible material.
R10	Flammable.
R11	Highly Flammable.
R12	Extremely Flammable.
R14	Reacts violently with water.
R15	Contact with water liberates extremely flammable gases.
R16	Explosive when mixed with oxidising substances.
R17	Spontaneously flammable in air.
R18	In use may form flammable/explosive vapour air mixture.
R19	May form explosive peroxides.
R20	Harmful by inhalation.
R20/21	Harmful by inhalation and in contact with skin.
R20/21/22	Harmful by inhalation, in contact with skin and if swallowed.
R20/22	Harmful by inhalation and if swallowed.
R21	Harmful in contact with skin.
R21/22	Harmful in contact with skin and if swallowed.
R22	Harmful if swallowed.
R23	Toxic by inhalation.
R23/24	Toxic by inhalation and in contact with skin.
R23/24/25	Toxic by inhalation, in contact with skin and if swallowed.
R23/25	Toxic by inhalation and if swallowed.
R24	Toxic in contact with skin.
R24/25	Toxic in contact with skin and if swallowed.
R25	Toxic if swallowed.
R26	Very toxic by inhalation.
R26/27	Very toxic by inhalation and in contact with skin.
R26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R26/28	Very toxic by inhalation and if swallowed.
R27	Very toxic in contact with skin.
R27/28	Very toxic in contact with skin and if swallowed.
R28	Very toxic if swallowed.
R29	Contact with water liberates toxic gas.
R31	Contact with acids liberates toxic gas.
R32	Contact with acids liberates very toxic gas.
R33	Danger of cumulative effects.
R34	Causes burns.
R35	Causes severe burns.
R36	Irritating to eyes.



R36/37	Irritating to eyes and respiratory system.
R36/37/38	Irritating to eyes, respiratory system and skin.
R36/38	Irritating to eyes and skin.
R37	Irritating to respiratory system.
R37/38	irritating to respiratory system and skin.
R38	Irritating to skin.
R39	Danger of very serious irreversible effects.
R39/23	Toxic: danger of very serious irreversible effects through inhalation.
R39/23/24	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R39/23/25	Toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/24	Toxic: danger of very serious irreversible effects in contact with skin.
R39/24/25	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/25	Toxic: danger of very serious irreversible effects if swallowed.
R39/26	Very toxic: danger of very serious irreversible effects through inhalation.
R39/26/27	Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R39/26/27/28	Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R39/26/28	Very toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R39/27	Very toxic: danger of very serious irreversible effects in contact with skin.
R39/27/28	Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R39/28	Very toxic: danger of very serious irreversible effects if swallowed.
R40	Possible risks of irreversible effects.
R40/20	Harmful: possible risk of irreversible effects through inhalation.
R40/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin.
R40/20/21/22	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed.
R40/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed.
R40/21	Harmful: possible risk of irreversible effects in contact with skin.
R40/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed.
R40/22	Harmful: possible risk of irreversible effects if swallowed.
R41	Risk of serious damage to eyes.
R42	May cause sensitisation by inhalation.
R42/43	May cause sensitisation by inhalation and skin contact.
R43	May cause sensitisation by skin contact.
R45	May cause cancer.
R46	May cause heritable genetic damage.
R48	Danger of serious damage to health by prolonged exposure.
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.

R48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R48/20/21.	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin.
R48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R49	May cause cancer by inhalation.
R50:	Very toxic to aquatic organisms.
R51:	Toxic to aquatic organisms.
R52:	Harmful to aquatic organisms.
R53:	May cause long term adverse effects in the aquatic environment.
R54:	Toxic to flora.
R55:	Toxic to fauna.
R56:	Toxic to soil organisms.
R57:	Toxic to bees.
R58:	May cause long term adverse effects in the environment.
R59:	Dangerous for the ozone layer.
R60	May impair fertility
R61	May cause harm to the unborn child.
R62	Possible risk of impaired fertility.
R63	Possible risk of harm to the unborn child.
R64	May cause harm to breastfed babies.
R65	Harmful: May cause lung damage if swallowed.

## **List of Precautionary (P) statements (replacing (S) phrases)**

### **General precautionary statements**

P101 If medical advice is needed, have product container or label at hand

P102 Keep out of reach of children

P103 Read label before use

### **Prevention precautionary statements**

P201 Obtain special instructions before use

P202 Do not handle until all safety precautions have been read and understood

P210 Keep away from heat/sparks/open flames/hot surfaces— No smoking

P211 Do not spray on an open flame or other ignition source

P220 Keep/Store away from clothing/.../combustible materials

P221 Take any precaution to avoid mixing with combustibles

P222 Do not allow contact with air

P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire

P230 Keep wetted with ...

