CRANN

Safety Statement

For

Centre for Research on Adaptive Nanostructures and Nanodevices

(CRANN)

Naughton Institute,

Trinity College Dublin.

This document, Sections A to D, must be read in full and the Employee Declaration Form (Part 7.0 within Section A) should be signed and returned to the CRANN Safety Officer.

Trinity College The University of Dublin

UCC Coláiste na hOllscoile Corcaigh, Éire University College Cork, Ireland

sfi science foundation ireland fondúireacht eolaíochta éireann

NDP NATIONAL DEVELOPMENT PLAN

SEVENTH FRAMEWORK PROGRAMME

HEA Higher Education Authority An tÚdarás um Ard-Oideachas

ENTERPRISE IRELAND

CRANN Safety Statement sub-sections

CRANN

Section A. CRANN Safety Statement.

Table of Contents;

CRANN

<u>**0.1. CRANN Safety Statement - Document Revision History**</u>

Version	Date	Description	Written by	Approved by	Comments
1	Nov 2007	Document Creation	Mike Finneran	Executive Director	
2	Sept 2008	Document Review – Sections A, D, C & D.	N/A	CRANN Health and Safety Committee	New CRANN Facilities Manager and Safety Officer Appointed - James Dempsey
3	Jan 2009	CRANN Nano Materials Handling Procedure – Section F	Chris Murray James Dempsey Mike Finneran	CRANN Health and Safety Committee	
4	Feb 2010	CRANN Gas Handling Procedure – Section E	Mike Finneran	CRANN Safety Officer	
5.	Nov 2013	Safety Statement update / review	Mike Finneran, CRANN / AML technical staff	Waiting approval by CRANN H & S Committee	
6.	March 2014	Safety Statement update	Mike Finneran	Waiting Approval	Inclusion of new CRANN Exec Director
7.	March 2017	Safety Statement update	Dermot Daly	Awaiting approval CRANN Health and Safety Committee	Inclusion of new CRANN Exec Director

CRANN

1.0. CRANN Health & Safety Policy

1.1 - Statement of Intent and Objectives

CRANN recognises and will ensure compliance with the requirements 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 CRANN.

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 CRANN 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 CRANN; 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

Prof. Stefano Sanvito

Signed ....

Dr. Lorraine Byrne

Director – CRANN Executive Director – CRANN

2.0 Introduction

The purpose of the Safety, Health and Welfare at Work Act 2005, is to ensure the safety, health and welfare of all employees in the workplace and to ensure that non-employees present in the workplace are safe. The Act applies to employees in all types of work and embraces all the activities of CRANN (TCD)

Section 20 of the Act requires CRANN to prepare a written safety statement specifying the manner in which the safety, health and welfare at work of employees is to be secured and managed.

In response to this requirement CRANN has prepared a framework Safety Statement outlining the institute's policies on occupational health and safety matters and defining the necessary management structure for the implementation of these policies. Specific health and safety issues of relevance to the University as a whole are detailed in Trinity college safety statement.

Due to the size and complexity of the University structure and operations, the TCD Safety Statement cannot address the individual hazards and risks in the various schools/units/research institutes and centre's. Each school/unit/research institute / center is therefore required to have its own local safety statement, documenting its hazards, risks, and protective and preventive measures taken and resources provided for ensuring a safe and healthy work environment.

In addition to the CRANN safety statement, TCD continually develops campus wide policies/procedures in areas of specific concern. The current policies/procedures are available on the TCD Health & Safety web page http://www.tcd.ie/Buildings/Safety , these include the following;

Contact Information College Specialist Hazard Officers Safety Statements Safety Consultation Emergency Procedures Fire Safety Chemical Safety Biological Safety Radiological Safety Accident Reporting Working with VDU's Safety Training Policies

This (local) CRANN safety statement will be updated as necessary in light of new legislation, staff feedback, university structural changes and practical experience. In addition, the safety statement will be reviewed annually.

WHO SHOULD READ THE SAFETY STATEMENT?

All staff, postgraduate students, researchers, visitors (resident for more than a week) should read the safety statement. It is the responsibility of the individual principal investigator / manager / supervisor to ensure that their postgraduate students, researchers, technicians, staff, visitors etc. read the safety statement. Copies of the safety statement will be provided as well as access to the safety statement available on CRANNShare.

3.0 Scope of CRANN Safety Statement

This safety statement covers people working in the following areas in (the Naughton Institute):

- CRANN Offices.
- CRANN Laboratories. (Including CRANN Advanced Microscopy Laboratories, TCD Enterprise Centre, Pearse Street)

All CRANN staff and students must read and sign off on this document under part 7.0 'Declaration by Employee' within Section A.

A copy of the signed declaration by employee sheet will be kept on file with the CRANN safety officer.

Members of the Schools of Pharmacy, Physics and Chemistry working in CRANN must also read and sign off on the safety statement that pertains to their school regardless of which building they work in.

4.0 CRANN Safety Responsibilities and Duties

4.1 All Personnel

All CRANN personnel (staff, students and visitors) have a personal responsibility to ensure the health and safety of themselves and of others who may be affected by their activities within (the Naughton Institute and) CRANN.

4.2 CRANN Director and Executive Director

The *Director of CRANN*, and the *Executive Director of CRANN*, are jointly responsible for safety in (the Naughton Institute &) CRANN as per the TCD College Safety Statement. Their joint duties include the following:-

- To ensure that a departmental safety statement is prepared, reviewed, and updated as necessary for CRANN.
- To cooperate in the undertaking of departmental safety inspections and audits in CRANN.
- To monitor the implementation of the departmental safety statement in CRANN.
- To cooperate in the distribution of health and safety documentation and information relevant to CRANN.
- To ensure that accidents/ dangerous occurrences are reported in accordance with the colleges reporting procedures.
- To liaise and cooperate with elected safety representatives.
- To cooperate in the initiation, organisation and local management of fire drills and other emergency procedures within the physical areas of (the Naughton Institute &) CRANN.
- To cooperate in the provision of staff safety training, by directly organising relevant training or by ensuring the attendance of staff at designated courses, as appropriate.

- To arrange for the identification of safety equipment requirements, including personal protective equipment within CRANN, and to make arrangements for its provision, as far as is reasonably practicable.
- To cooperate with other college personnel in the management of health and safety within CRANN

4.3 CRANN Safety Officer

The ***CRANN Safety Officer*** has executive responsibility for safety and reports to the Director of CRANN. He is supported by the Technical Officer.

- Be familiar with the College Safety Statement.
- Liaise with the College Safety Officer.
- Periodically review Health and Safety Procedures within the Naughton Institute & CRANN.
- Advise and assist the Director on any revision of the CRANN Health and Safety policy.
- Monitor that safe working practices and procedures, together with and necessary risk assessments are completed and complied with.
- Disseminate Health and Safety information and reports and pass to appropriate members of staff and students within CRANN.
- Monitor that adequate precautions are being taken regarding any special hazard in, or about to be introduced to CRANN.
- Conduct or coordinate systematic Health and Safety inspections and accident investigations to identify unsafe or unhealthy conditions or work practises, and monitor any preventative action taken including implementation.
- Attend relevant CRANN Safety Committee meetings.
- Monitor that plant equipment and processes within areas are being maintained as required by any relevant instructions, statutory provisions, codes of practice etc. and that staff and students are suitably informed instructed trained and supervised.
- Maintain adequate Health & Safety records where appropriate as required by relevant statutory provision or College/ CRANN Safety Statements.
- Monitor the standard of housekeeping in their area and ensure a high level is maintained as far as is reasonably practicable.
- Monitor that suitable and sufficient personal protective equipment is available and used within their areas.
- Act with the delegated authority of the CRANN Director in matters of safety urgency.
- Refer promptly to the CRANN Director in the first instance any safety problems that cannot be resolved on a time scale commensurate with the risk.
- Report all defects in plant equipment structure or fabric promptly to the CRANN Director or Buildings Office.
- Ensure that new members of CRANN receive adequate induction with respect to health and safety matters.

- Report to the CRANN Director any matters requiring disciplinary proceedings.

4.4 CRANN Principal Investigators

CRANN Principal Investigators (PI) are responsible for the safety of their groups and the laboratories in their charge. They are responsible for ensuring that their group adheres to the policies stated in the TCD and CRANN Safety Statement(s).

The Principle Investigator is responsible for the following safety requirements within his or her group / laboratories;

- Identify and list all hazards.
- Prepare and file risk assessments.
- Where a hazard exists in an area or activity, each PI is responsible for ensuring that each employee is adequately trained and these training records are prepared and filed.
- Prepare and file a chemicals inventory (chemical name, formula, quantity, hazard identification etc.) for each lab.
- Prepare and file the MSDS for each chemical (the MSDS must come from the chemical supplier). The MSDS file must be within reach of the employee and stored in the lab itself.
- Ensure that all chemicals are properly labeled as per TCD requirements.
- Ensure that each project is registered with the appropriate College Safety Officer, Personnel & PI registration is complete as per TCD requirements.
- Ensure that Permit to Work Applications are completed and approved by the appropriate College Safety Officer.
- Ensure that Standard Operating Procedures SOPs in place.
- Ensure that Sealed, unsealed, X-Rays sources of radiation are registered with the appropriate College Safety Officer.
- Identify a Safety Representative for each area/ group.

4.5 Fire Wardens

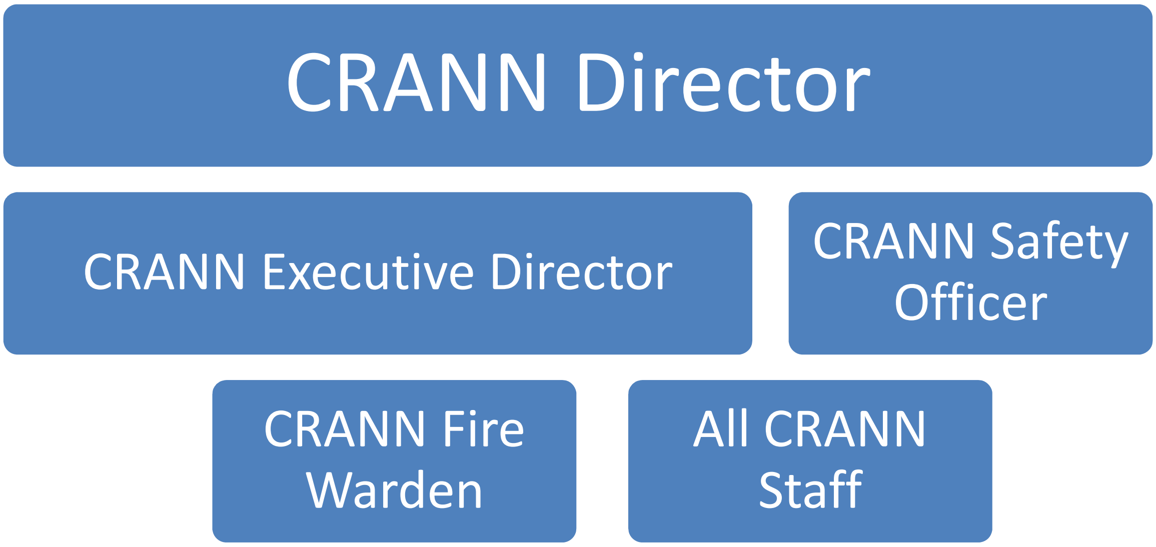
Perform weekly checks to ensure the following.

- Escape route exits are easily open able from the inside by any person within the building
- Escape routes are not obstructed
- All combustible materials from escape routes and building are removed as far as possible
- All fire extinguishers directional signs break glass unit keys and other items in association with fire safety are in position and functioning

- Monitor Departmental areas top ensure compliance with fire safety control measures (in conjunction with Departmental Safety Officer)
- Assist in the evacuation of the building in the event of fire/ fire drill.
- Account for all people on the premises at the designated assembly points as far as possible.

4.6 CRANN Organisation Chart

The organisation chart for health and safety within CRANN is shown below.



TCD SAFETY MANAGEMENT STRUCTURE

Ultimate responsibility for Safety, Health and Welfare rests with the Board of the College. The Board of the College includes, among others, the following individuals:

- The Provost of the College – Prof. Patrick Prenergast
- Registrar – Professor Juergen Barkhoff
- Secretary to the College - Ms. Anne FitzGerald

Persons responsible for implementing the Health and Safety policy:

The Board understands and accepts its ultimate responsibility for Health and Safety. It exercises this control through the normal administrative structures and in accordance with the following procedures:-

Heads of Schools, Disciplines & Administrative Areas

Senior members of staff (usually Heads of Departments) have been assigned the role of being the Head of specific buildings functions, actions, areas, units or Departments. They are responsible for implementing and maintaining College Health and Safety policy and procedures in their areas, as far as is reasonably practicable, given the resources allocated by Board. These Heads of Departments have been granted full responsibility and control over their specified buildings or areas. Within shared buildings, Heads of Departments carry control for the space allocated to their Departments equitably and severally. Within individual rooms the most senior member of staff or person nominated, carries similar control for the room when occupied. Day to day management of the policy within Departments or areas can be further delegated to individual persons if a specific role or action is required.

Departmental Safety Officers:
Each Head of Department must appoint a Departmental Safety Officer. This person is to carry out specific duties aimed at ensuring day to day compliance with the policy.

4.7 Monitoring of Safety Performance

All personnel within CRANN have a responsibility to contribute to the continuous monitoring of safety performance within the institute. On a day-to-day basis this can be achieved by forwarding comments, queries and complaints on safety matters to the CRANN Safety Officer.

In pursuance of the safety policy of CRANN, the Safety Officer will carry out regular safety inspections of CRANN offices and laboratories (at least once per calendar year) and maintain appropriate written records. The results of these inspections will be discussed at CRANN safety committee meetings.

Any deficiencies in equipment or procedures must be rectified promptly. Where equipment is deemed to be unsafe it should not be used until corrective action is taken.

The CRANN Safety Officer will hold a detailed record of all accidents, injuries, property damage and near misses. These reports will be discussed at the regular meeting of the Science Faculty Safety Committee with a view to establishing why and where the safety performance was inadequate.

The CRANN Safety Officer will conduct periodical Safety Audits in CRANN in collaboration with the Chief Technician and the College Safety Officer, and reports on these audits will be given to the Director.

4.8 Reporting of Hazards, Accidents and Dangerous Occurrences

All personnel working in CRANN have an individual responsibility to report, directly to the CRANN Safety Officer or Technician, all potential hazards and/or hazardous occurrences, which they may observe.

All accidents and dangerous occurrences, even those of a minor nature, must be immediately recorded in the CRANN Accident Record Book held by the Chief Technician. In the case of accidents leading to personal injury and/or potentially dangerous occurrences the CRANN Safety Officer will provide an official College Accident/Incident Form (Appendix Section 8.1), which must be completed as soon as possible after the incident.

Details of witnesses to the incident, if any, will also be noted and forwarded, along with the report form, to the College Safety Officer as soon as possible after the incident. Copies of the form will be retained in the School.

4.9 Safety Training

All CRANN personnel 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. The Training requirements are listed in Appendix Section 8.2.

The TCD College Safety Office provides a number of various Safety Health and Welfare training courses on an annual basis to address these training requirements. **http://www.tcd.ie/Buildings/Safety/safetytrainingform.php**

For further information with regard to the content, purpose or suitability of any of the following courses E-Mail elaine.doorly@tcd.ie, or phone Elaine Doorly at 8962887.

The School of Chemistry hold a Post Graduate Safety Training Day, Junior Sophister Safety Workshop, and Fire Safety Training. Further details are available from the School of Chemistry.

The School of Physics holds an annual Safety day at the beginning of each Academic year. All new staff and postgraduate students are required to attend. Fire safety training is also mandatory for technicians and administrators working in CRANN research laboratories and office areas. Each floor in CRANN will be assigned with a fire warden. Additional training may also be mandatory for personnel working in specialist hazard areas.

4.10 HAZARD IDENTIFICATION AND RISK ASSESSMENT

The actual managerial and procedural measures required to achieve the TCD Health and Safety policy will vary with the department, unit, building, function and area. In order to produce a Departmental Safety Statement and thus comply with the policy, departmental inspections incorporating hazard identification and risk assessment procedures must be undertaken on a regular basis.

Hazard Identification:

A hazard, is anything which has the potential to cause harm. Hazard is any substance, article, material or practice within a work place, which has the potential to cause harm to employees at work or visitors to that workplace.

A comprehensive review and assessment of hazards, risks and controls within CRANN will be undertaken. This exercise will be carried out in accordance with the definitions and procedures detailed in the TCD safety statement.

Risk Assessment:

Risk can be defined as a combination of the likelihood of an accident occurring as a result of the existence of this hazard, and the possible severity of the consequences of such an accident. Hazards can be categorised as being High, Medium or Low risk depending on the chance of an accident occurrence resulting, and the likely severity of such an accident occurrence.

All hazards identified should be risk assessed, ie, categorised as being High, Medium or Low Risk. Control measures must then be identified and implemented to either eliminate the risk completely or if this is not possible, to reduce the risk as far as is reasonably practicable. The feasibility of eliminating the hazard completely, or substituting with safer alternatives or practices, should be looked at before considering implementing any alternative control measures. Personal protective equipment should only be used in the last instance when other control measures cannot reduce the risk to an acceptable level.

The level of risk, should reflect the control measures being implemented and the amount of resources both financial and managerial, necessary to eliminate or reduce the risk to acceptable levels. The person responsible for implementation of these control measures must also be identified.

The Hazard Identification and Risk Assessment procedure is an integral part of the CRANN Safety Statement. The CRANN Safety Committee will ensure that the CRANN Safety Statement is periodically reviewed and amended as necessary.

Hazards Associated with work Practices:

<u>All potentially hazardous activities within CRANN must be risk assessed</u>.

A guide to carrying out these assessments is included in Appendix Section 8.3. This guide can be modified as necessary and serves to illustrate specific areas that need consideration. Such activities may include the use of hazardous chemicals or equipment, working with Nano materials, research projects, hazardous physical manipulations, maintenance of hazardous machinery, and the manufacture of new hazardous substances or equipment etc.

Each completed risk assessment form must be signed by the relevant principal investigator / research supervisor and a copy lodged with the CRANN safety officer.

<u>5.0 TCD & CRANN Safety contacts</u>

TCD Safety Officer - Mr. Tom Merriman (01 896 1914)

CRANN Safety Officer - Dermot Daly x4930, Keith Boland

CRANN Technical Officer - Mr. Mike Finneran (01-896 3023)

Chemical Safety – Dr. Michael Bridge (01-8961264)

Biological Safety – Mr. Frank Mangan (01896 3965)

Biological Safety and Genetic Manipulation – Dr. Ronnie Russell (01-8961194)

Radiological Protection – Ms. Elaine Doorly (01-8962887)

School of Physics Radiological Supervisor - Ms. Gillian Gunning 3530 (01-896 3530)

CRANN Deputy Radiological Supervisor – Mr. Mike Finneran (01 896 3023)

Laser Safety - Dr. Vincent Weldon (01 896 2168)

School of Physics Electrical Safety - Mr. Joe McCauley (01-896 2218)

Fire Safety – Mr. Karl Flynn (01896 3545)

Security – Mr. Pat Morey, Chief Steward (01 896 1144)

CRANN Security - Mr. Des Keany (01 896 3030)

Occupational Health Physician – TCD Health Service (01 896 1556)

CRANN First Aid – Des Keany (3033); Mary McCarthy (3144); Mary Colclough (3022)

Lisa Lambert	Ex 3019 L3.12
Jacqueline Ballentine-Armstrong	Ex3033 L3.
Keith Boland	Ex 4358 AML
Dermot Daly	Ex 4930 AML
Eoin McCarthy	Ex 4936 AML
Michael McCarthy	Ex 3027 L3.
Deirdre Caden	Ex 3403 L3.
Jing Li	Ex 4837 L4.

CRANN

CRANN Fire Wardens – 4th Floor; Mr. Neal O'Hara (4642)

3rd Floor; Mr. Mike Finneran (3023), Ms. J.B Armstrong (3033)

2nd Floor; Mr. Mike Finneran (3023), Ms. J.B Armstrong (3033)

Ground Floor; Mr. Des Keany (3030)

Basement; Dr. Borislav Naydenov (4611)

Your Fire Wardens are: July 2016

Name	Ex : Location Floor
Dermot Daly	Ex 4930 1st AML
Keith Boland	Ex 4358 4th AML
Mike Finneran	Ex 3023 3rd CRANN
J.B. Armstrong	Ex 3033 3rd CRANN
Des Keany	Ex 3030 0 F.Desk CRANN
Boris Naydenov	Ex 4611 - 2 Basement
	Ex 4092 Science Gallery
Derek Williams	**Ex 4198 Science Gallery**
	Ex 4095 Science Gallery
	Ex 4133 Science Gallery
	Ex 4197 Science Gallery
Declan Greaney	**Ex 4107 Science Gallery**

6.0 College Specialist Hazard Officers

The following members of Staff have been appointed by the Board as specialist advisors in the fields outlined below. They advise the College Safety Officer, Local, Faculty and College Safety Committees and the College Community in general on matters relating to their respective fields. If you have a query in relation to safety in the use of lasers, radioactive materials, biologically hazardous materials, fire safety or hazardous chemicals, the relevant specialist in College can be contacted at the telephone numbers or addresses shown.

- **Hazardous Chemicals** Dr. Michael Bridge, Chemistry School, Chemistry Building,

  College *tel*:01-896 1264 *e-mail*:mbridge@tcd.ie

- **Bio-Hazards** Mr. Frank Mangan, Microbiology School, Moyne Institute,

  College *tel*:01-896 3965 *e-mail*:manganfr@tcd.ie

- **Bio-Safety and Genetic Manipulation** Dr. Ronnie Russell, Microbiology School, Moyne Institute,

  College *tel*:01-896 1194 *e-mail*:rrussell@tcd.ie

- **Laser Safety** Dr. Vincent Weldon, Physics School, Physics Building,

  College *tel*: 01 896 2168 *e-mail*:vweldon@tcd.ie

- **Bio-Resources** Mr. Peter Nowlan, Bio-Resources Unit, Biochemistry Building,

  College *tel*:01-896 1008 *e-mail*:peter.nowlan@tcd.ie

- **Radiological Protection** Dr. Elaine Doorly, Director of Buildings' Office, West Chapel,

  College *tel*:01-896 2887 *e-mail*:elaine.doorly@tcd.ie

- **Fire Safety** Mr. Karl Flynn, Director of Buildings' Office, West Chapel,

  College *tel*:01-896 3545 *e-mail*:karl.flynn@tcd.ie

7.0 Declaration by Employee

I have fully read and understand the CRANN Safety Statement and its sub sections A to D inclusive.

I agree to abide by the terms of the CRANN Safety Statement, and to carry out my duties in CRANN according to the Safety Statement.

Section A. CRANN Safety Statement.

Section B. CRANN Emergency Procedures.

Section C. CRANN General Safety Rules.

Section D. Safety Rules for CRANN Laboratories and Offices.

Staff Number : ....

Print Name : ....

Signed : ....

Position : ....

Department / School : ....

Supervisor / PI : ....

Date : ....

8.0 Appendices

8.1 Accident/ Incident Report Form

This form must be completed by the School Head, Chief Technician, or School 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 School, and copies sent to (1) School Safety Officer, (2) Mr. T. Merriman, West Chapel (Secretary to the College Safety Committee), and (3) Ms. J. Gill, West Chapel (for insurance purposes).

Name: ………………………………………………………….………… **Staff** □ **Student** □ **Other** □

School: ……..…………..………………………….. **Job Title:** ………………………….............………..

Date & Time of Alleged Accident: ………..............…… **Place/Building Name:** ………………………..

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

Brief Particulars…………………………………………………………………………..........................

………………………………………………………………………………………..…………………………..

(Continue on separate page if necessary)

Nature of Injury: ………………………………………………………………………………………………

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

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

……………………………………………………………………………………………………..…………….

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

(1…………………………………………………………………

(2…………………………………………………………………

CRANN

**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.

8.2 CRANN Training Requirements

1 - Personnel.

Tier 1 – Administration Management, Principle Investigators

Tier 2 – Laboratory Supervisors, Postdocs, Administration Supervisors, Technicians

Tier 3 – All Academia, All Full-time and part-time administration staff.

2 - College Training Courses/ Personnel

- Fire Safety & Extinguisher Training / Tier 2
- Fire Warden Training / Tier 2
- Manual Handling / Tier 3
- Voice Training / Tier 3 (where applicable)
- School/ Departmental Safety Officer Training / Tier 2
- Occupational first Aid / Tier 2
- Occupational first Aid Refresher / Tier 2
- Health & Safety Legal Briefing for Managers / Tier 1
- Security Officers Emergency Training / Tier 2
- Safe Handling of Cryogenics such as Liquid Nitrogen / Tier 3 (where applicable)
- College Radiological Protection Workshop / Tier 3 (where applicable)
- College Biological Safety Workshop / Tier 3 (where applicable)
- Office Safety/ VDU Assessors Course / Tier 3

- Laser Safety Training (Class 3 & Class 4 Lasers) / Tier 3 (where applicable)

8.3 CRANN Risk Assessment Form

CRANN RISK ASSESSMENT FORM (please use additional sheets as needed)

RISK ASSESSMENT NO: ……………. **Location: ………………………………….**

Brief outline of work / activity:			
Hazards / Risks:		**L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐** **L ☐ M ☐ H ☐**	
Personnel Exposed:		**Approx No. of Personnel Exposed**	
Existing control measures:		**Are the risks adequately controlled: Yes / No**	
If NO, list additional	**Additional controls**	**Action by:**	

controls and actions required:		

Completed by:	**Print Name:**	**Signature:**	**Date:**
Dates of Reviews:			
Supervisior:			

CRANN RISK ASSESSMENT FORM

<u>GUIDANCE NOTES ON COMPLETING THE FORM:</u>

Hazards

• Only list those that you could reasonably expect to cause significant injuries or affect several people.

• Will the work require the use of machines and tools? How can you or anyone else be injured?

• Will the work require the use of chemicals? If so, check safety data sheets for harmful effects and any exposure limits.

• Will the work produce any fumes, vapours, dust or particles? Can they cause significant harm?

• Are there any significant hazards due to where the work is to be done, such as confined space, at height, poor lighting, high/low temperature?

• Specific hazards should be assessed on a separate risk assessment form and cross-referenced with this document. (e.g. Cryogens, Compressed gases etc.)

Who might be exposed?

• Remember to include yourself, your supervisor, others working in or passing through the work area.

• Those more vulnerable or less experienced should be highlighted as they will be more at risk, such as people unfamiliar with the work area, disabled or with medical conditions, *e.g.* Asthma.

Existing control measures:

• List the control measures in place for each of the significant hazards, such as machine guards, ventilation system, use of Personal Protective Equipment (PPE), generic safety method statement/procedure.

• Remember appropriate training is a control measure and should be listed.

CRANN

• List any Permits to Work, which may be in force. (e.g. Hot work permits)

Are risks adequately controlled?

• With all the existing control measures in place, do any of the significant hazards still have a potential to cause significant harm.

• Use your judgement as to how the work is to be done, by whom and where.

Additional controls:

• List the additional control measures, for each of the significant hazards, which are required to reduce the risk to the lowest so far as is reasonably practicable.

• Additional measures may include such things as: increased ventilation, Permit to Work, confined space entry permit, barriers/fencing, and fall arrest equipment, *etc*.

PPE should only be used as a last resort, if all else fails.

Section B. CRANN Emergency Procedures

Table of Contents;

1.0 CRANN Alarm and Evacuation Procedures:

College Incident / Emergency Procedures – EMERGENCY call 1999

The Internal telephone number for emergencies in college is 1999, and provides immediate access to professional assistance on a 24 hour basis.

Be prepared to state:

1. Type of assistance required (ambulance, fire brigade, police etc.)
2. Type of emergency (fire, injury, etc.)
3. Name, extension number and location.

If possible and safe to do so, keep close to telephone, in order to give further information should it be required by the emergency services.

There is a legal duty on the College to ensure Incident / Emergency procedures are in operation, tested and reviewed. This legal duty is to ensure that persons within the College confines, i.e., staff, students, contractors and visitors, are not exposed to any unnecessary danger should an emergency occur.

These procedures detail the steps to be taken in the event of emergencies and serious and imminent dangers which may involve a full or part evacuation of an area(s) or building(s) and subsequent actions.

Emergencies and serious and imminent dangers can include fire, explosion, chemical or gas release, oxygen depletion, bomb threat, structural collapse etc

Staff and students will not be required to continue or resume work while the serious and imminent danger continues.

The Naughton Institute is provided with an (inclusive) automatic fire, gas detection and oxygen depletion alarm system, which is regularly tested by the College Buildings Office. All alarm conditions within the Naughton Institute will be sounded through the fire alarm system. Gas detection and oxygen alarms will be sounded initially on the floor where an alarm condition exists, and then throughout the building as detected. In the event of hearing a gas detection or oxygen depletion alarm, evacuate your area of work immediately. The alarm system can be manually triggered from any of the many break-glass alarm boxes, which are placed in strategic areas around the Naughton Institute. In the event of a fire, the fire alarm system should be activated immediately and the building evacuated. Persons present in (or in charge of) laboratories, conference and meeting rooms should assist with the evacuation of their areas.

When the fire alarm sounds all personnel must immediately leave the building using the nearest available exit route (or the exit route specified by local fire wardens). In the event of an emergency evacuation all personnel must obey, promptly, all instructions given by the Fire warden/Safety officer.

Do not congregate at the building entrance. After evacuation go directly to the designated assembly point for the Naughton Institute. The location of the Naughton Institute assembly point is Fire Assembly Point E located outside the Lloyd Institute and is shown on the map below.

Fig. 1 CRANN Evacuation Assembly point: (Outside Lloyd Institute)

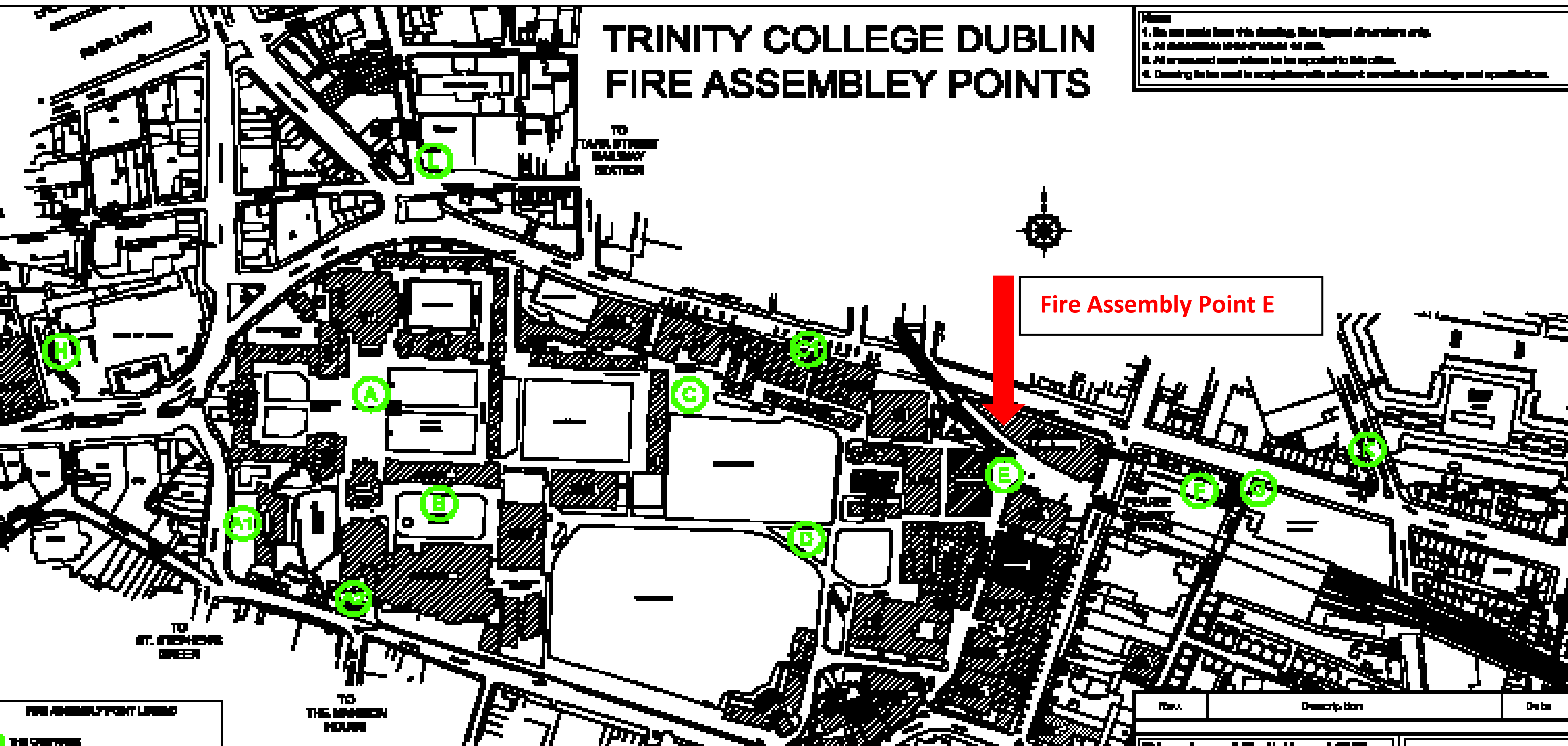


Fig 2. TCD Fire and Evacuation Map.

2.0 Gas Detection / Oxygen Depletion System:

Fig 3. Oxygen Depletion Sensor

Fig. 4. Midas Gas Detection Sensor

CRANN Oxygen Depletion System

All CRANN laboratories have an O2 Depletion sensor installed. The CRANN gas detection system consists of a total of 67 detectors throughout the building. Fifty five of the detectors are oxygen depletion sensors 'Signalpoint' and the balances are for a number of specific specialist Gases 'Midas'. A central control panel is located in the 5^{th} floor plant room. The fire alarm panel is located on the ground floor at the front desk.

Oxygen depletion sensors are replaced twice yearly and calibrated during each service visit by a third party service provider.

Persons risk assessing cryogenic activities in their laboratory should detail the O2 Depletion sensor number and its calibration date in the Existing Control Measures section of the risk assessment.

System Operation

The gas detection system is always on line monitoring the detectors in each laboratory unless they are specifically isolated or the system is fully turned off. The gas detectors have 2 limits - level 1 and level 2.

Level 1 Gas Detection Alarms (19.5% O2)

Level 1 alarms are indicated visually and audibly at the control panel on Level 5 only. The indicator light will be slowly pulsing light indicating the specific detector activation. When this occurs the room should be examined and any cause identified. Following this it should be logged with date, time, detector number and fault cause if identified. Following this the fault should be cleared from the gas detection panel. Level 1 gas detection alarms do not indicate on the fire alarm panel.

Level 2 Gas Detection Alarms (18.5% O2)

Level 2 alarms also sound at the control panel at the level 5 control panel. Level 2 alarms cause the indicating lamp to pulse rapidly and an audible sound. When this occurs the room should be examined and any cause identified. As it is a level 2 alarm it means the threshold value has been exceeded so great care should be exercised in entering a room that has had such activation. Following this the incident/event should be logged with date, time detector number and fault cause if identified.

In addition when the gas detection control panel is activated in a level 2 alarm it also links to the building fire alarm panel at the entrance. This is a local visual and audible indication of the fire panel - **not the general building alarm**. When a level 2 alarm occurs the fire alarm panel indicates the floor level of the gas alarm level 2 activation. The fire panel is programmed to cause the sounders and beacons on **that floor level only to operate** at a different sound pattern (called a pulse pattern) than the standard fire alarm sound. This is to warn/advise other occupants on that floor level that activation has taken place.

3.0 Fire wardens:

Fire warden training.

It is the policy of CRANN to encourage volunteers from the permanent, scientific / postdoctoral staff and postgraduate students to attend fire warden training courses provided by TCD Safety Training.

This half-day training session should be attended by all fire wardens appointed in College. The course covers fire safety legislation, structural and building fire safety issues, such as escape routes, compartmentation, fire detection and alarm systems and emergency lighting. It also covers fire safety management rules and policy in College and the role and duties of the fire warden including maintaining the buildings Fire Safety Register.

Each floor in the Naughton Institute will be assigned with a trained fire warden.

The Fire wardens for CRANN / Naughton Institute are:

4th Floor;	Mr. Neal O'Hara (4642)
3rd Floor;	Mr. Mike Finneran (3023), Ms. J..B Armstrong (3033)
2nd Floor;	Mr. Mike Finneran (3023), Ms. J..B Armstrong (3033)
Ground Floor;	Mr. Des Keany (3030)
Basement;	Dr. Borislav Naydenov (4611),

Mr Des Kearney (Tel 3030) is the senior fire warden for CRANN.

Duties of the Fire Warden.

The principal duties of the fire warden are to:

- Ensure that escape and refuge areas are available for use at all times.
- Assist in identifying fire hazards in the workplace.
- Ensure that any changes to work practices or modifications to existing processes do not introduce unforeseen fire hazards.
- Record and report their findings accordingly.
- Ensure the inspection of all fire safety equipment is carried out according to the requirements of the regulations and ensure that the findings are recorded in the fire register.
- Ensure that all employees and employees of others are aware of fire assembly points and the actions to be taken in the event of fire.
- Notify the appropriate people when a fire drill has been arranged.
- Liaise with the employer or safety manager to ensure that there is adequate fire warden cover in the event of holidays or sickness etc.

4.0 Action in the event of Fire:

On discovery of fire:

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

LEAVE the building using the nearest exit route, closing doors behind you.

NOTIFY SECURITY CENTRE on extn*. 1999,

REPORT to your assembly point (Assembly Point E)

Fig 5. Gent Break Glass Unit.

5.0 Action on hearing the Fire / Gas detection / Oxygen depletion Alarm:

LEAVE the building using the nearest exit route, closing doors behind you,

REPORT to your assembly point. (Assembly Point E)

6.0 Action on Power Outage:

- Emergency lights will come on.
- Building facilities may not reset when power is resumed.
- If you are working in a chemical hood, close the shields immediately. You are no longer working in a safe, exhausted environment.
- If you are working with a hazardous gas system that is manually valved, close all gas valves.
- If the power remains off, leave whatever you are doing in as safe a condition as possible and exit the laboratory.
- Do not resume your work until you have been given assurance that building facilities are back on.
- When in doubt, seek help to return process equipment to a safe status.

Remember:

Check and familiarise yourself (and visitors) with the nearest exit(s) from your building, break glass units and the location of your Assembly Point (see map).

Note: on assessment of the incident, those assembled may need to be moved to an alternative Assembly Point location.

- Only use Fire Extinguishers if you have been trained to do so.
- Do not take risks.
- Do not return to the building for any reason, unless authorised
- Do not use lifts.
- Keep Exit Routes clear at all times

Keep your area clean, tidy and clutter free. Remove rubbish regularly and report any electrical faults to extn. 1828.

7.0 College general response to Fire alarm activations:

Internal Properties (i.e. main College Green campus site)**:**

Fire alarms on the main campus (with the exception of a few key areas which are also linked back to a security firm) are monitored back to the Security Control Centre which is staffed 24 hours a day. On activation of a fire alarm the Security Control Centre contact the nearest security ground patrol officer by radio who immediately goes to the relevant building, views the fire panel to identify the type of activation, the area within the building where the alarm has been activated, and then checks the actual area in question.

If there is a fire:

(a) They immediately inform the Security Centre who immediately call the fire service and dispatch all security staff to the area.

(b) Immediately evacuate the building (this should already be under control on the sounding of the alarm in any case).

If there is no fire:

They re-set the alarm panel and report the false activation to the Buildings Office maintenance staff.

8.0 Fire Drills:

These are held at least once a year for each building. The CRANN Fire / Safety Officer, College Safety Officer, Facilities Officer and Chief Steward will carry out the drills as required or as directed by Heads of Departments. These drills also serve to practice multiple building evacuations. This could occur in the unlikely event of a major incident such as a multiple gas leak, external toxic waste release or similar, requiring the evacuation of a section of the College grounds and buildings.

9.0 Fire fighting equipment:

Diskins Fire Services Ltd. carries out regular inspection, renewal and servicing of fire extinguishers under the direction of the College Buildings Office.

Any person who has used one of the School fire extinguishers, even for a very short time, must report the fact immediately to the CRANN Safety Officer and Technician, so that it can be fully recharged or replaced. Additionally, an Accident/Incident Report Form must be completed in respect of each such use of any fire extinguisher.

Unauthorised use of any fire fighting equipment is a criminal offence and will be dealt with severely.