P231 Handle under inert gas

P232 Protect from moisture

P233 Keep container tightly closed

P234 Keep only in original container

P235 Keep cool

P240 Ground/bond container and receiving equipment

P241 Use explosion-proof electrical/ventilating/light/equipment

P242 Use only non-sparking tools

P243 Take precautionary measures against static discharge

P244 Keep reduction valves free from grease and oil

P250 Do not subject to grinding/shock/.../friction

P251 Pressurized container – Do not pierce or burn, even after use

P260 Do not breathe dust/fume/gas/mist/vapours/spray  
P261 Avoid breathing dust/fume/gas/mist/vapours/spray  
P262 Do not get in eyes, on skin, or on clothing  
P263 Avoid contact during pregnancy/while nursing  
P264 Wash ... thoroughly after handling  
P270 Do not eat, drink or smoke when using this product  
P271 Use only outdoors or in a well-ventilated area  
P272 Contaminated work clothing should not be allowed out of the workplace  
P273 Avoid release to the environment  
P280 Wear protective gloves/protective clothing/eye protection/face protection  
P281 Use personal protective equipment as required  
P282 Wear cold insulating gloves/face shield/eye protection  
P283 Wear fire/flame resistant/retardant clothing  
P284 Wear respiratory protection  
P285 In case of inadequate ventilation wear respiratory protection  
P231+232 Handle under inert gas. Protect from moisture  
P235+410 Keep cool. Protect from sunlight

### **Response precautionary statements**

P301 IF SWALLOWED:

P302 IF ON SKIN:

P303 IF ON SKIN (or hair):

P304 IF INHALED:

P305 IF IN EYES:

P306 IF ON CLOTHING:

P307 IF exposed:

P308 IF exposed or concerned:

P309 IF exposed or you feel unwell:

P310 Immediately call a POISON CENTER or doctor/physician

P311 Call a POISON CENTER or doctor/physician

P312 Call a POISON CENTER or doctor/physician if you feel unwell

P313 Get medical advice/attention

P314 Get Medical advice/attention if you feel unwell

P315 Get immediate medical advice/attention

P320 Specific treatment is urgent (see ... on this label)

P321 Specific treatment (see ... on this label)

P322 Specific measures (see ... on this label)

P330 Rinse mouth

P331 Do NOT induce vomiting

P332 If skin irritation occurs:

P333 If skin irritation or a rash occurs:

P334 Immerse in cool water/wrap in wet bandages

P335 Brush off loose particles from skin

P336 Thaw frosted parts with lukewarm water. Do not rub affected areas

P337 If eye irritation persists:

P338 Remove contact lenses if present and easy to do, continue rinsing

P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing

P341 If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing

P342 If experiencing respiratory symptoms:

P350 Gently wash with soap and water

P351 Rinse continuously with water for several minutes

P352 Wash with soap and water

P353 Rinse skin with water/shower

P360 Rinse immediately contaminated clothing and skin with plenty of water before removing clothes

P361 Remove/Take off immediately all contaminated clothing

P362 Take off contaminated clothing and wash before reuse

P363 Wash contaminated clothing before reuse

P370 In case of fire:

P371 In case of major fire and large quantities:

P372 Explosion risk in case of fire

P373 DO NOT fight fire when fire reaches explosives

P374 Fight fire with normal precautions from a reasonable distance

P375 Fight fire remotely due to the risk of explosion

P376 Stop leak if safe to do so

P377 Leaking gas fire – do not extinguish unless leak can be stopped safely

P378 Use ... for extinction

P380 Evacuate area

P381 Eliminate all ignition sources if safe to do so

P390 Absorb spillage to prevent material damage

P391 Collect spillage

P301+310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician

P301+312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

P301+330+331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting

P302+334 IF ON SKIN: Immerse in cool water/wrap in wet bandages

P302+350 IF ON SKIN: Gently wash with soap and water

P302+352 IF ON SKIN: Wash with soap and water

P303+361+353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower

P304+312 IF INHALED: Call a POISON CENTER or doctor/physician if you feel unwell

P304+340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

P304+341 IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing

P305+351+338 IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing

P306+360 IF ON CLOTHING: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes

P307+311 IF exposed: Call a POISON CENTER or doctor/physician

P308+313 IF exposed or concerned: Get medical advice/attention

P309+311 IF exposed or you feel unwell: Call a POISON CENTER or doctor/physician

P332+313 IF skin irritation occurs: Get medical advice/attention

P333+313 IF skin irritation or a rash occurs: Get medical advice/attention

P335+334 Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages

P337+313 Get medical advice/attention

P342+311 Call a POISON CENTER or doctor/physician

P370+376 In case of fire: Stop leak if safe to do so

P370+378 In case of fire: Use ... for extinction

P370+380 In case of fire: Evacuate area

P370+380+375 In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion

P371+380+375 In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion

## **Storage precautionary statements**

### **Code Text**

P401 Store ...