10.0 Liaison with the fire brigade:

CRANN recognises the special hazards, which its use of compressed gases and chemicals presents to fire service personnel. CRANN will seek to reduce these as follows:

1) It will pursue, as far as is practicable, a policy of piping in gases rather than keeping gas cylinders on the premises.

2) It will keep records of the main hazards relating to cylinders of compressed gases and chemicals in each area of the building. These will be sent to the Fire Brigade, the Chief Technician's office, the Chief Steward's office and a copy to the buildings Fire Safety register.

11.0 Action in the event of other Emergencies:

- **For Rescue or Emergency Services contact Security Centre at extn.1999**
- **Fire, Garda, Ambulance, Gas Leak, Chemical Spill or Personal Safety: Security Centre at extn.1999**
- **Personal injury - summon assistance from your Department First-Aider or call Security Centre at extn.1999**
- **College Health Service (office hours), House 47, contact extn.1556**
- **Dr McGrath (outside office hours – ph 6903567 or mobile 087 6646861).**

11.1 Plumbing, Gas or Electrical faults:

• During office hours: contact extn.1828

• Outside office hours: contact Security Centre extn.1317

12.0 CRANN First aid boxes and burn kits:

- First aid boxes and burn kits will be kept in all safety shower and eye wash stations at either end of all main corridors, in the CRANN clean room and at the front desk.
- Names and telephone numbers of the nearest personnel with First Aid expertise are posted on all First Aid stations, as is the College emergency number and that of the College Health Centre.
- First aid boxes will be maintained by CRANN Technical staff and safety officer and the contents checked and replaced as necessary on a monthly basis.
- The Institute also will carry a stock of commonly used first aid materials which will be available at the front desk.

13.0 First aid training:

It is the policy of CRANN to encourage volunteers from the permanent and postdoctoral staff, and postgraduate students to attend First Aid courses.

14.0 CRANN First Aid contacts:

It is the policy of CRANN that first aid will not take the place of professional treatment. In the case of minor injuries such as cuts or burns, assistance may be sought from CRANN staff who possess a qualification in First Aid.

People who are currently qualified in First-aid are:

First Aid Occupational Training (FETAC) provided on Jan and Feb 2012 to the following staff members:

CRANN	**Advanced Microscopy Laboratory**

CRANN

Des Keany

Mary McCarthy

Mary Colclough

Dermot Daly

Robbie O'Connell

For more serious injuries the person injured will be accompanied to the College Health Centre or an ambulance will be summoned (contact extn. 1999).

15.0 CRANN Safety Showers and Eye Wash stations:

SAFETY NOTE: THE SHOWERS ARE PART OFTHE SAFETY EQUIPMENT INSTALLED IN THE NAUGHTON INSTITUTE AND ANY OTHER USE APART FROM THAT LISTED BELOW COULD LEAD TO DISCIPLINARY ACTION.

TCD Buildings will periodically functional test and keep records.

Chemical contact with eyes and skin can cause serious injury.

Therefore, it is very important that you act quickly to prevent injury. Safety showers and eyewashes are located at both ends of each corridor close to laboratories where chemicals are in use. Additional stations are also located in the CRANN clean room.

Chemical neutralising agents Hexafluorine for Hydrofluoric Acid and any other acid exposure, and Diphoterine for any chemical exposure except Hydrofluoric Acid, are also available in the CRANN Class 100 clean room at the acid wet bench location. An acid wet bench safety induction is necessary for staff who need to work and process samples in this area, and this will be provided as required by CRANN technical staff.

Familiarize yourself with their locations, and when necessary USE THEM.

Do not waste time going to the rest room. Remove clean room attire when necessary.

Do not worry about getting the area wet. Your safety is more important.

16.0 Chemical Contact With Eyes:

SAFETY NOTE: CONTACT LENSES MUST NOT BE WORN IF YOU ARE WORKING WITH CHEMICALS. HOWEVER DO ASK THE INJURED PERSON IF HE/SHE IS WEARING CONTACT LENSES AS THEY MUST BE REMOVED TO ENSURE THAT NO CHEMICAL GETS TRAPPED IN THE EYE. THE ACCIDENT REPORT FORM MUST BE FILLED OUT AS DESCRIBED IN SECTION A 8.1.

- **Go to any eyewash immediately.**
- **Flush both eyes continuously for 30 minutes (timed).**
- **The head should be tilted in the direction of the affected eye to prevent contaminating the opposite eye.**
- **Hold eyelids apart with your thumbs and fingers whilst rinsing. Roll your eyes around, flushing the entire surface, especially the lower eyelid, as the chemicals may tend to pool there.**

The First-Aider or Facilitator should call "1999" and request assistance – ambulance etc.

The injured person should now be taken to hospital for a full medical examination. Always bring the Material Safety Data Sheet (MSDS) for the specific chemical to the hospital and ensure that the medical staff are aware of the type of chemical.

Chemical Contact With Eyes:

Table 1: Chemical contact with the eyes

Chemical	**Action**
PHOTORESIST	**DO NOT USE WATER as a precipitate can form which may further damage the eye.** **Only use SODIUM CHLORIDE (NaCl / 500ml) or Diphoterine (500mL) chemical neutralising agent if exposure occurs in the CRANN clean rooms**
HYDROFLUORIC ACID **(HF)**	**DO NOT USE HF-ANTIDOTE GEL on the eye.** **Use SODIUM CHLORIDE (NaCl / 500ml) or WATER from safety shower / eye wash,** **or Hexafluorine 500mL Eye Wash (for neutralising HF)**

17.0 Chemical Contact With The Skin:

SAFETY NOTE: IT IS VITAL TO REDUCE THE CONTACT TIME OF THE CHEMICAL WITH THE SKIN AND EYES AS SWIFTLY AS POSSIBLE. TRACK SUITS / SMOCKS AND TOWELS ARE

AVAILABLE IN THE MEDICAL CENTRE UNDER THE EYE WASH. THE ACCIDENT REPORT FORM MUST BE FILLED OUT AS DESCRIBED IN SECTION A 8.1.

- **Rinse the affected area immediately for 30 minutes (timed).**
- **Do not wait to see what happens before reacting. Some chemicals, notably Hydrofluoric Acid (HF), do not cause an immediate reaction upon contact.**
- **Contact with a large amount of chemical requires you to shower immediately.**
- **If assisting an injured person it is advisable to double-glove the hands.**
- **Once under the shower, remove all contaminated clothing quickly. Cut away if necessary.**

Clothing tends to keep the chemicals in close contact with the skin, causing severe burns. Never bring clothes up over the body or face - always pull down or cut off. Avoid contaminating healthy skin or eyes. If the casualty is already wearing air-tight safety goggles do not remove them.

The First-Aider or person assisting should call "1999" stating location, and request assistance – ambulance etc.

The injured person should now be taken to hospital for a full medical examination. Always bring the Material Safety Data Sheet (MSDS) for the specific chemical to the Hospital and ensure that the medical staff are aware of the type of chemical.

Chemical Contact With The Skin:

Table 1: Chemical contact with the skin

Chemical	**Action**
HYDROFLOURIC **ACID (HF)**	1. Use Hexafluorine chemical neutralising agent (with in 1 minute of exposure) if exposure occurs at acid wet bench in CRANN class 100 clean room. Otherwise: 2. Irrigate the affected area immediately with water. As soon as the **HF Antidote gel** (located in the First Aid box) is available, massage into the affected area and continue to do so for 30 minutes. 3. After 30 minutes of irrigation, the area should be pat dried and the HF-Antidote gel applied again. 3. Cover with the shiny side of a melolin dressing located in the First Aid box.
CAUSTIC BURN	Irrigate under cool running water for at least 30 minutes or until the feeling of stickiness or soapiness caused by the caustic chemical disappears. This may take an hour or more

CRANN

18.0 Chemical Spillage:

In the case of a chemical spillage the following actions should be taken to contain the situation.

The cleaning of such is the responsibility of the Technician / Safety officer groups within CRANN.

Should you cause or find a spillage, asses the situation, with regard to both your own safety and that of others in the area and immediately inform the Safety Officer and/or technician.

Should you discover a major spillage or leak, the laboratory should be evacuated and the Tech / Safety officer informed of the situation. On these occasions it may be necessary to evacuate the area by the fire exits.

The person involved should inform the Safety Officer of the material which has spilt, i.e. acid or solvent. Personnel should not re-enter the laboratory until the all clear is given by the safety officer.

19.0 General Guidelines :

Ensure that you fully adhere to the following guidelines:

- **Do not wear contact lenses if working with chemicals.**
- **Do not assume that a substance is water.**
- **Do not sit on Acid / Solvent bins.**
- **Do wear relevant Personal Protective Equipment (PPE).**
- **Do know the First Aiders close to your work area.**
- **Do know the location of First Aid boxes.**
- **Do know that 1999 is the only number for an emergency.**
- **Do know locations of fire exits and assembly points.**
- **Do cooperate with the CRANN Safety Officers and Fire Wardens.**
- **Do know the location of safety showers.**
- **Do know all safety specifications for your area.**
- **Do know all environmental specifications for your area.**
- **Do treat all Solvents / Acids with due respect.**
- **All personnel using a particular chemical should read the manufacturer's Safety Data Sheet (SDS) for that chemical.**

CRANN

Section C. CRANN General Safety Rules

Table of Contents

14.0 Stress at Work

1.0 Introduction

The following are the general safety rules which apply to *all personnel in CRANN*, including staff, students and visitors.

Additional more specific safety rules apply to the personnel working in the following areas:

- CRANN Research Laboratories and Offices
- CRANN Cleanroom.
- CRANN Nano-Bio Laboratory
- CRANN Photonics Laboratory
- CRANN Advanced Microscopy Laboratories (TCD Enterprise Centre, Pearse St.)

2.0 Access:

- The normal working hours for CRANN are 0830-1800, Monday to Friday.
- Although free access is available to most TCD buildings during normal working hours, access outside normal working hours is limited strictly to authorized staff, postgraduate students, authorised visitors and contractors.
- Contractors and maintenance personnel must be made aware of the hazards in the areas to which they are admitted.

3.0 Visitors to CRANN:

Visitors to CRANN must immediately contact their staff host (or the CRANN administrative office / reception) on entering the Naughton Institute. CRANN staff, who have visitors, are responsible for ensuring that their visitors are aware of all CRANN safety rules, are fully aware

of local fire evacuation procedures and have been informed of any special risks associated with the area being visited.

No visitor who is not technically qualified will be left unattended in any laboratory.

Casual visitors to CRANN should go to the front desk.

Transition year school students who may be temporarily attached to CRANN will be classified as visitors.

All visitors, contractors and maintenance personnel must comply with the CRANN safety regulations.

4.0 Working outside normal hours:

The normal working hours for the Institute are 0830-1800, Monday to Friday.

CRANN will maintain a "late book" for access outside the normal working hours. This book will be signed by all staff members, postdoctoral workers, postgraduate students and others who are in CRANN outside the hours 0800-1800 from Monday to Friday, or at any time on a Saturday, Sunday or public holiday. There will be two "late books", one kept at the main front desk and the other kept in the lift lobby at the back door. When signing out of CRANN the same book as was used to sign in must be used.

The only circumstances in which those other than staff members, postdoctoral workers, graduate students and *accompanied* visitors will be permitted to be in CRANN outside the above hours are as follows:

1) Security Staff.

2) Cleaning Staff.

3) Maintenance Staff.

4) Persons with special permission of the Executive Director of CRANN.

Persons in categories (1), (2), (3) and (4) above need not sign the night book.

5.0 Working in Isolation:

Working on experimental systems (or machinery) outside normal working hours is not permitted without prior authorization of the project supervisor (or person-in-charge) after he/she has conducted a full assessment of risk and devised a safe system of work.

No staff member, postdoctoral worker or postgraduate student will be permitted to carry out experimental or technical work of any kind in the institute at any time outside normal working hours unless there is another person (Buddy system) close by *who is aware of their presence* so that they can summon assistance in the event of an accident. The **buddy system** is a procedure in which two people, the "buddies", operate together as a single unit so that they are able to monitor and help each other.

Isolated individuals must not carry out potentially hazardous work or activities at any time.

6.0 Hazardous Areas:

Areas and laboratories within CRANN, which contain potentially hazardous equipment and/or substances, must be clearly marked with appropriate warning signs.

Unauthorised personnel are prohibited from accessing such areas.

Fig 6. Hazardous Warning Sign

7.0 Clearways:

As far as is practically possible all entrances/exits, corridors, stairways and doorways must be kept clear of obstructions. All temporary obstructions (e.g. during movement of large equipment or maintenance work) should be notified to the CRANN Safety Officer who will designate alternative temporary emergency exit routes.

8.0 Electrical Switch Rooms/Plant Rooms/Gas Pads:

These rooms must be kept clear of obstructions at all times. Access to these areas must be kept clear and by authorised persons only.

9.0 DEIONIZED WATER

CRANN provides 2M ohm deionized water (DI Water) at either end of all corridors available to all laboratories. All conductive ions, salts, metals, and chemicals are removed from the water to provide contamination free water for processing operations. While this water is not hazardous it should not be used like regular city water. Do not drink DI water. It has no taste since everything that adds taste to the water has been removed. In addition, since the chlorine has been removed there is a chance that harmful bacteria might be present.

10.0 Smoking on Campus:

In accordance with the Public Health (Tobacco) Act 2002 & Public Health (Tobacco) (Amendment) Act 2004 smoking is prohibited in all indoor places of work in TCD. In addition, in order to ensure the safety, health and welfare of staff located in offices adjacent to certain outdoor locations on campus, smoking is prohibited within a 5m radius.

11.0 Pregnant Employees:

CRANN is committed to protecting the reproductive health of all employees and students and minimising risks to the unborn.

- Pregnant employees of CRANN must make their immediate supervisor aware of their condition as soon as possible.
- Each pregnant employee must complete the TCD / web based preliminary risk assessment for submission to the Health and Safety Office.
- Where the preliminary assessment highlights areas of concern, the Health and Safety Office will complete a more in-depth assessment in conjunction with the employee and/or the School Safety Advisor to establish appropriate controls.

12.0 Management of Contractors:

TCD Director of Buildings Office operates a mandatory Permit to Work system for all contractors, incorporating a Hot Work Permit System where necessary. All work undertaken by outside contractors on behalf of CRANN must be carried out under a Buildings Office issued Permit to Work.

Details of the Permit to Work system are available on the TCD Buildings Office Web site.

13.0 Bullying and Harassment:

The TCD Policy to Promote Respect and Protect Dignity outlines the procedures which should be followed by any member of the University Community who may experience sexual harassment, harassment or bullying.

Please see - https://www.tcd.ie/about/policies/respect/dignity-and-respect-march09-brochure.pdf

14.0 Stress at Work:

Occupational stress can be defined as 'the reaction a person may have to excessive demands or pressures arising when they try to cope with tasks, responsibilities or other types of pressures connected with their job but find difficulty, strain or excessive worry in doing so'. Stress can result when the cumulative demands on a person (both occupational and personal/family) exceed the person's capacity to cope at a given time.

Examples of sources of stress are:

- Organisational change
- Strained working relationships
- Overwork / under work
- Unattainable / constant deadlines
- Skills shortfalls to cope with job requirements
- Bullying and harassment
- Personal, non-work related difficulties

The effects of stress, particularly where pressure is intense and continues for some time, can be sustained and damaging both physically and psychologically. CRANN recognises that from time to time staff may experience work related stress. It is our aim to be proactive in the reduction / management of sources of stress. Staff who are subject to occupational stressors beyond their control are encouraged to seek assistance from their immediate manager in the first instance or from any other member of staff.

*Staff experiencing personal difficulties may avail of the University Employee Assistance Program. This is a confidential service provided by an external agency. Staff may contact T***CD Health Centre** *to arrange assistance.*

Section D. Safety Rules for CRANN Laboratories and Offices

Table of Contents:

1.0 Introduction

The following safety information apply specifically to all personnel (including staff, students and visitors) who are authorised to enter and work in CRANN laboratories and offices within CRANN.

2.0 Authorised access to research laboratories:

Access to each individual research laboratory is strictly limited at all times to those individuals authorised by the appropriate principal investigator / research supervisor or person in charge. In the case of visiting researchers and new staff the principal investigator / research supervisor is responsible for ensuring that the appropriate safety training is provided, if necessary by specialist safety consultants, before laboratory access is authorised.

Laboratories which contain specific identified hazards (e.g. lasers, high voltage equipment, hazardous substances etc.) must be clearly marked with warning signs. Access to such areas is strictly limited to authorised personnel with the appropriate training and expertise.

For such areas prior authorisation must be obtained from the research supervisor before visitors or other unauthorised personnel are permitted to either enter the laboratory or undertake any work within the laboratory.

3.0 General Laboratory Practice:

All researchers have a responsibility to maintain a tidy well organised and safe laboratory environment with a safe means of rapid access to and egress from all working areas. Access to all laboratory services (water valves, oxygen level monitors, electrical fuse boxes/switches etc.) should be kept clear at all times.

All experimental systems should be designed to be fail-safe.

All researchers should carry out a detailed assessment of the likely hazards and risks associated with their experimental systems and procedures. Research supervisors have a responsibility for ensuring that such systems and procedures meet the appropriate safety standards. Research supervisors must keep written records of risk assessments carried out and provide, where necessary, appropriate written work instructions and additional written local safety rules. The essential steps that are taken in order to complete a risk assessment are as follows:

- Identify the hazards to health or safety arising from the activity or the workplace.
- Decide who might be harmed and how.
- Evaluate the risks and decide whether existing precautions are adequate or more needs to be done.
- Record your findings.
- Review your assessment and revise it if necessary.
- A copy of the risk assessment should be lodged with the CRANN Safety Officer. If in any doubt consult the appropriate safety consultant.
- All researchers have a personal responsibility to make correct and full use of all protective clothing, personal protection equipment and safety aids provided in order to minimise risks.
- Researchers must not attempt new procedures or tasks without consulting their supervisor and receiving appropriate safety training.
- All researchers within a laboratory should be kept fully aware of day-to-day modifications carried out on experimental systems or operating procedures and clearly visible warning notices of any resulting potential hazard must be provided.

4.0 Protective Clothing and Personal Protective Equipment:

- It is the policy of CRANN that, where necessary, staff and post graduate students should be provided with protective clothing and personal protective equipment.

- Provision of protective clothing (lab. coats, overalls, aprons, gloves) is the responsibility of the principal investigator or research supervisor.

5.0 Unattended experiments / apparatus:

Systems should not be left running unattended without consulting with the relevant research supervisor.

Where systems operate unattended for any period of time, an UNATTENDED APPARATUS FORM (See Appendix 13.2) must be filled in and clearly displayed on the laboratory door. It is also advised to attach a copy to the apparatus, experiment or equipment concerned.

When carrying out the risk assessment for such systems, special attention should be given to the effects of a loss of services (water, electricity etc.) on the safety of the system.

6.0 VDU Equipment:

VDU/Workstation safety consultation is with Mr. Ken Concannon (Ext: 2218 or 01-896 2218)

A booklet, outlining the correct use of VDU equipment, is available from the CRANN Safety Officer. Personnel using VDUs should consult this booklet.

Any users of VDU equipment who experience health problems, which they feel may be associated with their working environment or facilities, should contact the Student Health Centre (extension 1556) for advice. If necessary a full ergonomic risk assessment will be carried out.

Further information is available at http://www.tcd.ie/Buildings/Safety/safetyworkingwithvdus.php

7.0 CRANN Laboratory Housekeeping Rules:

Please leave everything as you found it. If the station or instrument is found dirty, please notify the laboratory staff. If the user is still present ask him/her to tidy up. Warnings will be issued for leaving a dirty station. If the user does not tidy up, he or she will be suspended from using the laboratory.

- Leave all equipment shut down properly (according to operator instructions).
- Wipe all counter tops and fume hood surfaces clean of dust, water and particulates.
- Rinse all used glassware and plastic lab ware and return into designated storage area.
- Throw out all disposable materials that have been used into the proper waste containers.
- Return all chemicals and mixtures to the proper storage areas. Return all materials to the cabinets, cupboards and drawers that they came from. Store all your belongings in a marked shelf or storage container to keep them away from laboratory traffic.
- If you have changed any settings on laboratory equipment, return them to original settings.
- Always wear latex/ nitrile gloves, to protect yourself from the laboratory chemicals.

Failure to comply with any of the above rules or failure to act in a safe, courteous manner will incur a written warning to you and your supervisor and may expose you to dismissal from the clean room facility.

8.0 CRANN Office Housekeeping / Slips, Trips & Falls:

Poor housekeeping can result in the accumulation of combustible materials, the impeding of escape routes, the proliferation of trip hazards, slippery floors, objects falling from heights etc.

- All areas must be kept clean & tidy at all times. All corridors and passageways must be kept free from obstruction at all times.
- All workplaces, passageways and stairs are adequately lit. Problems with lighting must be reported to the Buildings Office for immediate repair.
- All defects in flooring / stair treads and handrails must be similarly reported.
- Storage and stacking of materials / articles must be done in specifically designated areas. Heavier / bulkier articles must not be place above head height where mechanical lifting devices and/or appropriate steps or other access is not provided.
- All liquid spillages must be cleaned up as soon as possible.
- The Buildings Office must be contacted to deal with spillages in corridors.
- All spillages must be cordoned off / warning signs erected if not immediately cleaned up.

9.0 Manual Handling:

Chapter 4 of Safety, Health and Welfare at Work (General Application) Regulations, 2007 defines manual handling as the *"transporting or supporting of a load by one or more employees and includes lifting, putting down, pushing, pulling, carrying or moving a load, which by reason of its characteristics or of unfavourable ergonomic conditions involves risks, particularly of back injury, to employees".*

The University is committed to minimizing the need for manual handling of loads by employees, e.g. by the use of mechanical equipment, organisational arrangements, etc. Training in manual handling is coordinated and arranged through the TCD Health and Safety Office. A number of university staff have been trained as Manual Handling Instructors and their role is to provide in-house manual handling training to university employees. All new employees are provided with manual handling training at induction. Training for staff recruited prior to the provision of formal induction is provided on a priority basis, i.e. staff with a substantial involvement in manual handling are trained first but ultimately all staff must have a knowledge of manual handling principles. Heads of School/Research Centre/Unit/Campus Companies are responsible for ensuring that at risk staff are provided with manual handling training and that they attend refresher training every five years.

- All employees involved in manual handling should acquaint themselves in so far as is possible with
- the weight of each load;
- the center of gravity of unusual loads;
- the nature and contents of the load.

To book a course for either e-mail Clodagh Kennedy at clodagh.kennedy@tcd.ie or phone Clodagh at 8961912.

10.0 Solvent Store TCD Hazardous Materials Facility (HMF) @ ext 3565

- The solvent store is open from **9.30-10.00 am Monday to Thursday** and **2.30-3.00 pm on Fridays**.
- The current list of available solvents, acids and bases and prices may be viewed on the HMF Solvent web page.
- Empty containers may be returned to the facility for re-filling *only* if in **good condition**. The label must not be written over, or defaced.
- Empty 5-Litre Ethanol containers must also be returned to the facility after use.
- Solvents may only be supplied if a **winchester carrier** or other safe method of transport is held by customers.
- **Requisition Forms must be completed in full** before any solvents will be issued, including the full 3-Part or 5-Part Cost Code (SFI Grant purchases).

If there are any special requests, it is recommended to contact the facility in advance. (ext 3565)

11.0 Waste Disposal:

TCD Hazardous Materials Facility (HMF) @ ext 3565

Please be aware that the disposal of hazardous waste down drains, sinks, etc. is prohibited.

11.1 Waste Solvent Store

- The Waste Solvent Store opening hours are the same as the solvent store i.e. **9.30-10.00 am Monday to Thursday** and **2.30-3.00 pm on Fridays**.

- **Chlorinated** and **Non-chlorinated** solvent waste may be deposited during these times without prior arrangement.
- All *other liquid wastes* must be **cleared with the facility** before deposit. Also note Material Safety Data Sheets may be required.
- All Solvent wastes must be transported in an **approved safe carrying can.** These are available for purchase from the facility. Check the Primary Packaging web page for details.
- It is important that the solvent cans are **not overfilled** and the **Flame Arrestor** in each can must be regularly checked for integrity.

11.2 Disposal of "empty" bottles:

Acids - triple rinse interior of empty bottles and rinse exterior in proper acid drains before discarding. Leave caps off after rinse has been completed. These bottles may be placed in regular glass recycling.

Solvents - "Empty" solvent bottles must be vented under the solvent hood, located in the photolithography area, at least 48 hours before discarding. Mark on bottles with time and date bottle is to be removed, and initial. Leave aerated bottle uncapped and discard in regular trash.

Disposal of acids and bases (excluding Hydrofluoric Acid and HF solutions):

- Use aspirator for siphoning acids in acid drains; never use industrial or water drains.
- Rinse acid tanks after aspirating and aspirate empty tanks twice with DI water.
- Clean area around acid tanks after emptying tanks or completing an operation. Use wet-lint free towels and then follow with dry lint-free towels.
- Rinse towels thoroughly with water before discarding in plastic bag lined trash can.

Disposal of Hydrofluoric Acid and HF solutions:

- The acid neutralization system is not designed to be used with HF.
- Use rinsed out plastic (HDPE, Nitrile or Teflon) chemical bottle for HF waste.
- Mark out old label and clearly mark contents of bottle, initial and date.
- HF etches glass. Do not use glass bottles!

Acid waste pick-up is scheduled by Campus Hazardous Materials Facility (ext. 3565).

11.3 Disposal of Hydrofluoric acid waste:

Hydrofluoric acid is a highly toxic and corrosive solution of hydrogen fluoride in water.

Warning: Symptoms of skin exposure to dilute HF are not felt immediately, but exposure of less than 10% of the body to it can be fatal, even with immediate medical treatment.

Waste HF can be brought to the HMF Waste Store packaged in clearly labeled original 5L leak proof HDPE, Nitrile or Teflon containers (or other suitable plastic screw-top container). As with all chemicals the correct PPE must be worn at all times. HF Waste contained in contaminated or damaged packaging will not be accepted.

11.4 Disposal of solvents:

CRANN

Aerated solvent bottles are used as waste containers for solvents. Waste bottle should be clearly marked for appropriate waste to be collected. Waste develop solution should be stored in waste container designated for waste developer.

11.5 Solvent waste safety carrier cans:

All solvent waste must be brought to the HMF Waste Solvent Store in an appropriate safety carrier can.

Safety Carrier Cans and replacement flame arrestors are available for purchase from HMF.

Please call HMF Ext. 3565 for details.

11.6 Organic Solvent Waste

Organic Solvent Waste is divided into two streams based on primary hazard and disposal method. These wastes must not be mixed.

Chlorinated (halogenated) organic solvent waste

- This is a *toxic liquid* waste and may contain the following solvents for example:
- Dichloromethane
- Chloroform
- Methylene chloride
- Trichloroethane

Non-chlorinated organic solvent waste

- This is a *flammable liquid* waste and may contain the following solvents for example:
- Acetone
- Alcohol
- Hexane
- Methanol
- Ethyl acetate
- Diethyl ether
- Chlorinated & Non-chlorinated Organic Solvent Waste may be brought to the HMF

Waste Stores Monday to Friday 9.30 am - 10.00 am.

The following wastes must <u>NOT</u> be mixed with organic solvent waste:

Malodourous solvent wastes containing Dimethyl Sulfoxide (DMSO), amines, thiols etc. (these must be disposed as Lab Smalls)

- Acid waste
- Base waste
- Oil waste
- Solely aqueous waste
- Any liquid waste other than organic solvent

12.0 Hazards - Designated Safety Areas – Guidelines and Procedures:

In several designated safety areas, for which either procedures are dictated by statutory provisions or where inherent hazards exist due to the nature of such work, explicit safety training is provided for researchers within CRANN. In these areas designated safety consultants identify hazards, evaluate risks and provide appropriate specialist safety advice. Specific safety rules and procedures apply in these designated areas.

These are detailed in the following sections 12.1 to 12.9.

12.1 Chemical safety:

Chemical safety consultation is with Ms. Anna Drury (Ext: 1469 or 01-896 1469)

The use of dangerous chemicals is strictly controlled by specific legislation, SAFETY, HEALTH AND WELFARE AT WORK (CHEMICAL AGENTS) REGULATIONS, 2001. *The Regulations cover all chemical agents in the workplace*. In particular it applies to chemicals, which are classed as very toxic, toxic, harmful, corrosive or irritant.

In brief the Regulations require that CRANN:

- To assess the health risks which arise from hazardous substances in the workplace and to identify and provide effective engineering and administrative controls to protect people's health.

- To ensure that the engineering controls are properly used and maintained in effective working order.
- To provide training and information for those who may be affected.
- To monitor exposure and implement health surveillance where necessary.

A copy of the regulations is available from the School / CRANN Safety Officer. A code of practice for the legislation is also available.

The following rules and procedures apply for all work involving chemical agents within CRANN:

- Hazardous substances may not be ordered (or otherwise procured) before a suitable and sufficient risk assessment has been carried out.
- All chemicals must be itemised on a chemical inventory, which details the quantity & storage location. An electronic copy of this inventory must be given to the CRANN Safety Officer.
- Hazardous substances or chemicals may only be procured through the Technical Officers office on foot of a signed requisition from the research supervisor / PI.
- Chemical safety training is given as part of the annual School of Physics / Chemistry safety day. No one may work with hazardous chemicals without having completed the School safety course.
- All personnel using a particular chemical should read the manufacturer's Safety Data Sheet (SDS) for that chemical.
- All work involving chemicals should, as far as is reasonably practical, be carried out in a fume hood making full use of the safety goggles, safety clothing and other safety aids provided.
- For work requiring use of a fume cupboard, users must at all times adhere strictly to the guidelines for correct fume cupboard usage.
- Suitable bottle carriers must be used, when transporting Winchester, Quart and Eurobottle containers of chemical substances, in order to prevent accidental spillages and personal injuries.
- All stocks of chemicals or hazardous substances used in the Naughton Institute must be properly stored in suitable chemical storage presses.
- All chemicals or hazardous substances used in the Naughton Institute must be clearly labelled including warning signs.
- All chemical waste must be clearly labelled and disposed of promptly through the Hazardous Materials Facility (HMF). Containers sent to the HMF should be no more than 2/3 full.
- Solvent waste should be divided into chlorinated and non-chlorinated waste (and kept apart from acid waste!). Special safety cans for solvent waste can be obtained from the HMF.
- All broken glassware and other "Sharps" should be disposed of in the Sharps bins provided. Bins containing contaminated sharps should be labelled and disposed of via the Hazardous Materials Facility.
- Further information is available at http://www.tcd.ie/Buildings/Safety/safetychemicalsafety.php

Ensure that you fully adhere to the following guidelines:

- **Do not wear contact lenses if working with chemicals.**
- **Do not assume that a substance is water.**
- **Do not sit on Acid / Solvent bins.**
- **Do wear relevant Personal Protective Equipment (PPE).**
- **Do know the First Aiders close to your work area.**
- **Do know the location of First Aid boxes.**
- **Do know that 1999 is the only number for an emergency.**
- **Do know locations of fire exits and assembly points.**

- **Do cooperate with the CRANN Safety Officers and Fire Wardens.**
- **Do know the location of safety showers.**
- **Do know all safety specifications for your area.**
- **Do know all environmental specifications for your area.**
- **Do treat all Solvents / Acids with due respect.**
- **All personnel using a particular chemical should read the manufacturer's Safety Data Sheet (SDS) for that chemical.**

12.2 Electrical safety:

Electrical safety consultation is with Mr. Joe McCauley (Ext: 2218 or 01-896 2218)

Due to the variety of electrical appliances within CRANN electricity is a major hazard. Research supervisors and persons in charge of research laboratories have a responsibility to ensure that new or visiting research staff have received appropriate training in electrical safety before authorisation of access to research areas and that good general working practices prevail within their research laboratory.

Electrical safety training is given as part of the annual School of Physics safety day.

The following electrical safety rules will apply to all mains-powered equipment used in research laboratories.

- Alteration of or maintenance to any part of a building's electrical services may only be carried out by staff of the College Buildings Office.
- All new mains-powered electrical equipment must be inspected by suitably qualified personnel prior to installation.
- Repair and servicing of mains-powered electrical/electronic equipment must be carried out by or under the supervision of qualified electrical/electronic staff.
- All electronic circuitry constructed or modified within the laboratory and which will ultimately be either directly mains-powered or electrically coupled to mains-powered units must be tested by qualified electronics technical staff prior to the mains power being switched on.
- All research supervisors have a responsibility to carry out periodically, detailed assessment of risks associated with electrical equipment under their control and to ensure that all electrical equipment is tested and maintained on an appropriate and regular basis.
- Hazardous mains-powered equipment undergoing modification or test must not be left powered and unattended without consultation with the electrical safety consultant.
- Areas containing equipment capable of generating high voltages, which may on occasion be exposed, must display warning signs on the entrance doors.
- Experiments involving electrical equipment, which operate overnight must be designed to be inherently failsafe and capable of safe shut down via the mains isolation switch.
- Mains cables and plugs should be regularly inspected. Faulty cables are to be replaced immediately.
- Extension cables and sockets must not be left on the ground.

12.3 Laser safety:

Laser safety consultation is with the College Laser Safety Officer, Dr. Louise Bradley (Ext: 3595 or 01-896 3595)

Within CRANN there are many lasers, ranging from devices in Class 1 (the least hazardous) to Class 4 (the most hazardous). A range of personnel, including undergraduate project students, work in laser designated areas in research laboratories. Everyone who may come in contact with lasers must be made aware of the hazards associated with laser radiation and laser devices. Those who work in areas containing Class 3B** and Class 4 lasers must have completed the college laser safety course before work in these areas is authorised.

College is required to keep:

A register of all lasers, giving details of each laser or laser system, its Class, location and Responsible Person in Charge. A copy of this register shall be kept by the College Laser Safety Officer.

A register of all designated Laser Workers - copies of this shall be lodged with the College Laser Safety Officer.

The following safety rules apply for all research laboratories where lasers are used.

- All research supervisors and persons in charge have a responsibility to ensure that all lasers under their control are entered in the College laser register held by the College Laser Safety Officer and that all new or visiting research staff are registered as designated laser workers and receive the appropriate level of laser safety training before access to laser areas is authorized.
- All research supervisors and persons in charge have a responsibility to ensure that appropriate eye protection is readily available and used by all personnel present in areas, which contain operating lasers.
- All personnel who use areas containing lasers must have completed the School of Physics Laser safety course.

In the case of Class 3B and Class 4 lasers the following safety rules must be strictly applied:**

- All lasers in this class are to have safety interlocks fitted. Under no circumstances should a laser interlock be defeated.
- Safety interlocks must be inspected regularly and records kept.
- Appropriate warning signs must be displayed on the room door.
- Only those personnel who have received the appropriate training and who are authorised by both the research supervisor and the Laser Safety Officer may be present in the laboratory when the laser is in use.
- Operators must check that the safety interlock is fully operational and that the door interlocks and warning lights are working before starting the laser.
- Beam stops must be used to terminate all spare portions of the laser beam and all specular reflections.
- All personnel in the laser area must wear the eye protection provided in areas where there is an unprotected laser beam.
- Lasers of differing wavelength may not be operated in the same room unless:
    - a) Goggles, which block all wavelengths in use, are worn or
    - b) The lasers are separated by partitions.
- When the laser has been shut down, the key must be removed from the power supply and stored in a secure location.

All accidents or incidents must be immediately notified on the standard College accident/incident report form to the School Safety Officer as well as to the College Laser Safety Officer.

CRANN

Detailed information regarding the use of lasers is contained in the CVCP booklet Safety in Universities, Part 2:1 Lasers.

12.4 Radiological safety:

The School of Physics Radiological Supervisor as approved by the RPII is Ms. Gillian O'Neill (Ext: 3530 or 01-896 3530)

The CRANN Radiological Safety Officer is Mr. Michael Finneran (Ext. 3023)

Ionising Radiation.

CRANN uses XRays located in Lab L4.24. A licence for these is granted by the R.P.I.I. This is displayed on the door outside room L4.24 of CRANN.

It is essential that all matters concerning sources of ionising radiation be discussed with the School Radiological Supervisor and notified in writing to him or her at the outset.

The following rules and administrative procedures will apply for all work in research laboratories involving ionising radiations:

- An inventory of all radioactive sources is to be maintained by the School Radiological Supervisor.
- Any person in the CRANN wishing to order a source of ionising radiation must supply to the ordering officer concerned appropriate written authorisation from the School Radiological Supervisor and the College Radiological Protection Officer.
- Under no circumstances whatsoever should any assurances be accepted from suppliers about the radiological safety of their products, until the College Radiological Protection Officer and the School Radiological Supervisor have investigated such assurances.
- Transportation of sources of ionising radiation must be notified to the School Radiological Supervisor.
- The College Radiological Protection Officer must be consulted prior to acquiring any equipment producing ionising radiations.
- Local Rules for the handling and usage of radioactive substances or the operation of equipment emitting ionising radiations must be drawn up in consultation with the College Radiological Protection Officer.
- All research supervisors and persons in charge have a responsibility to ensure that all new or visiting research students and staff receive appropriate training before access is authorised to areas containing sources of ionising radiations. Personnel working in these areas must have completed the College Training Workshop in Radiological Protection or an appropriate equivalent.
- All laboratories with sources or equipment producing ionising radiations must display an appropriate warning sign specifying limited access to personnel without the appropriate safety training and expertise.
- The School Radiological Supervisor arranges the supply of dosemeters for all personnel exposed to sources of ionising radiation, and keeps records of doses received.
- Radiation monitors must be available or dosemeters worn in all laboratories containing sources or equipment emitting ionising radiations.
- All sources or equipment producing ionising radiations must be monitored frequently and approved warning signs displayed where appropriate.
- Sources of ionising radiation are to be shielded appropriately.

All accidents or incidents must be immediately notified on the standard College accident/incident report form to the School Radiological Supervisor, with a copy to the School Safety Officer.

Further information is available at http://www.tcd.ie/Buildings/Safety/rswelcome.php

12.5 Radio Frequency and Microwave Radiation Safety:

Guidance on exposure to electromagnetic fields is summarised in the NRPB booklet “Restrictions on Exposure to Static and Time–varying Electromagnetic Fields”, published in 1995, based upon Documents of the NRPB 4, No. 5, 7-63 (1993).

No radio frequency or microwave systems should be operated in CRANN research laboratories unless the appropriate recommendations of the NRPB document have been followed and leakage monitors installed.

12.6 Magnetic Fields Safety:

A number of systems exist in CRANN, which are capable of producing high magnetic fields. (Up to 25 Tesla).

All entrances to CRANN laboratories containing such equipment must display appropriate warning signs.

12.7 Compressed Gases safety:

Compressed gas safety consultation is with Mr. Michael Finneran (Ext: 3023 or 01-896 3023)

Scope:

This guidance covers all portable and fixed gas systems including, but not exclusively:

- All gases provided in compressed gas cylinders regardless of cylinder capacity;
- All gas generation systems such as Compressed Dry Air, Nitrogen and Hydrogen gas generators;
- Any liquid not under pressure that can produce a hazardous gas at room temperature i.e. liquid helium, liquid nitrogen and other cryogenic gases; CO_2 dry ice.

Overview:

Gases are available in CRANN laboratories distributed from a number of different sources for various laboratory uses and equipment / experimental applications. Nitrogen gas (N_2) is available in all laboratories from the central Nitrogen generator located in the L5 plant room. The generator produces high purity N_2 (N6.0 – 99.9999% purity - <10 ppm O_2) and pressurises a large buffer vessel with N_2 gas which is then piped throughout the building to all laboratories to point of use regulators on the N_2 gas supply network.

A process description of the N2 system in available below in the Nitrogen Generator Process Description (Appendix 13.5). Instructions on how to safety use and shut off laboratory point of use gas supply regulators is available in the following section, Safe use of Gas Point Regulators. Further gas handling guidelines are provided in Appendix 13.6 Extract from BOC publication 'Safe under pressure'

Compressed Dry Air (CDA) is also available in all laboratories from the central air compressor system located in the L5 plant room, and is piped throughout the building on the compressed air supply network to point of use regulators to all laboratories. Compressed dry air is not hazardous by its gaseous contents, but possess a hazard in that it is has a potential energy with high pressure air in a compressed state, both in the compressed air buffer tank in the L5 plant room and supply network throughout the building. Only CRANN technical staff is permitted to enter the plant rooms where such generator and compressor systems are located. Daily checks and inspections on these systems will be carried out by CRANN technical staff and any issues with supply and operation will be reported by email to all CRANN staff immediately.