P402 Store in a dry place

P403 Store in a well ventilated place

P404 Store in a closed container

P405 Store locked up

P406 Store in a corrosive resistant/... container with a resistant inner liner

P407 Maintain air gap between stacks/pallets

P410 Protect from sunlight

P411 Store at temperatures not exceeding ... °C/... °F

P412 Do not expose to temperatures exceeding 50 °C/122 °F

P420 Store away from other materials

P422 Store contents under ...

P402+404 Store in a dry place. Store in a closed container

P403+233 Store in a well ventilated place. Keep container tightly closed

P403+235 Store in a well ventilated place. Keep cool

P410+403 Protect from sunlight. Store in a well ventilated place

P410+412 Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122 °F

P411+235 Store at temperatures not exceeding ... °C/... °F. Keep cool

### **Disposal precautionary statements**

#### **Code Text**

P501 Dispose of contents/container to ...



### List of Safety phrases (S).

S01	Keep locked up.
S010/2	Keep locked up and out of the reach of children.
S02	Keep out of the reach of children.
S03	Keep in a cool place.
S03/07	Keep container tightly closed in a cool place.
S03/09/14	Keep in a cool well ventilated place away from (incompatible materials to be indicated by manufacturer).
S03/09/14	Keep only in the original container in a cool well ventilated place away from (incompatible materials to be indicated by the manufacturer).
S03/09/49	Keep only in the original container in a cool well ventilated place.
S03/14	Keep in a cool place away from (incompatible materials to be indicated by the manufacturer).
S04	Keep away from living quarters.
S05	Keep contents under (there follows the name of a liquid).
S06	Keep under (there follows the name of an inert gas).
S07	Keep container tightly closed.
S07/47	Keep Container tightly closed and at a temperature not exceeding *C (to be specified by manufacturer).
S07/8	Keep container tightly closed and dry.
S07/9	Keep container tightly closed and in a well ventilated place.
S08	Keep container dry.
S09	Keep container in a well-ventilated place.
S12	Do not keep the container sealed.
S13	Keep away from food, drink and animal foodstuffs.
S14	Keep away from (a list of incompatible materials will follow).
S15	Keep away from heat.
S16	Keep away from sources of ignition.
S17	Keep away from combustible material.
S18	Handle and open container with care.
S20	When using, do not eat or drink.
S20/21	When using do not eat, drink or smoke.
S21	When using do not smoke.
S22	Do not breathe dust.
S23	Do not breathe vapour.
S24	Avoid contact with skin.
S24/25	Avoid contact with skin and eyes.
S25	Avoid contact with eyes.
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S27	Take off immediately all contaminated clothing.
S28	After contact with skin, wash immediately with plenty of soap-suds.
S29	Do not empty into drains.
S29/56	Do not empty into drains, dispose of this material and its container to hazardous or special waste collection point.
S30	Never add water to this product.
S33	Take precautionary measures against static discharges.

S35	This material and its container must be disposed of in a safe way.
S36	Wear suitable protective clothing.
S36/37	Wear suitable protective clothing and gloves.
S36/37/39	Wear suitable protective clothing, gloves and eye / face protection.
S36/39	Wear suitable protective clothing and eye/face protection.
S37	Wear suitable gloves.
S37/39	Wear suitable gloves and eye/face protection.
S38	In case of insufficient ventilation, Wear suitable respiratory equipment.
S39	Wear eye / face protection.
S40	To clean the floor and all objects contaminated by this material, use – (there follows suitable cleaning material).
S41	In case of fire and / or explosion do not breathe fumes.
S42	During fumigation / spraying wear suitable respiratory equipment.
S43	In case of fire use (there follows the type of fire fighting equipment to be used.)
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label whenever possible.).
S46	If swallowed, seek medical advice immediately and show this container or label.
S47	Keep at temperature not exceeding.
S47/49	Keep only in the original container at temperature not exceeding *C (to be specified by manufacturer).
S48	To be kept wet with (there follows a material name).
S49	Keep only in the original container.
S50	Do not mix with.
S51	Use only in well ventilated areas.
S52	Not recommended for interior use on large surface areas.
S53	Avoid exposure - obtain special instructions before use.
S56	Dispose of this material and its container at hazardous or special waste collection point.
S57	Use appropriate container to avoid environmental contamination.
S59	Refer to manufacturer / supplier for information on recovery recycling.
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/safety data sheets.
S62	If swallowed, do not induce vomiting; seek medical advice immediately and show this container or label.