Periodic maintenance will be carried out by third party service providers to ensure best possible service and supply of central gas supplies to CRANN laboratories and equipment.

Other process gases are available from compressed gas cylinders located and piped from the gas storage and supply facilities on Level 5 and the Level 0 ground floor facility supplying the laboratories below ground level. Gas cabinets, (Messer SpectroPUR Gas Cabinets) dedicated to delivery of specific process gases from compressed gas cylinders are located throughout the building supplying gas to specific laboratories and equipment. Each gas cabinet is vented, fitted with gas detection systems and automatic gas shut off safety systems should a leak be automatically detected. MSDS will be posted on the front of all cabinets for reference. Some compressed gas cylinders are also located directly in laboratories for specific equipment and experimental purposes. All compressed gas cylinders, regardless of size, pressure or gas type are subject to strict safety protocols detailed below in the CRANN Safe Use of Gas and Compressed Gas Cylinders. These protocols exist so as to best help manage and minimise the hazards and risks associated with gases, and storage and handling of compressed gas cylinders and must be adhered to for your own and everyone else's safety and wellbeing working in CRANN.

The hazards and risks identified are detailed below and outlined in the **Risk assessment: The transport, storage and installation of compressed gas cylinders in CRANN (for trained staff who have completed the BOC Gas Manual Handling Course)**

All gas supplies are terminated to a point of use pressure regulator in the laboratories. Each regulator has its own unique identification label detailing the regulator I.D number, gas supply manifold number from which the particular gas is supplied from, detailing the gas name, and supply room number where the compressed gas cylinder is connected.

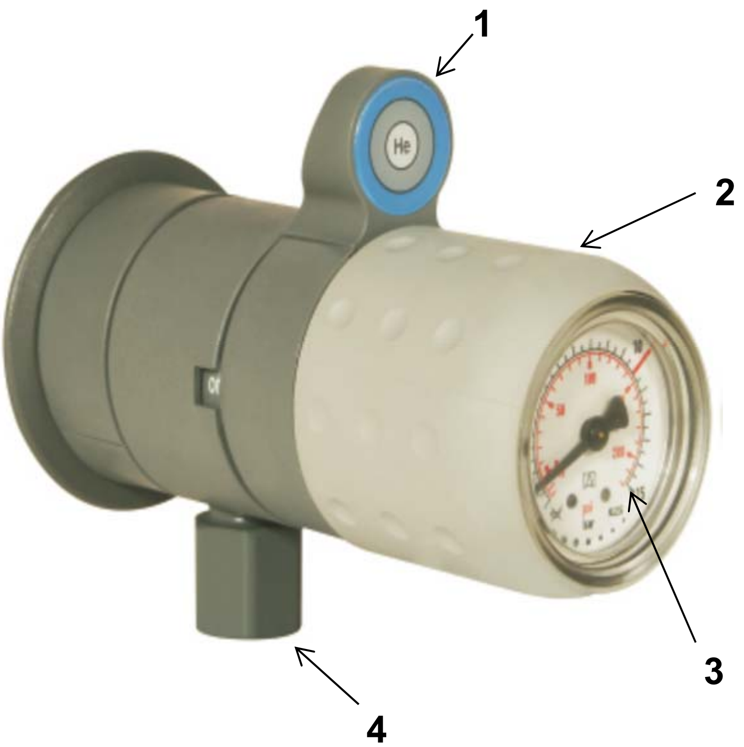
Schematics detailing the CRANN gas supply network throughout the building are available on CRANNShare or from technical staff on request.

e.g. **Gas Point ID No. 74**

Manifold No.	**Gas Name**	**Supply**
Geni	**N2**	**L5.11**
25	**Argon**	**L5.11**

This gas point identification system is in place to assist research staff working in laboratories to communicate issues with supply of gases to technical staff, and to assist technical staff completing safety checks who will be connecting compressed gas bottles onto the gas supply network into laboratories to end user points of use as required or requested.

How to safety use and shut off laboratory point of use gas supply regulators in CRANN laboratories.



1. Shut off Valve – to shut gas on and off to the regulator.
2. Hand knob pressure control adjustment valve. **(Turn clockwise to increase pressure and anti-clockwise to decrease pressure.)**
3. Pressure Gauge (bar/psi) for line pressure.
4. Outlet Adaptor – ¼" -18 NPT

Before a compressed gas cylinder can be brought into a laboratory and installed for experimental or instrument use, the following forms must be completed by the person requesting the use of any gas, and the college / departmental safety officer.

(a). **Risk Assessment** form (Appendix D) and

(b). **Compressed Gas Permit** (Appendix E) must *both* be completed and countersigned, either manually or electronically, by the relevant supervisor *and* the CRANN Safety Officer. The CRANN Safety Officer shall retain a file copy of each such Permit Form. A copy of the completed Gas Permit shall be sent to the College Safety Officer.

Copies of the Compressed Gas Permit form shall be exhibited on the outer door(s) to the laboratory in question during the conduct of the experiment and shall be removed once the experiment has been completed and the gas cylinder in question has been removed from the interior of the building.

(c). Additionally, a '**Compressed Gas Cylinder in Use in CRANN Laboratory'** notification (Appendix F) stating the name of the gas being used and hazard type, and bearing 24 hour contact details for each of the researcher, his/her supervisor and the relevant School Safety Officer shall be affixed to all doors opening into the laboratory.

An additional copy of the Compressed Gas Permit form shall be kept at the reception desk of the building (in a location known to the Fire Brigade) during the conduct of the experiment and shall only be removed once the experiment has been completed and the gas cylinder in question has been removed from the interior of the building.

CRANN will keep an inventory of all compressed gas cylinders in the building, irrespective of the size and type. Therefore it is the responsibility of laboratory managers and assigned researchers to follow the guidelines as detailed below and to update the inventory system with existing and any new gases brought into their laboratories.

The following safety protocols apply to the safe use of gases and compressed gas cylinders in CRANN laboratories.

- Ensure that you have read a current Material Safety Data Sheet (MSDS) for each gas in use in your laboratory and that these are clearly displayed either on or adjacent to the cylinder.
- All compressed cylinder gases should be ordered through the Technical Officer on foot of a signed purchase requisition from the research supervisor.
- Cylinders may not be used in a laboratory except by permission of the College Safety Officer. Only those cylinders, which are in current use, may be kept within the laboratory. Do not store full or empty cylinders in the laboratory.
- A “Compressed Gas Cylinder in use” form (Appendix ??), and a ‘Compressed Gas Permit’ form (Appendix ??) listing all the compressed gas cylinders currently in use must both be displayed outside the entrance to all laboratories containing compressed gases. A compressed gases warning sign must also be displayed.
- Before connecting the gas cylinder or gas supply from a regulator to your apparatus / experiment check the complete system for suitability particularly in terms of pressure rating and materials compatibility.
- All new gas supply pipe work and connections to experiments or equipment should be inspected and leak tested by qualified personnel.
- In laboratories where flammable or other hazardous gases are in use, appropriate signage must be displayed on the laboratory entrances.
- Where possible pipe gases from a secure location outside the laboratory.
- All users of compressed gases must be fully familiar with the appropriate manufacturer’s identification codes and cylinder configurations.
- Never remove or deface gas cylinder identification.
- All such gases shall be contained in approved cylinders of appropriate structural quality which are fitted with approved regulator valves suitable for the pressures involved.
- Cylinders must be handled carefully and correctly at all times. All persons handling cylinders must be trained in vendor (BOC) safe gas manual handling techniques.
- Only suitably equipped (PPE) and trained personnel (BOC safe gas manual handling) may move and connect gas cylinders.
- Gas cylinders which are to be brought into the building for use within laboratories shall firstly be placed in an open air location and fitted with approved regulators which shall be pressurised and tested for leaks at that location. Regulators will then be removed before transport of cylinder commences to point of use.
- Gas cylinders which are brought into laboratories shall, as far as is practicable, be of the minimum size and capacity consistent with the experimental work which is to be carried out.
- Gas cylinders shall be moved into and out of the building / laboratories using a properly constructed trolley or other appropriate means with cylinder restraints in-situ.
- When being used in laboratories gas cylinders shall be properly secured by the use of an approved restraint system.

- Experiments requiring the use of special gases shall generally be conducted in such a manner that the point-of-use of the gas is within an approved fume hood.
- Whenever practicable experiments requiring the use of special gases shall be conducted in the rooftop gas storage and supply facility. In particular, cylinders containing toxic, flammable and pyrophoric gases with a NFPA rating system number of 3 or more may not be used within the building other than in the rooftop storage and supply facility.
- When gas supply from a compressed gas cylinder or central Nitrogen generation plant is not required, the laboratory gas regulators will be set to zero flow and main supply valves turned off.
- Gas detection and Oxygen detection points in laboratories will not be obstructed or interfered with – for your safety these detection points require un-obstructed air flow in order to monitor the gaseous contents of the laboratories in case of leaks or Oxygen depletion.
- Flexible or other hoses utilised to deliver gas from a regulator outlet to the point-of-use shall be of appropriate material and pressure rating, and shall be securely attached to flanges, spigots, etc. in a gas-tight manner and leak checked by technical staff.
- Experimental work shall be scheduled in such a manner that the need to keep gas cylinders in laboratories overnight or at weekends is minimised.
- Gas cylinders shall be removed from the interior of the building immediately after an experiment has been completed following which action the relevant Compressed Gas Permit shall expire.
- The copy of the Compressed Gas Permit forms located on the doors of the relevant laboratory and at the relevant reception desk shall be retrieved and destroyed immediately after the experiment has been completed and the gas cylinder(s) have been removed from the interior of the building.
- At the expiry of a Compressed Gas Permit, the School Safety Officer shall confirm that the gas container has been removed and notices withdrawn.

Empty Gas Cylinders:

Empty gas cylinders are not really empty. They contain gas at atmospheric pressure, which of course does not cause deflection of the gauge needle because the gauge reports the pressure *greater* than atmospheric. The cylinder still contains gas at a pressure of at least 1 Bar depending on cylinder size, this can be a substantial quantity of toxic or flammable substance.

It is important to ensure that gas containers are in a safe condition after use and returned to the vendor as soon as possible. Before returning empty gas containers, a check should be carried out to ensure that:

(a) the cylinder valve is closed and not leaking.

(b) the cylinder valve outlet plug or cap nut, if supplied, has been securely refitted. This is particularly important if the contents of the container are toxic.

Only staff members that have completed the BOC safe gas manual handling course may transport and connect compressed gas cylinders in CRANN.

Personal Protective Equipment (PPE) to be worn for the transportation to and from the gas storage and supply facilities to points of use, and connection of compressed gas cylinders to regulators and manifolds and is mandatory for such gas related operations in CRANN.

Before handling gas cylinders ensure you are wearing the following PPE:

- **Gloves**
- **Safety shoes**
- **Eye Protection.**

Cylinder pressures may be as high as 300 bar and the gas or gas mixture may be flammable and/or toxic so great care must be exercised in their storage, handling and use. In addition the use of some gases will also be subject to the CRANN Chemical Safety Rules and protocols.

Flammable or Explosive Gases constitute a particular hazard within the laboratory environment. Guidance for use of such gases is provided in *CP8 - The Safe Storage of Gaseous Hydrogen in Seamless Cylinders & Similar Containers: 1986,* produced by the British Compressed Gases Association. Such gases may be used only after appropriate local safety rules and procedures have been established by the research supervisor, in consultation with the compressed gases consultant. Such rules and procedures must be formally recorded and clearly displayed along with appropriate warning notices at all entrances to the designated work area.

Risk assessment: The transport, storage and installation of compressed gas cylinders in CRANN (For all technical Staff who have completed BOC Gas Manual Handling Course)

Hazard No. 1 - Physical weight, size and shape of compressed gas cylinders for manual handling:

Risk : Gas cylinders can be very heavy, up to 80 Kgs, and can be unstable and difficult to handle and move due to their shape, size and weight. Physical injury can occur due to incorrect manual handling to persons back / neck, hands / fingers, feet / toes and eyes.

Hazard No.2 - Gaseous contents of compressed gas cylinders:

Risk : Compressed gas cylinders can contain gases that may be toxic, flammable or asphyxiating and are stored at high pressures. Sudden release could result in injury or exposure to dangerous gases for person or persons.

Hazard No.3 - High pressure(s) / potential energies of the gaseous contents of compressed gas cylinders:

Risk : Aside from the chemical risk from the gas, cylinder pressures up to 300 bar are common and serious physical injury / damage can occur due to the full force of the escaping gas should there be a sudden release or depressurisation / explosion.

Hazard No.4 - Incorrect installation of compressed gas cylinder to regulator / manifold or failure of same components:

Risk : Compressed gas cylinder valves are very robust and difficult to break even if the cylinder should fall over. However gas cylinder regulators / manifolds and pig-tails are much less robust and if damaged or fitted incorrectly may allow the catastrophic escape of gas causing injury to person or persons.

The following safety rules and protocols apply for the transport, storage and installation of compressed gas cylinders in CRANN (For all technical Staff who have completed BOC Gas Manual Handling Course)

- Only suitably equipped (PPE) and trained personnel (BOC Gas Manual Handling) may move and connect / disconnect gas cylinders.
- A second trained ‘buddy’ must be present during when compressed gas cylinder are being connected.
- Technical staff, operators and laboratory personnel when handling and using gas should always access the corresponding Material Safety Data Sheet (MSDS) for any gas being stored, transported and used
- Each new installation of a gas cylinder must be leak and pressure tested by technical staff.
- Always use the appropriate gas cylinder trolley to move heavy cylinders and using the trolley restraints to secure the cylinder.
- Gas cylinders should not be transported in *occupied* lifts – send in lift person to person.
- All users of compressed gases must be fully familiar with the appropriate manufacturer’s identification codes and cylinder configurations. (see Appendix I below)
- Never remove or deface cylinder identification.
- Store cylinders vertically and clamp securely to prevent toppling. Cylinders must not be left free standing at any time.
- Store in a well-ventilated area away from any fire risk.
- Valves should be closed and valve outlets plugged or blanked. Valve guards or caps should be securely fitted.
- Separate cylinders of flammable gases from those of oxygen or oxidants by at least 3m or fire wall.
- Use only approved regulators and check their suitability for the gas in use. It is recommended that regulators are either replaced or refurbished after (at maximum) 5 years from date of purchase.
- Before connecting the cylinder to your apparatus check the complete system for suitability particularly in terms of pressure rating and materials compatibility.
- All new pipe work and connections to experiments or equipment should be inspected and leak tested by qualified personnel.
- Never transfer gas from one cylinder to another.
- Report all faulty cylinder valves and regulators immediately to the Technical Officer and/or Safety Officer.
- Always close the main cylinder valve when the cylinder is not in use and ensure that an appropriate cylinder key is readily available for rapid shut down of cylinder output.

Compressed gas cylinder installation and safety inspections.

Users must ensure that the regulator and its bull-nose or manifold and its pigtails is **matched** to the selected compressed gas cylinder / type, and can set correctly at the correct inlet and outlet pressures and required flow rate.

Regulators and bull-nose / manifolds and pig-tails and high pressure safety valve (burst disk) must be visually examined by the user to determine suitability each time a compressed gas cylinder is disconnected and / or connected.

Persons changing compressed gas bottles must ensure that points of use or laboratory regulators on that particular gas network are closed off, if necessary, or current status checked before connecting a new or replacement bottle. The line pressure regulator should then be closed off at the manifold and pressure noted – when the new bottle is connected and manifold vented and leak checked, the line pressure should be reset to the initial gas line pressure. Thereafter the main cylinder valve should be closed and the manifold / regulator pressures checked to verify any leaks in the supply line –

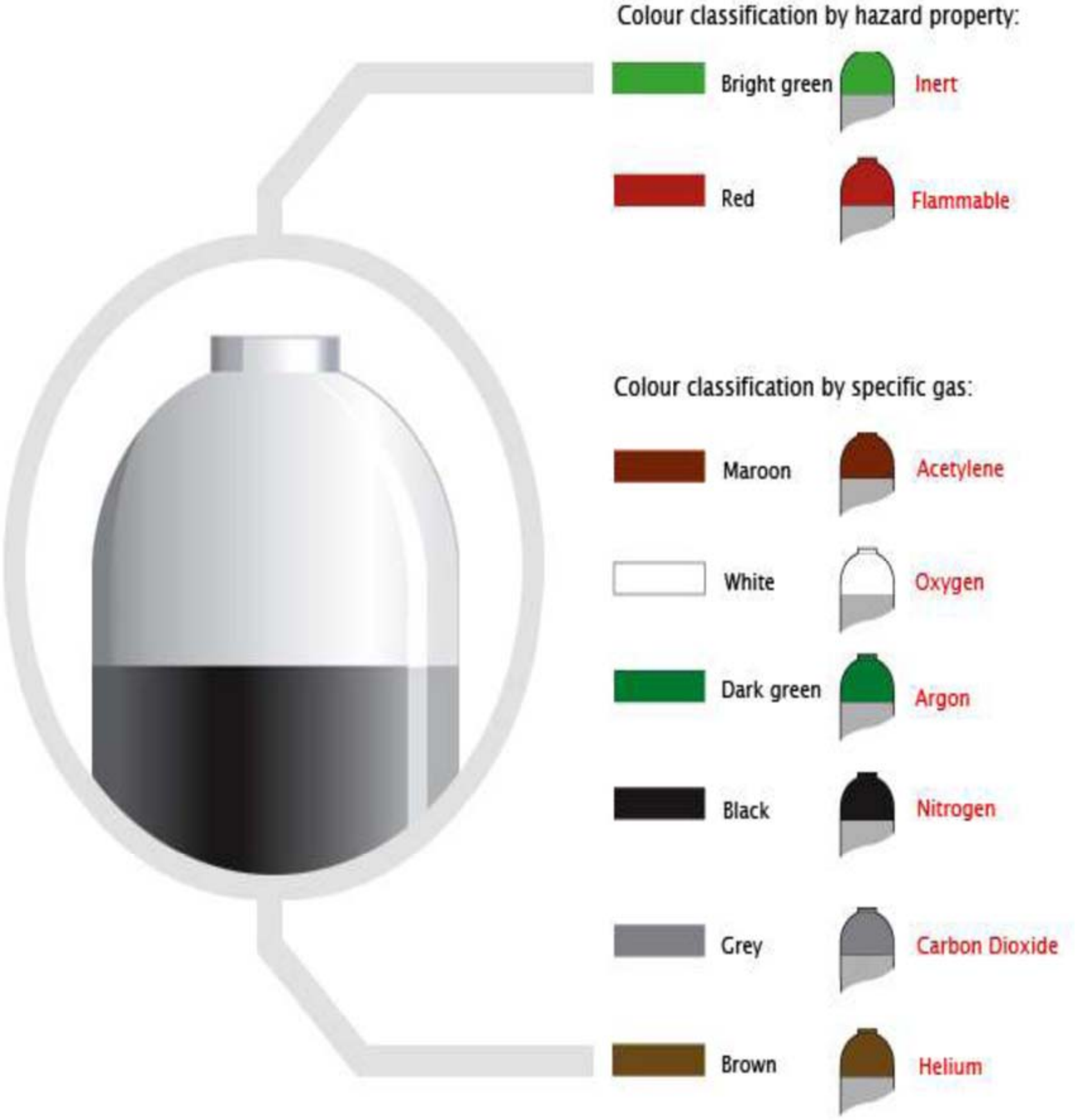
Please see procedure below.

- Ensure that regulator / manifold is clean and free of contamination.
- Check that there is no physical damage to unit and connecting bull-nose / pig-tails.

- Check that there is no damage or dirt in / on pig-tail or bull-nose stem.
- Check that there is no damage or dirt in / on cylinder outlet connection.
- Check all pointers on regulator / manifold gauges read zero.
- Ensure pressure adjusting valves turns freely.
- **Connect regulator bull-nose / manifold pig-tail to compressed gas cylinder, tighten correctly using appropriate bottle key and slowly open main cylinder valve.**
- Check inlet pressure is steady (contents gauge) on regulator / manifold.(200 bar or 3000 psi)
- Use leak detector spray / fluid to check for leaks around connection to cylinder and regulator / manifold.
- **Close main cylinder valve.**
- Check inlet pressure on manifold / regulator reads steady for approx 1 minute.
- **Open main cylinder valve and adjust the line pressure regulator to the specified gas line working pressure.**
- Check bottle contents and outlet pressure gauges are steady at the correct pressures and note the readings.
- **Close main cylinder valve.**
- Check bottle contents and outlet pressure gauges are steady at the correct pressures.
- **Open main cylinder valve and record cylinder change and leak test in gas log.**

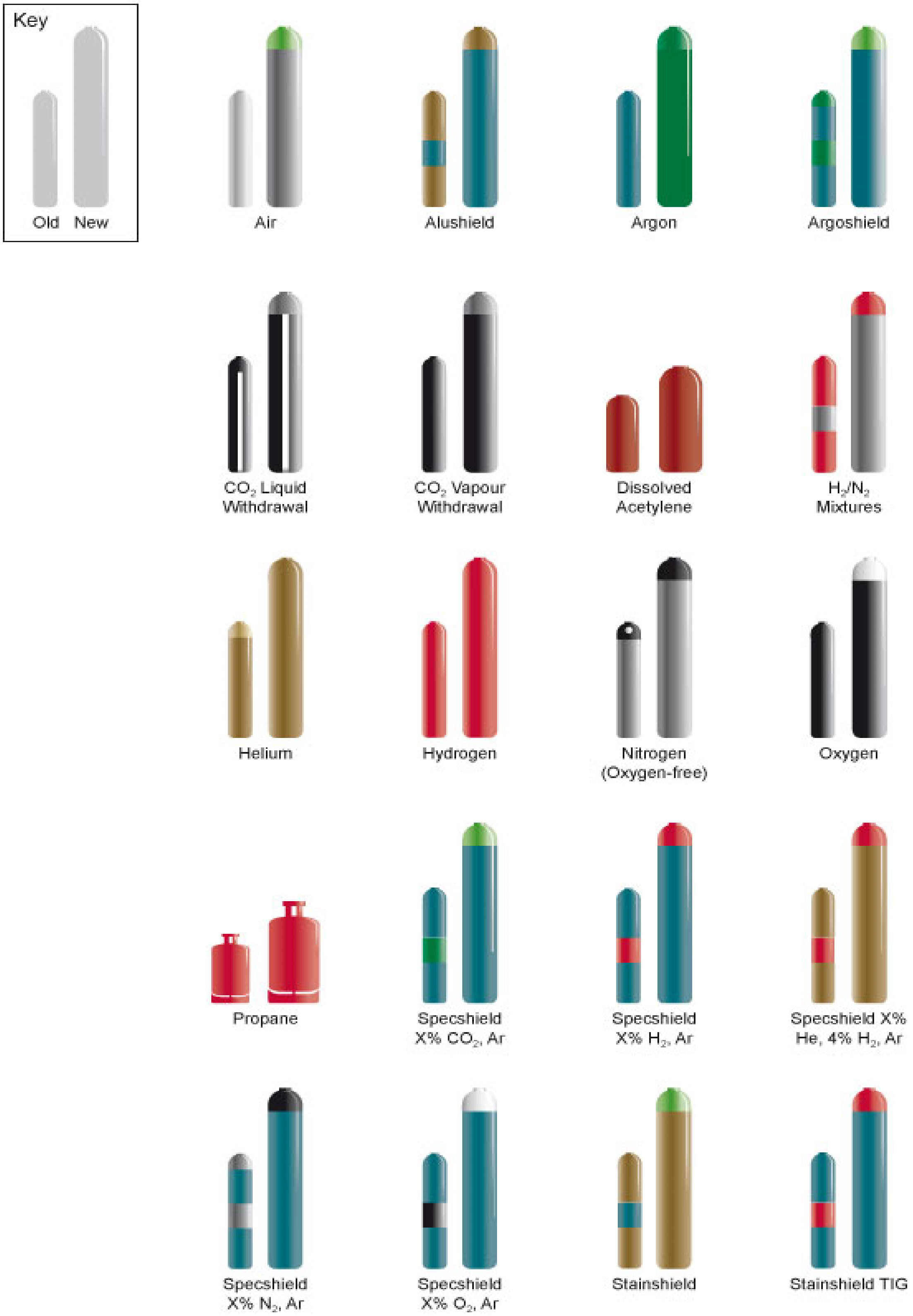
Gas cylinder colour classifications

The following guidance comes from the new EN 1089-3 portable gas cylinder making requirements.



Cylinder body - BOC colour coding scheme

The colour of the body of the cylinder may differ for the same gas among different gas companies. The BOC cylinder body colours are displayed below:



12.8 Cryogenic Liquids safety:

Safe Handling of Cryogenics Safety Briefing - https://www.tcd.ie/Buildings/Safety/safetytraining.php

CRANN

This 1½ hour safety briefing covers the safe handling, storage and use of cryogenics such as liquid nitrogen, the characteristics of cryogenics and associated hazards, personal protective equipment, filling dewars, handling cylinders, oxygen depletion and risk assessment. It is recommended that all staff members and post-graduate students using cryogenic liquids should attend this safety briefing.

The common cryogenic hazards found in the laboratory are caused by liquid nitrogen (boiling point - 196°C, 77K) and liquid helium (boiling point - 269°C, 4K).

Cryogenic materials can pose a number of hazards in the laboratory. These include:

1. Asphyxiation due to the evaporation of cryogenic material into the atmosphere leading to drop in ambient oxygen levels. For instance, nitrogen expands approximately 700 times in volume, going from liquid to gas at ambient temperature.
2. Severe cold "burns" or frostbite may be inflicted if the human body comes in contact with cryogenic fluids, boiled-off vapour, or surfaces cooled by cryogenic fluids.
3. Inhalation of cold vapours can cause lung damage and asthma attacks in asthma sufferers.
4. Cold damage to laboratory equipment such as brittle fractures leading to further hazards. Low temperature equipment can also fail due to thermal stresses caused by differential thermal contraction of the materials.
5. It is possible that air temperatures in the proximity of cryogenic liquids may be lower than the general temperature; therefore hypothermia could be a hazard.
6. Potential hazards exist in highly compressed gases because of the stored energy. In cryogenic systems high pressures are obtained by gas compression during refrigeration, by pumping of liquids to high pressures followed by rapid evaporation, and by confinement of cryogenic fluids with subsequent evaporation. If this confined fluid is suddenly released through a rupture or break in a line, a significant thrust may be experienced.
7. Liquid oxygen poses a risk of oxygen enrichment which may cause normally stable materials to become highly flammable. Escaping liquid oxygen, while not itself a flammable gas, can combine with combustible materials and cause spontaneous combustion. Oxygen clings to clothing and cloth items and presents an acute fire hazard for approximately one-half hour after exposure.
8. Liquid hydrogen and other flammable cryogens also pose significant flammability risks.

Guidance for use of such liquids is provided in CP30 - The Safe Use of Liquid Nitrogen Dewars up to 50 litres: 2000 produced by the British Compressed Gases Association. Guidance for bulk storage is provided in Guidance for bulk storage of cryogenic liquids is provided in CP21 - Bulk Liquid Argon or Nitrogen Storage at Users' Premises. Revision 1: 1998.

The following safety rules will apply to all personnel handling cryogenic liquids or working in areas where cryogenic liquids are used. (Ref: CRANN Cryogenic Risk Assessment)

Introduction

An initial risk assessment must be performed in which the potential depletion or enrichment in oxygen concentration from the largest foreseeable spillage must be calculated for all facilities / laboratories where cryogenic materials are stored or handled, and where there is no Oxygen Depletion Detector installed. The calculation is shown in Section 1 below. The exact type and quantity of the cryogenic material must be detailed on the risk assessment.

Where this could result in an oxygen concentration below 19.5%, corrective actions must be implemented to mitigate the potential. Possible actions include limiting the maximum quantity of cryogenic material stored and handled so that oxygen depletion below 19.5% cannot arise, moving the process requiring cryogenic materials to a larger laboratory, providing engineering controls such mechanical ventilation with indicators that it is operating, and installing either fixed or temporary / portable oxygen alarms. Where the risk assessment shows that mechanical ventilation and oxygen alarms are needed, CRANN Facilities and Safety / Technical Officers must be consulted before any action is taken. Risk assessments, written operating procedures and training are needed to cover the full range of hazards associated with storage and use of cryogenic materials in any laboratory. The PI is responsible for the development of workplace specific safety information related to the use and storage of cryogenic liquids.

Please Note – All CRANN Laboratories are fitted with an Oxygen Depletion Monitor and a description of the system follows next. (See also Section B; 2.0)

CRANN Oxygen Depletion System

All CRANN laboratories have an O2 Depletion sensor installed. The CRANN gas detection system consists of a total of 67 detectors throughout the building. Fifty five of the detectors are oxygen depletion sensors 'Signalpoint' and the balances are for a number of specific specialist Gases 'Midas'. A central control panel is located in the 5th floor plant room. The fire alarm panel is located on the ground floor at the front desk.
Oxygen depletion sensors are replaced twice yearly and calibrated during each service visit by a third party service provider.
Persons risk assessing cryogenic activities in their laboratory should detail the O2 Depletion sensor number and its calibration date in the Existing Control Measures section of the risk assessment.

System Operation

The gas detection system is always on line monitoring the detectors in each laboratory unless they are specifically isolated or the system is fully turned off. The gas detectors have 2 limits - level 1 and level 2.

Level 1 Gas Detection Alarms (19.5% O2)

Level 1 alarms are indicated visually and audibly at the control panel on Level 5 only. The indicator light will be slowly pulsing light indicating the specific detector activation. When this occurs the room should be examined and any cause identified. Following this it should be logged with date, time, detector number and fault cause if identified. Following this the fault should be cleared from the gas detection panel. Level 1 gas detection alarms do not indicate on the fire alarm panel.

Level 2 Gas Detection Alarms (18.5% O2)

Level 2 alarms also sound at the control panel at the level 5 control panel. Level 2 alarms cause the indicating lamp to pulse rapidly and an audible sound. When this occurs the room should be examined and any cause identified. As it is a level 2 alarm it means the threshold value has been exceeded so great care should be exercised in entering a room that has had such activation. Following this the incident/event should be logged with date, time detector number and fault cause if identified.
In addition when the gas detection control panel is activated in a level 2 alarm it also links to the building fire alarm panel at the entrance. This is a local visual and audible indication of the fire panel - **not the general building alarm**. When a level 2 alarm occurs the fire alarm panel indicates the floor level of the gas alarm level 2 activation. The fire panel is programmed to cause the sounders and beacons on **that floor level only to operate** at a different sound pattern (called a pulse pattern) than the standard fire alarm sound. This

is to warn/advise other occupants on that floor level that activation has taken place.

Risks

1. **Oxygen Deficiency and Asphyxiation – calculation for laboratories without oxygen depletion sensors.**

The **most significant risk** of cryogenic liquids is death by asphyxiation where a spill or leakage depletes the atmospheric oxygen. If the oxygen concentration falls below 18% adverse effects will occur resulting in loss of mental alertness and performance combined with distortion of judgment. In atmospheres containing less than 10% oxygen death by asphyxiation is rapid: just two breaths of oxygen-free air kills. For example, oxygen depletion resulting from a spill of 50 litres of liquid nitrogen in a room 10m x 8m x 3m is calculated below can be determined using the equation:

$$\frac{100 \times V_o}{V_r}$$

Where:

$\mathbf{V_0}$ = $0.209(V_r - V_g)$ (for cryogenic liquids other than oxygen)

$\mathbf{V_r}$ is the volume of the room in m^3

$\mathbf{V_g}$ is the maximum gas release upon the expansion of the cryogenic liquid (volume of liquid in m^3 x expansion coefficient)

To calculate the oxygen concentration when oxygen is the cryogenic liquid, V_o in the formula becomes $0.209(V_r - V_g) + V_g$.

An example of the oxygen depletion resulting from a spill of 50 litres of liquid nitrogen in a room 5m x 10m x 3m is calculated as: 100 X 0.209(150 m^3 - (0.05 m^3 X 682))/150 m^3 = 100 x 0.209 X 115.9/150 = 16.2

Oxygen levels will deplete to 16.2% in the immediate area following a spill of 50l of liquid nitrogen in a room of this size. This is a serious drop in oxygen levels and could lead to serious injury in the event of a spill.

2. **Cold burns, Frostbite and Hypothermia**

   1. Contact of the skin with cryogenic liquids (or even cold gas) can cause severe cryogenic burns; the tissue damage that results is similar to that caused by frost bite or thermal burns. While the cold itself can reduce the feeling of pain, the subsequent thawing of tissue can cause intense pain.
   2. Contact with non-insulated parts or equipment or vessels containing cryogenic liquids can produce similar damage. Unprotected parts of the skin may stick to low-temperature surfaces and flesh may be torn upon removal.
   3. Inhalation of cold vapour can cause damage to the lungs and may trigger an asthma attack in susceptible individuals.
   4. Hypothermia is a risk due to the low temperatures arising from the proximity of cryogenic liquids. Risk is dependent upon the length of exposure, the atmospheric temperature and the individual; those exposed for prolonged periods should be warmly clothed.

3. **Oxygen Enrichment**

Although not flammable, oxygen when present in higher concentrations can significantly increase the chance of fire or an explosion. The boiling point of oxygen is above those of nitrogen and helium. In closed systems (such as cold traps cooled with liquid nitrogen) these liquids can cause oxygen to condense on their surface (resulting in a bluish liquid on the surface). This can lead to the ignition of normally non-combustible materials and the flammability limits of flammable gases and vapours are widened. Oil and grease may spontaneously ignite and as such should not be use where oxygen enrichment may occur.

4. **Pressurization and Explosion**

Cryogenic liquids vaporize with a volume change ratio of 700-900 can cause violent changes in pressure, particularly if this occurs in a confined space. This in turn can result in an explosion. Vent systems must be in place to allow gas to escape from confined spaces.

Pressurization can occur due to the following:

1. Ice forming on the venting tube, plugging it and preventing gas release.
2. Damaged equipment resulting in cryogenic fluids leaking into small areas, upon vaporization the cryogenic liquid vaporizes and causes pressure build up.
3. Loss of vacuum inside a cryostat or Dewar.
4. If a liquid helium-cooled superconducting magnet "quenches" (changes spontaneously from a superconducting state to a normal state).
5. Liquid nitrogen having permeated through sealed cryotubes containing samples which then return to room temperature.
6. Direct contact of the cryogenic liquid with water in a tube results in rapid vaporization of the cryogenic liquid and can cause the tube to explode.

5. **Damage to Equipment**

The very cold temperatures of cryogenic liquids can damage equipment and materials, which can result in danger. Examples of damage include the following:

1. Spilled liquid nitrogen can crack tiles and damage flooring such as vinyl.
2. Rubber tubing may become brittle and crack during use.
3. Condensation of water around electrical cables may result in an electrical shock hazard.

Required Control Measures to Reduce Risk

Handling, Storage, Transport and Use of Cryogenic Materials

1. Handling

No person may handle or use cryogenic material without being suitably trained in its safe use. It is the responsibility of principal investigators and laboratory supervisors / managers to ensure that all persons under their control using cryogens have been trained, and that full records of such training are maintained.

TCD Safe Handling of Cryogenics Safety Briefing https://www.tcd.ie/Buildings/Safety/safetytraining.php

1. Material Safety Data Sheets (MSDS) for each cryogenic material must be available for any such material in use in the laboratory.
2. Suitable Personal Protective Equipment (PPE) must be worn when handing or working with cryogenic liquids.
   At a minimum this should include:
   a. Face shield and goggles must be worn during the transfer and normal handling of large volumes of material or when pouring / decanting cryogenic liquids or filling secondary containers and dewar flasks.
   b. Safety glasses must be worn when working with small volumes of cryogens.
   c. Protective gloves conforming to BS EN 511 (Cold Protection). The gloves should be specifically designed for cryogenic handling with ribbed cuffs to prevent splashing into the glove or be loose fitting gauntlets that can easily be removed. The glove material should be rough to give good grip while handling and not increase the chance of spillage
   d. Suitable apron for handling large volumes of cryogenic material.
   e. Closed laboratory coat must be worn for all cryogenic material handling.
   f. Safety boots when handling large volumes or large containers. Boots must be worn in such a way that there is no risk of spilled material getting inside the boot (i.e. they must be tucked under trouser legs)
3. Long sleeves and trouser legs must be worn when handling cryogenic material. **There must be minimal exposed skin when handling cryogenic materials.**
4. All metallic jewellery should be removed when handling cryogenic materials as metal items will quickly spread the cold from any contact with the cryogenic material.
5. Transfer operations involving open cryogenic containers, such as dewars, must be conducted slowly to minimize boiling and splashing of the cryogenic fluid. Transfer of cryogenic fluids from open containers must occur below chest level of the person pouring liquid.
6. Such operations shall be conducted only in well ventilated areas to prevent the possible gas or vapour accumulation, which may produce an oxygen-deficient atmosphere and lead to asphyxiation. The volumetric expansion ratio between liquid and atmospheric nitrogen is approximately 700 to 1.

2. Storage

A cryogenic liquid storage unit left open to the atmosphere, or catastrophic failure of a storage unit, could create an oxygen deficient atmosphere. Follow these procedures to reduce the likelihood of this occurrence:

1. Storage vessels must be suitably rated for the holding of cryogenic materials. Vessels holding cryogenic materials will be subjected to cold temperatures and increased internal pressure. Carbon steel, plastics and rubber becomes brittle and may fracture at low temperatures.
2. Storage vessels for liquid oxygen must be kept clean to avoid contamination with materials that might become flammable in an oxygen enriched environment.
3. Purpose designed non pressurised vacuum flasks must be used to store volumes of cryogenic liquids between 1-50 litres, i.e. Dewar Flasks. Dewar Flasks must have non sealed stoppers to allow boiling material to vent. Any glass component of a Dewar flask must be covered in tape to prevent shattering in the event of an explosion.
4. Always make sure that containers of liquid nitrogen are suitably vented and unlikely to block due to ice

formation.
5. Small Dewar flasks may be carried by hand. All other cryogenic liquid containers must be carried in or on purpose built trolleys.
6. Bulk storage (>25 litres) areas for cryogenic materials must:
    a. Display hazard warning signage on laboratory door or storage area.
    b. Be restricted to authorised personnel only.
    c. Be isolated from naked flames and other ignition sources if they contain liquid oxygen, hydrogen or any other flammable cryogen.
    d. Be continuously ventilated.
    e. Have more than one escape route if possible.
    f. The use of atmospheric oxygen sensors should be considered in areas where large amounts of cryogenic materials are stored, if not already available.
7. Bulk storage areas should be subjected to an assessment of oxygen levels during spillages, storage and topping up / refilling of cryogens. Be aware that CO_2 can be toxic at elevated atmospheric levels as well as displacing oxygen.

3. Transport

1. When transporting Dewars and Dewar Flasks the appropriate PPE must be worn (see above).
2. Cryogenic material must only be transported when necessary.
3. Heavily populated areas within buildings must be avoided or traversed during periods of low occupancy.
4. Extreme care must be taken when negotiating paths, edges and steps.
5. Where possible Dewars must not be transported up or down stairs unless they are small enough to be carried by hand.
6. If transporting Dewars in lifts then the following protocol should be followed:
    a. Dewars must not be accompanied in lift. A lift is a confined space and should leakages occur asphyxiation is possible.
    b. One person should place the Dewar in the lift whilst another waits to receive the Dewar from the lift once the journey is complete.
    c. There should be a clearly visible sign on the Dewar warning others not to enter the lift with the Dewar.
    d. Where possible a goods lifts should be used.
7. If transporting Dewars in vehicles then they should be held in a well ventilated area in a separate compartment to the driver. Drivers should be aware that the transport of cryogenic materials off the university campus may be regulated by *Carriage Of Dangerous Goods Regulations*. Further information is available from the TCD Safety Office.

4. Transport between buildings on campus.

Follow the guidelines above, plus the following.

1. In addition, avoid grates, large cracks in pathways/pavements, or other hazards that could cause tripping.
2. For transport of large nitrogen Dewars outside -- over pavement, pathways, speed ramps, wheelchair access ramps, a 4-wheel tipcart should be used. The casters welded to the tank, and/or the casters on the trollies in common use, are not meant for transport over pavement and concrete.
3. While in route exercise great care stay completely clear of drainage grates, large cracks, and/or uneven portions of the pavement, and any other hazards which could catch a cart wheel and cause tipping.

5. Use of Cryogenic Materials and Systems

1. An oxygen depletion / enrichment assessment should be carried out to determine the likelihood of an

oxygen deficient / enriched atmosphere developing following a spill of material when larger volumes of cryogens are in use, if and oxygen depletion sensor is not already installed, calibrated and operational in the proposed work area or laboratory. Oxygen depleted atmospheres pose a risk of anoxia whilst oxygen enriched atmospheres pose a fire risk. If enriched or depleted atmospheres are generated then suitable emergency response plans should be put in place.

2. When pouring cryogenic liquids do so slowly and carefully to minimise splashing and rapid cooling of the receiving container.
3. Always use thongs when placing or removing items from cryogenic liquids and vessels.
4. Avoid the use of wide-necked, shallow vessels to prevent excessive evaporation and the possibility of oxygen depletion / enrichment.
5. Never overfill dewars or dewar flasks.
6. Use dip sticks to check liquid depth in Dewars. Do not use fingers.
7. When disposing of cryogenic materials do NOT pour them down the sink or allow them to vaporise into enclosed areas such as laboratories, fridges, freezers, cold rooms, etc. Cryogenic materials to be disposed of through vaporisation must be left in well ventilated areas, e.g. a fume hood.
8. Pregnant females and asthmatic workers must seek medical approval prior to working with cryogenic materials.
9. Low temperature damage to the insulation on electrical cables can lead to electrocution and equipment damage. Cryogen users must ensure that cables are not placed where they can be affected by cryogen spills.
10. Equipment cooled outside by liquid nitrogen but open to air may allow liquid oxygen to form inside which can create a dangerous pressure rise on warming or an explosion or fire in contact with flammable or combustible material. Use liquid nitrogen to cool sealed or evacuated systems only.
11. The ability of liquid nitrogen to cause condensation of liquid oxygen from the air onto cooled pipe work must be considered when designing processes involving liquid nitrogen.
12. Beware of the formation of liquid oxygen in cold traps that are open to air or the increase of liquid oxygen content in a flask of liquid nitrogen that has been cold for a long period.
13. If necessary the use of oxygen depletion and or gas detection alarms should be considered in areas in which large volumes of cryogenic materials are stored or handled.
14. Lone working with cryogens should be avoided wherever possible. If required a Lone Working Risk assessment should be carried out.

Mandatory Personal Protective Equipment and Safety Precautions

1. **Employee Information and Training** - All people who work with low temperature liquefied gases or systems using such gases should be given attend safety training on the risks of asphyxiation, fire hazards, cold burns, frostbite and hypothermia.

   TCD Safe Handling of Cryogenics Safety Briefing - https://www.tcd.ie/Buildings/Safety/safetytraining.php
   This 1½ hour safety briefing covers the safe handling, storage and use of cryogenics such as liquid nitrogen, the characteristics of cryogenics and associated hazards, personal protective equipment, filling dewars, handling cylinders, oxygen depletion and risk assessment. It is recommended that all staff members and post-graduate students using cryogenic liquids should attend this safety briefing.

2. **Eye Protection** – Safety eyewear, goggles or face shield to EN166 should be used to avoid exposure to liquid splashes. Face shield required for handling large volumes of material or when pouring cryogenic liquids or filling containers at all times.

3. **Body Protection**
   1. Protect eyes, face and skin from contact with product.
   2. Suitable apron for handling large volumes of material or decanting material. Closed laboratory coat

3. Safety boots when handling large volumes or large containers. Boots must be worn in such a way that there is no risk of spilled material getting inside the boot (i.e. they must be tucked under trouser legs)
4. Long sleeves and trouser legs must be worn when handling cryogenic material. There must be minimal exposed skin at all times.

4. **Hand protection** – Wear protective gloves conforming to BS EN 511 (Cold Protection). The gloves should be specifically designed for cryogenic handling with ribbed cuffs to prevent splashing into the glove or be loose fitting gauntlets that can easily be removed. The glove material should be rough to give good grip while handling and not increase the chance of spillage

Emergency Procedures

University Emergency Number: 1999 or 1317

1. **First Aid Measures - First Aid General Information:**

Liquid Nitrogen (LN2) is the most commonly used cryogenic liquid. Oxygen depletion resulting from nitrogen gas may occur rapidly with no warning properties. A person entering an oxygen deficient environment may become disoriented and unable to respond properly. Nitrogen gas is odorless, colorless, tasteless, and inert. The failure of a large Dewar could spill 180 L of LN2 which in gas form will completely displace all oxygen in a 21x21x10 ft room. A much smaller spill in the same room could still create a safety hazard. Simply reducing the oxygen content in a room below 19.5 % is considered an oxygen deficient environment.

If a spill occurs, immediately exit the affected area. For large spills immediately contact TCD college emergency at ext. 1999, and notify a member of the technical staff as the spill area may need to be monitored for oxygen levels to determine when it is safe to re-enter. Please see spillage and accidental release measures below.

If experiencing symptoms such as light-headedness, dizziness, or confusion, immediately exit the area, seek fresh air and request medical attention.

If an employee becomes unconscious in a cryogenic liquid storage area or any confined space that has become oxygen deficient, they should only be retrieved by personnel using proper PPE (such as a Self-Contained Breathing Apparatus(SCBA)). If none is available, then do not enter to attempt rescue – notify TCD emergency immediately at 1999, giving exact name, location building and lab / room number and request fire brigade assistance with SCBA.
Over fifty percent of deaths associated with asphyxiation in confined spaces occur to would-be rescuers.

Most important symptoms and effects, both acute and delayed in high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. All users of cryogenic material should be aware of the symptoms of anoxia (physiological oxygen depletion). These include dizziness, a narcotic type affect; nausea, confusion, etc. Persons experiencing such symptoms should remove themselves to fresh air. Persons observing such symptoms in co-workers should remove them to fresh air.

First Aid - Inhalation:

Remove victim to uncontaminated area wearing appropriate PPE, and self-contained breathing apparatus if necessary. Keep victim warm and rested. Apply artificial respiration / CPR if breathing has stopped. Immediately contact TCD emergency at 1999 and request medical assistance.

First Aid - Skin / Eye exposure:

In case of frostbite or cold burn exposure from a cryogenic material,

1. Remove any restrictive clothing, but none that is frozen to tissue and flush the affected area with lukewarm water for at least 15 minutes to help return affected tissue to normal body temperature.
2. Apply a sterile dressing to the affected area. Do not apply dry heat or rub damaged flesh or eyes. Immediately flush eyes thoroughly with lukewarm water for at least 15 minutes.
3. Contact TCD emergency at 1999 and request medical attention.

First Aid Ingestion:

Ingestion is not considered a potential route of exposure.

2. Spillage / Accidental Release Measures - Personal precautions, protective equipment and emergency procedures

Evacuate area. Use PPE. Wear self-contained breathing apparatus when entering affected area unless atmosphere is proved to be safe. Ensure adequate air ventilation is made available by opening doors and windows if safe to do so. If possible prevent spillage from entering sewers, basements and work pits, or any place where its accumulation can be dangerous.

MINOR SPILL (< 1 litre)

1. Allow liquid to evaporate, ensuring there is adequate ventilation in the spill area.
2. Following return to room temperature, inspect area where spillage has occurred.
3. If there is any damage to the floors, benches or walls, report it to technical staff / TCD buildings office.
4. If any equipment has been damaged following the spillage, inform your supervisor and notify technical staff immediately.

MAJOR RELEASE (> 1 litre)

1. Shut off all sources of ignition.
2. Evacuate area of all personnel.
3. Inform technical staff, H&S and your supervisor.
4. **DO NOT** return to the area until it has been declared safe by technical staff and H&S representative.

3. Fire Fighting Measures - Extinguishing media- Suitable extinguishing media

All known extinguishants can be used.

Raise the Alarm – glass break unit or call 1999.

Advice for fire-fighters- Specific methods

If possible, stop flow of product. Move container away or cool with water from a protected position.

Special protective equipment for fire-fighters - In confined space use self-contained breathing apparatus.

References.

- CGA P-12-1993, Safe Handling of Cryogenic Liquids
- BOC / Linde Group, Care with Cryogenics
- UCD – UCD4 Handling and Use of Cryogenic Liquids
- Arizona State University, Safety Handling Procedures for Cryogenic Materials
- EIGA SL 01/03 Dangers of Asphyxiation Leaflet

Physical Properties of Common Cryogens

Physical properties of common cryogens

	Boiling Point (K)	Liquid-to-gas Expansion Ratio	Gas Specific Density	Critical Temperature (K)	Critical Pressure (atm)	Liquid Density (g/l)
He	4.2	780	0.14	5.2	2.2	125
H_2	20.3	865	0.07	33.0	12.8	71
Ne	27.1	1470	0.70	44.4	26.2	1206
N_2	77.3	710	0.97	126.3	33.5	808
air	--	--	1.00	--	--	--
Ar	87.3	860	1.39	150.9	48.3	1402
O_2	90.2	875	1.11	154.8	50.1	1410
CO_2	194.7	790	1.70	304.2	72.8	1560
R-12	243.4	294	4.35	385	40.6	1487

12.9 Nano materials Handling Safety.

Introduction.

These guidelines are sourced from Industrial standard practice and TCD Department of Physics standard practice.

General Guidelines

- Classifies Nano materials as harmful (Xn) except where the SDS defines a higher class.

- Use Zero-Stat gun when handling Nanotubes (NT) or transferring them to other containers
- Use suitable PPE (gloves, goggles, clothing) and respirators with HEPA (high efficiency particulate air) filters
- Reduce Exposure as much as possible
- Production should be done within a contained process
- Always weigh out large amounts in a glove box

And where possible/ practical:

- Isolate individuals who are using NTs or provide suitable protection for people in the vicinity
- Monitor exposure concentrations
- Quantum dots are to be used only in a chemical fume hood. Do not breathe vapour. Do not get in eyes, on skin, on clothing. Avoid exposure - obtain special instructions before use. Wash contaminated clothing before re-use. Wash thoroughly after handling. Follow the risk and safety phrases on the MSDS. Wear suitable PPE.

CRANN Nanomaterial Handling Procedures

Task	Procedure

Handling, mixing or measuring liquid suspensions of nano materials when there is potential for aerosolization of dried liquids	Use in (Approved) Ventilated Laboratory Hood or local exhaust enclosure. • Safety goggles • Latex or Nitrile clean room gloves • Wet cleaning of laboratory hood surfaces or local exhaust enclosure following conclusion of handling operations.
Handling, mixing or measuring dry powders when there is potential for aerosolization and release of nano materials into the workplace atmosphere.	Use in (Approved) Ventilated Laboratory Hood or local exhaust enclosure with the following PPE. • Double pair of Latex or nitrile clean room gloves • Wet cleaning of laboratory hood surfaces or local exhaust enclosure following conclusion of handling operations.

Task	Procedure
Handling, mixing or measuring liquid suspensions of nano materials when there is potential for aerosolization of dried liquids	Use in (Approved) Ventilated Laboratory Hood or local exhaust enclosure. • Safety goggles • Latex or Nitrile clean room gloves • Wet cleaning of laboratory hood surfaces or local exhaust enclosure following conclusion of handling operations.
Handling substrates or material surfaces that have been coated with nano materials which are permanently bonded to the substrate surface.	• Minimise use in the open atmosphere while wearing the following PPE: • Latex or Nitrile clean room gloves

Task	Procedure

Local exhaust systems utilized to control nanomaterial emissions from process tools / instrumentation	**All local exhaust systems utilized to capture nano materials will be HEPA filtered or equivalent filtering process prior to discharge to the outside environment. Filtered exhaust air will not be recirculated back into the workplace environment.**

Task	**Procedure**
Solid waste containing nano materials	**Solid wastes containing nano materials will be managed under ventilation controls until they are properly packaged and sealed for disposal. Standard waste analysis will be performed on any solid waste produced which contains nano materials. Appropriate waste streams will determined based on analysis results. As new, proven analysis methods and techniques are developed for nano materials, they will be employed in waste stream characterization.**

Task	**Procedure**
Dispensing of nanomaterial suspensions directly onto wafers or substrates	• **Ventilated laboratory hood.** • **Latex or nitrile clean room gloves** • **Standard laboratory PPE** • **Note: Additional PPE or EHS controls may be required based on the suspension solvent selection.**
Dispensing of nanomaterial suspensions onto wafers or substrates within wafer spin coaters	• **Ventilated wafer spin coaters (wet bench)** • **Latex or nitrile clean room gloves** • **Standard laboratory PPE** • **Wet cleaning methods when cleaning wafer spin coaters. Note: Additional PPE or EHS controls may be required based on the suspension solvent selection.**

Task	**Procedure**

Operation of nanoparticle generators and or experimental nanomaterial R&D production tools / instrumentation.	**All nanomaterial generators must have sufficient operating controls to prevent employee exposures to nano materials during operating and maintenance procedures** **All nanomaterial generators and R&D research tools shall be SEMI S2 compliant and reviewed by Intel EHS prior to operation.** **All operating and PM procedures must be in accordance with the manufactures instructions / specifications.**

Task	**Procedure**
Handling substrates or material surfaces that have been coated with nano materials that have the potential to become aerosolized or released from the surface of the substrate.	**Nanomaterial coated surfaces shall be handled within ventilated enclosures. When exhaust ventilation is not feasible, respiratory protection shall be utilized to prevent potential inhalation of nano materials. Wet cleaning methods shall be employed to decontaminate surfaces that have been potentially contaminated with nano materials.**
Receipt and Shipping of Nano materials	• **Wear double latex gloves when handling package.** • **Only open package in Fume-Hood whilst wearing disposable latex gloves, FFP3 half face mask and goggles for eye protection.** • **Do not inhale, ingest or touch (with the bare skin) the material inside of this package.** • **Packages must be appropriately labelled as harmful material.**

13. 0 Appendices

13.1 Unattended Apparatus Form

UNATTENDED APPARTUS FORM

Location				
Type of apparatus / experiment				
Services used	**Electricity**	**Water**	**Compressed Gas**	**Cylinder in Room (Y/N)**
				☐
				☐
				☐
				☐
				☐
				☐
Other services or energies				
Special Hazards				

To shut down in an emergency:

Contacts

Name				
Phone				

Please read the instructions on the following page before completing.

Equipment should only be left running when absolutely necessary.

INSTRUCTIONS FOR COMPLETING THIS NOTICE.

If unattended equipment is left running, a completed copy of this notice must be left on the outside of the main doorway of the workroom. In certain circumstances, it may be prudent to attach an additional copy(ies) of this notice to the equipment concerned.

When completing this notice please: **Remember to remove this notice from display when the equipment is no longer running.**

• Print clearly.

• Define the item of equipment to which the notice refers in a clear manner, for example 'Vac rig A' referring to a vacuum system with the letter 'A' boldly displayed on it. If necessary, define the location of the machine to avoid confusion.

• Tick the appropriate box(es) to indicate the service(s) being used and name the cylinder gases / piped gases (if any). If a gas cylinder is used rather than piped gas, check the appropriate box.

• Provide information relating to any special hazards, such as high temperature, high voltage etc., in the 'Hazards' section.

• State the emergency shutdown procedure in a numbered sequence, for example:

1) CLOSE VALVE 'A'

2) OPEN VALVE 'B'

3) ISOLATE MAINS ELECTRICAL SUPPLY AT SOCKET 'C'

4) TURN OFF COOLING WATER AT TAP 'D'

• State your name, home address and telephone number and include details of an alternate who is reasonably familiar with the equipment in the 'Now contact' section.

13.2 CRANN Risk Assessment Form

CRANN RISK ASSESSMENT FORM (please use additional sheets as needed)

CRANN

RISK ASSESSMENT NO: ……………. **Location: …………………………………**

Brief outline of work / activity:			
Hazards / Risks:		L ☐ M ☐ H ☐ L ☐ M ☐ H ☐ L ☐ M ☐ H ☐ L ☐ M ☐ H ☐ L ☐ M ☐ H ☐ L ☐ M ☐ H ☐ L ☐ M ☐ H ☐	
Personnel Exposed:		**Approx. No. of Personnel Exposed**	
Existing control measures:		**Are the risks adequately controlled: Yes / No**	
If NO, list additional controls and actions required:	**Additional controls**	**Action by:**	

Completed by:	**Print Name:**	**Signature:**	**Date:**
Dates of Reviews:			
Supervisior:			

CRANN RISK ASSESSMENT FORM

<u>GUIDANCE NOTES ON COMPLETING THE FORM:</u>

Hazards

• Only list those that you could reasonably expect to cause significant injuries or affect several people.

• Will the work require the use of machines and tools? How can you or anyone else be injured?

• Will the work require the use of chemicals? If so, check safety data sheets for harmful effects and any exposure limits.

• Will the work produce any fumes, vapours, dust or particles? Can they cause significant harm?

• Are there any significant hazards due to where the work is to be done, such as confined space, at height, poor lighting, high/low temperature?

• Specific hazards should be assessed on a separate risk assessment form and cross-referenced with this document. (e.g. Cryogens, Compressed gases etc.)

Who might be exposed:

• Remember to include yourself, your supervisor, others working in or passing through the work area.

• Those more vulnerable or less experienced should be highlighted as they will be more at risk, such as people unfamiliar with the work area, disabled or with medical conditions, *e.g.* Asthma.

Existing control measures:

• List the control measures in place for each of the significant hazards, such as machine guards, ventilation system, use of Personal Protective Equipment (PPE), generic safety method statement/procedure.

• Remember appropriate training is a control measure and should be listed.

• List any Permits to Work, which may be in force. (e.g. Hot work permits)

Are risks adequately controlled?

• With all the existing control measures in place, do any of the significant hazards still have a potential to cause significant harm.

• Use your judgement as to how the work is to be done, by whom and where.

Additional controls:

• List the additional control measures, for each of the significant hazards, which are required to reduce the risk to the lowest so far as is reasonably practicable.

• Additional measures may include such things as: increased ventilation, Permit to Work, confined space entry permit, barriers/fencing, and fall arrest equipment, *etc*.

PPE should only be used as a last resort, if all else fails.

13.3 Compressed Gas Permit Form

CRANN Compressed Gas Permit Form

This form must be completed and countersigned by the research supervisor *and* the CRANN Safety Officer *before* the commencement of any experiment which necessarily requires the use of a cylinder of compressed gas within any laboratory in CRANN.

Your attention is drawn to the mandatory conditions relating to the use of cylinders of compressed gases within laboratories which are set out in document *'Safe Use of Gases and Compressed Gas Cylinders In CRANN'.*

What gas do you propose to use?

(CO, NH, HC=CH , etc.)

Where do you propose to use it?

(Building + Room number)

When will your experiment (a) start (*date + time)*

(b) finish (*date + time)*

<u>Provide an outline of your experimental set-up:</u>

Do not forget to read and complete the normal compressed gas risk assessment form and attach copy to this document

Signed: **Name** .... **Date**..

Supervisor .... **Date**..

Safety Officer .... **Date**...

Note: A COPY OF THIS COMPLETED FORM MUST BE SENT TO THE TCD COLLEGE SAFETY OFFICER.

CRANN

Compressed Gas Cylinder in Use in Laboratory

Notification

CAUTION!!

Compressed Gas Cylinder in Use in CRANN Laboratory.

Location: ……………………………………………………

Gas: ……….…..................….……….. **Hazards:** (toxic, flammable etc.) …………..…...………

Gas: ....….…...………….. **Hazards:** (toxic, flammable etc.) …………......…………

Gas: ....….…...………….. **Hazards:** (toxic, flammable etc.) …………....…………

Gas: ……….............................…………. **Hazards:** (toxic, flammable etc.) …………....…………

MSDS for each compressed gas cylinder must be kept in laboratory or laboratory safety handbook.

In Case of Emergency Contact :

Name: …………....…..........................…...…… **Tel:** ……………...........................……

Name: …………....…..........................……… **Tel:** ……………..................….…..……

Name: ……………...........................…..……… **Tel:** ……………...........................……..

13.5 Nitrogen Generator Process Description

CRANN HOUSE NITROGEN GAS GENERATOR PROCESS DESCRIPTION

Air to Nitrogen Method

Overview:

The Process Description below outlines the method used to generate gaseous Nitrogen from Atmospheric Air. In general terms compressed air is pre-filtered to remove moisture, dust and any oil carry over. Oxygen and other atmospheric gasses are removed by means of a patented Activated Carbon filtration method leaving a stream containing 99% (adjustable) N_2 gas with a Dew point of -40°C. Finally in order to ensure the level of microbiological purity the gas is passed through a 0.22 μm filter. Oxygen and moisture meters are provided to ensure the levels of Nitrogen and moisture in the gas comply with levels indicated above.

Wet Air Generation:

Compressed air is generated at 10 Bar via an oil lubricated rotary screw compressor. The variable speed drive compressor monitors the pressure in the wet air receiver via its electrokon control unit to keep its target pressure i.e. 10 bar, if the compressor goes into alarm a signal goes to the BMS system. This air enters a wet air receiver where bulk wet air/oil is allowed to "drop out" by the hot air condensing against the cold steel receiver. There is a timed on/off drain solenoid valve on the bottom of the wet air receiver directing condensate to drain. The air leaves the receiver and flows to a water separator, which removes up to 99% of bulk liquids. .

Air Pre-filtration

After the water separator the air is directed to a triplex pre-filtration train in a parallel arrangement. The first stage is an "AO" grade filter, = this removes particles down to 1 micron, including water and oil aerosols. The air flows next to an "AA" grade high efficiency oil removal filter with particle removal down to 0.01 Microns, including oil aerosols and water.

The pre-filtered air then enters a desiccant dryer where the pressure dew-point (PDP) of the air is reduced to -40°C typically. All the desiccant dryers are pressure swing absorption method (PSA) and are controlled by a PLC unit. They have each been fitted a with a hygrometer with dew point dependant switching (DDS) which reduces the number of exhaust cycles to save energy consumption. The DDS monitors the dryness of the outlet air and if the air is better than -40°C PDP it goes into economy and saves the purge air being used. The clean air then flows through an "AR" high efficiency dust filter, which removes dry dust particles down to 0.1 micron.

The air then enters an oil vapour removal unit (OVR) where any remaining oil vapour content is reduced to 0.003mg/m³ at 21°C - 0.003 PPM at 70°F. The OVR unit is a carbon tower filter unit with carbon elements in it to remove oil vapour. The cartridge life is 6000 Hrs approx. at full flow of air demand.

The clean dry Oil Free air passes through a further "AO" grade high efficiency dust filter before entering the nitrogen generator.

Nitrogen Generation:

The nitrogen generator produces nitrogen via a "pressure swing adsorption" method (PSA). Specialty carbon molecular sieves separate the oxygen and other gas molecules from the air allowing only 99% adjustable nitrogen to pass on to the next stage. There are three Nitrogen Generators arranged in parallel for use at any one time. Each of The generators have 2 column's A&B One column is always on line while the other column is exhausting itself for regeneration. This is controlled by timing cycles within each Generators controller.

The Nitrogen leaves the generator and flows to a "Buffer Vessel". From this buffer vessel it flows through another "AA" high efficiency dust filter back to the Nitrogen Generator where the nitrogen is then analysed for oxygen content by an on-line line Oxygen analyser. Provided the oxygen content meets the pre-selected oxygen level the nitrogen then exits the generator and flows into the nitrogen bulk storage tank. All of these filters are fitted with visual differential pressure gauges.

If the Nitrogen Gas is not within specification the generator stops the outlet gas to the bulk storage vessel and vents the gas to Atmosphere. The generator then continues to vent the gas until it has come back to the desired purity specifications. On leaving the bulk tank the N_2 gas passes through a Stainless Steel pharmaceutical grade tetpor filter giving sterile gas before entering the existing plant distribution system. A pressure regulator, external oxygen analyser, hygrometer, flow-meter and a pressure transmitter are also fitted to the bulk tank outlet line.

Should a problem occur with any one of the generators the faulty generator goes into alarm. The generator vent valve opens releasing any non-conforming gas to the atmosphere. The other generators carry on as normal. Any of the generators that go off line will come back on line without manual reset once the fault has been eliminated this also applies should a power interruption occur. The two main pre-programmed alarm conditions for the Generators are low inlet air pressure and Hi oxygen levels, both conditions will shut down the output of gas to the plant from that generator.

Generator Economy:

Should the plant not require nitrogen the system automatically goes into an "economy" mode thus providing maximum efficiency and energy savings. The economy mode is controlled by individual outlet gas pressure switches, which sense demand requirements. Each generator's economy start/stop pressure can be set individually. When the generator senses no demand for 15 minutes it starts to shut down. If there is a 7 psi drop in pressure then the generator comes back immediately. All three generators can go into economy mode simultaneously but will return to operating one by one, as demand requires.

All three individual banks of generators can operate independently of each other and their economy settings can be set independently. The economy mode is only an efficiency setting for times of low demand, it will have no effect on the quality of the gas produced. The on/off control of the generators during economy will be seamless. Adjustments will be required to the economy mode based on the actual operating conditions found during commissioning.

Gas Distribution :

An automatic change over system will control a switch back to the existing bulk gas supply system if the tank pressure in bulk liquid nitrogen tank falls below set point pressure. The auto change over mechanism comprises two non-return valves (check valves) working in opposite directions with a ½ bar differential pressure setting.

Alarm/Outputs:

The following list of Alarms and outputs is provided from the Nitrogen generation Plant

1. Each generator will have a volt free alarm output.
2. Each generator will have a 0-20mA output for nitrogen purity.
3. 4-20mA output is from the in line Hygrometer.
4. 4-20mA output from the in line oxygen analyzer.
5. 2 x 4-20mA outputs from the in line pressure transmitter.
6. 2 x 4-20mA outputs from the in line flow-meter.

13.6 Extract from BOC publication 'Safe Under Pressure'

The following information is selected from the BOC publication 'Safe Under Pressure' and is intended for reference and safety training purposes only – booklets and CD ROM detailing the full content are available from CRANN technical staff and will be included as part of any gas safety training safety for staff.

More information can be found in the BOC booklet Safe under pressure.

As a gas user you may work with a variety of different gases in the laboratory environment. Each gas has its own characteristics, which affect:

The way your body reacts to the gas.

The gases behaviour in the environment around you.

Therefore it is essential that you know ALL the properties of the gases you deal and work with. Anyone who works in a laboratory where gas is used or stored should also understand the characteristics and potential hazards of the gas. This includes people who may not work directly with the gas. Operators and laboratory personnel when handling and using gas should always have access to the corresponding Material Safety Data Sheet (MSDS) for any gas stored, transported and used. MSDS will provide information on the gas properties, how to identify hazards associated with the gas, first aid and fire fighting measures, handling and storage information and other useful facts.

MSDS are available on-line from BOC at: http://www.bocsds.com/uk/sds/

One of the most important properties of a gas is its density relative to air:

Gas	Density relative to air	
Hydrogen	0.07	
Helium	0.14	Lighter
Acetylene	0.9	than air
Nitrogen	0.97	
Air	**1**	
Argon	1.38	Heavier
Propane	1.5	than air
Propylene	1.5	
Carbon Dioxide	1.52	

The density dictates whether the gas will rise or fall. Knowing the density of a gas means that you can have a better understanding of where increased risk of hazards may occur in your laboratory or work place.

If the density is lower than air the gas will rise, if higher it will fall.

All gases that are lighter than air will tend to move to the highest point in any enclosed space, they will collect there unless ventilated at high level. Gases that are heavier than air will collect in low-lying areas. For this reason they should be stored well away from drains or ducts where they could collect if a leak occurs.

Gas properties and the associated hazards

Inert Gas Risks - Oxygen Deficiency

Oxygen deficiency can arise when using gases such as nitrogen, carbon dioxide and argon, unless good practice is observed.

This page specifies the dangers and outlines simple precautions to be taken so that every user can employ these gases with confidence and without danger.

Composition of air

The approximate volumetric composition of air is:

Gas	Abbreviation	%
Oxygen	0_2	21%
Nitrogen	N_2	78%
Argon	Ar	1%

- atmospheric gases are non-toxic but alterations in their concentrations - especially that of oxygen - have an effect upon life and combustion processes
- if good practice is not observed accidents may happen as changes in concentration cannot be easily detected by the human senses
- oxygen is not flammable but it does support combustion
- nitrogen and argon inhibit combustion
- when these gases are in the liquid state it is necessary to bear in mind the very low temperatures involved (below -180°C). They can rapidly cause cold burns and make certain materials sufficiently brittle to lead to structural failure

Hazards from oxygen deficiency

Oxygen is essential to life and it is therefore vital that adequate oxygen is present in any atmosphere being breathed.

While a healthy person may survive a short exposure to air with an oxygen content as low as about 16%, no one should ever be asked to endanger his or her life by breathing such an atmosphere.

Oxygen deficiency cannot readily be detected by human senses. Victims are usually unaware of the danger they are in and may even have a feeling of wellbeing.

Symptoms

Human beings vary considerably in their reactions to oxygen deficiency and it is therefore not possible to lay down hard and fast rules.

A general indication of what is likely to happen is given in the table below. It should be appreciated that some individuals may react very differently and the reaction may vary due to the presence of other gases, especially carbon dioxide.

Oxygen content (vol %) Effects and symptoms (at atmospheric pressure)

11-16	Diminution of physical and intellectual performance without the person being aware of this
8-11	Possibility of fainting without prior warning
6-8	Fainting within a few minutes, resuscitation possible if carried out immediately
0-6	Fainting almost immediate

Below 11% oxygen there is a risk of death due to asphyxia unless the person is resuscitated immediately. In general, oxygen deficiency can lead to:

- loss of mental alertness
- distortion of judgement
- brain damage (after a relatively short time)

Causes and avoidance of oxygen deficiency

Oxygen deficiency is best guarded against by careful attention to the following points:

Leakage of gases other than oxygen

- this leads automatically to oxygen deficiency. Newly assembled equipment which uses inert or any other gas should be thoroughly leak-checked by a timed gas pressure drop test. This must be supplemented by testing with an approved leak-test fluid which is compatible with the equipment for which it is being used. Alternatively a solution of 1% Teepol in demineralised water may be used
- all equipment, for instance piping and hose connections, should be properly fitted. Hoses and other equipment should be kept leak-tight and be protected from damage
- all maintenance and repair work should be carried out by experienced and fully skilled personnel
- when the work period is over, the cylinder valve or piped supply stop valve must be turned off. This is in order to avoid possible leakage in the time between the end of one working period and the beginning of the next
- the valves on welding equipment should not be relied upon for turning off the gas supply
- gas cylinders in use should be protected against being knocked or dropped

Spillage of liquid gases

A small amount of liquid can lead to the formation of a large amount of gas.

Consequently, liquid spillage can rapidly cause oxygen deficiency in confined spaces, pits, etc.

Tanks and equipment for the storage and handling of liquid gases should be inspected carefully and maintained in accordance with the relevant regulations or recommendations.

Vent outlets

Vented gases are often deficient in oxygen and work should not be carried out in such atmospheres.

Purging and cryogenic processes

Oxygen deficiency will arise when preparing plant items (such as vessels) for repair by purging with nitrogen or other inert gases.

Processes such as food cooling, ground freezing, cryogenic surgery and blood plasma preservation lead automatically to oxygen-deficient atmospheres.

People should not enter such areas, even if the atmosphere is only slightly deficient in oxygen, unless adequate breathing equipment is used.

Welding and heating processes

All gas welding and heating processes involve taking oxygen from the air and can lead to a deficiency unless the workspace is sufficiently ventilated.

Removal of argon, carbon dioxide and cold gas

Removal of argon, carbon dioxide and cold gas from large vessels and deep pits can be difficult due to the relatively high density of the gas compared with air.

Air introduced into the bottom of such spaces often floats up through the dense gas without displacing it. This presents a special problem in that purging is liable to take much longer than expected.

Detection of oxygen enrichment or deficiency

Measuring instruments

These indicate increases and decreases in the oxygen concentration of the ambient atmosphere and have a measuring range from 0 to 40% by volume of oxygen.

Various measuring techniques are available, giving visible and/or audible warnings and can provide continuous or discontinuous measurement.

Please refer to statement of operation for CRANN Gas Detection / Oxygen Depletion System utilized in the Naughton Institute in Section B; 2.0

Accuracy

The accuracy of the measuring method should be such that the real oxygen value is between 19.5% and 22.5%.

Using measuring instruments

The manufacturer's operating and maintenance instructions must always be carefully followed.

In confined work environments the measuring instrument should be located as near as possible to the worker.

It is recommended that the worker has a portable measuring instrument attached to his working clothes which gives an audible and visual alarm if the oxygen content of the atmosphere is likely to deviate more than 2% from that of normal air.

Other gases

The safety of a space does not depend on oxygen content alone but can be affected by other gases such as fuel gases. These should be analysed as necessary.

Preventative measures

General considerations

Apparatus and or gas generators used for the manufacture, distribution and utilisation of inert gases must be installed and identified in accordance with the recommendations of the industrial gas industry, and must comply with the applicable regulations.

Any leak must be dealt with by adequately trained staff using specific equipment.

Information should be available to all personnel on the actions to be taken by staff and first aiders in the event of an incident.

Operating personnel must at all times obey works rules and regulations and, where called for, protective equipment must be worn.

Breathing equipment

Application

Appropriate breathing equipment is essential in situations where oxygen deficiency can arise and on no account should rescue be attempted without proper equipment and adequate training in its use.

Breathing equipment is not required for oxygen-rich situations.

Types of equipment

Absorbent types of respirator give no assistance whatsoever in an oxygen-deficient atmosphere.

Recommended types of breathing equipment are:

- self-contained breathing apparatus using air cylinders. When wearing this apparatus, it may be difficult to enter manholes
- fresh air masks where the respirator is connected via a tube of adequate length and diameter to a clean compressed air supply or to a region where the atmosphere is of satisfactory composition to support life

Double manning / Buddy system

Where personnel have to work in confined spaces which may become subject to atmospheric oxygen enrichment or deficiency, a watcher must be stationed immediately outside the confined space entrance.

The watcher should hold the rope of a rescue harness attached to the person working in the confined space and should, if necessary, have a winch available.

Analysis

Before people enter a space which may be subject to oxygen enrichment or deficiency the atmosphere should be analysed for oxygen. Free entry is permissible only if the oxygen concentration is between 20 and 22%.

If there is any possibility of a change in concentration, anyone entering such a space must be issued with a personal continuous oxygen-measuring device giving an audible alarm when the oxygen concentration in the atmosphere varies outside the safe limits.

Information and training

All people who work in spaces where oxygen deficiency or enrichment can occur should be given adequate instructions as to the risks involved, special attention being drawn to the nature of the risks, the rapidity of their effects and that the operator may be unaware of the potential danger he is exposed to.

Practical risk-reduction training should be given.

Blanking and ventilation

- any vessel which is connected to a gas source other than air containing 21% oxygen must be disconnected from such a source by the removal of a section of pipe, by the use of a spectacle plate or by inserting blanking spades
- the space should be thoroughly ventilated so as to maintain a normal atmosphere before and during entry
- reliance on the closure of valves to prevent oxygen enrichment or deficiency is not sufficient
- permission to enter such a space may be given only after the issue of a permit certificate signed by the responsible person

Oxygen deficiency – first aid

- remove the patient to the open air without delay and keep him warm
- administer oxygen from an automatic resuscitator or supply artificial respiration by an approved method
- summon medical assistance and continue treatment until the patient revives or professional medical assistance is available
- ensure that all rescue personnel have adequate supplies of oxygen or air from self-contained breathing apparatus or a fresh air line

Detecting Flammable Gas Leaks

Leakage of flammable gases may result in a fire. In the event of a gas leak, first identify the gas and take appropriate action.

The tabled data below provides you with procedures for dealing with leaks for the following gases: dissolved acetylene, LPG and hydrogen.

Dissolved acetylene (DA)

Identifying features:

- hissing sound and often a garlic-like smell will reveal leakage from a dissolved acetylene cylinder
- specific gravity of gas: 0.9
- dissolved acetylene is lighter than air and therefore will dissipate into roof spaces

Problem - suspected leak

Action - suspected leak

- Check to see if valve is properly closed using moderate force (hand tight) Perform a leak test

Problem - persistent leak

Action - persistent leak

- Extinguish all ignition sources
- Evacuate personnel from the area
- Move the cylinder to a safe position - outside and away from drains. Keep the leak uppermost and take care to ensure further risks are not encountered along the way
- Cordon off the area
- Warn everyone in the area of the gas leak and give priority to those downwind or downhill
- Inform BOC and call the Customer Service Centre on 0800 111 333
- Ensure the work area is thoroughly ventilated before returning

Problem -ignited leak

Action - ignited leak

- Extinguish all ignition sources
- Wear leather gauntlet
- Extinguish the flame with a dry powder extinguisher or a wet rag - but only if it is safe to do so
- Close the cylinder valve
- If the flame from the cylinder has started a secondary fire, or is heating the cylinder, evacuate personnel to a safe location
- Call the fire service
- Inform BOC and call the Customer Service Centre on 0800 111 333

Hydrogen

Identifying features:

- hydrogen is colourless and odourless
- hissing will reveal leakage from a cylinder valve

- specific gravity of gas: 0.7
- hydrogen is lighter than air and will therefore gather in roof spaces

Problem - suspected leak

Action - suspected leak

- Hydrogen burns with an invisible flame
- Ensure the suspected leaking gas is not ignited before approaching the cylinder
- Look for evidence of heat haze
- If a leak has ignited, follow the 'ignited leak procedure' below
- Check to see if the valve is properly closed using moderate force (hand tight
- Perform a leak test

Problem - persistent leak

Action - Persistent leak

- Hydrogen burns with an invisible flame
- Ensure the leaking gas is not ignited before approaching the cylinder
- Look for evidence of heat haze
- If a leak has ignited, follow the 'ignited leak procedure' below
- Extinguish all ignition sources
- Evacuate personnel from the area
- Move the cylinder to a safe position outside
- Keep the leak uppermost
- Take care to ensure further risks are not encountered along the way
- Cordon off the area
- Warn everyone in the area of the gas leak and give priority to those downwind or downhill
- Inform BOC and call the Customer Service Centre on 0800 111 333
- Ensure the work area is thoroughly ventilated before returning

Problem - ignited leak

Action - ignited leak

- Extinguish all ignition sources
- Wearing leather gauntlets
- Extinguish the flame with a dry powder extinguisher or a wet rag - but only if it is safe to do so
- Close the cylinder valve
- If the flame from the cylinder has started a secondary fire, or is heating the cylinder, evacuate personnel to a safe location
- Call the fire service
- Inform BOC and call the Customer Service Centre on 0800 111 333

Emergency Procedure for Gas Cylinders in a Fire

Fires present urgent and serious risks to gas users. It is very rare that cylinders are the cause of fires but all gas cylinders, whatever their gas content, are potentially dangerous when directly exposed to a fire.

If subjected to sustained heat from a fire, a cylinder may in some circumstances rupture with explosive force. If it contains fuel gas or oxygen it will cause the fire to burn more ferociously and may cause it to spread.

The force from a cylinder rupture may create flying debris which could cause damage to property and injury to personnel.

Your Emergency Plan, established as part of Employer duties of the Safety Health and Welfare at Work Act and the General Applications Regulations, should take these hazards and risks into account as part of the risk assessment. Therefore in the event of an incident you should follow your established plan.

If a gas cylinder is directly involved in a fire

1. evacuate the area to a minimum of 200 metres from the cylinder
2. call the fire service
3. advise neighbours within the 200-metre hazard zone area about the danger
4. inform BOC: call the Customer Service Centre on 0800 111 333
5. cylinders which are not directly involved in the fire and have not become heated should be moved as quickly as possible to a safe place, provided this can be done without risk to personnel. Make sure the cylinder valves are closed
6. when the fire service arrives, explain the location and number of gas cylinders directly involved in the fire and the names of the gases they contain. The fire service cannot enter your premises to deal with the situation without this information

When the fire has been extinguished

NEVER move or use cylinders that have been exposed to a fire until the fire service or BOC has declared it safe to do so.

Dissolved acetylene (DA) cylinders

- once the fire has been extinguished, dissolved acetylene cylinders which have been involved in the fire need to be cooled for a total of 24 hours
- the fire service will impose a cordon while the cylinder is cooled
- ensure nobody tampers or interferes with the DA cylinder during this period. The fire service will inform you when it is safe to handle the cylinder
- BOC will arrange for the collection of the DA cylinder after the 24-hour cooling period

CRANN

Declaration by Employee

I have fully read and understand the CRANN Safety Statement and its sub sections A to D inclusive.

I agree to abide by the terms of the CRANN Safety Statement, and to carry out my duties in CRANN according to the Safety Statement.

Section A. CRANN Safety Statement.

Section B. CRANN Emergency Procedures.

Section C. CRANN General Safety Rules.

Section D. Safety Rules for CRANN Laboratories and Offices.

Staff Number : ....

Print Name : ....

Signed : ....

Position : ....

Department / School : ....

Supervisor / PI : ....

Date : ....