



RISK ASSESSMENT FOR AN ACTIVITY INVOLVING THE USE OF CRYOGENIC LIQUIDS

This form aids in assessing the hazards associated with the use of cryogenic liquids and the subsequent application of suitable controls**.** To assist with completion of the form, the College Liquid Nitrogen Code of Practice (the principles of which also apply to other cryogenic liquids) can be found on the [Safety Department website](http://www3.imperial.ac.uk/safety/subjects/gasesandcryo).

If you require further help with completing this form, please contact [Safety Department](mailto:safetydept@imperial.ac.uk).

A suitable Standard Operating Procedure (SoP) should exist for all activities involving cryogenic liquids and should include details on the usage of all control measures identified in this risk assessment form

This form is not designed for risk assessing compressed gases – a separate [risk assessment](https://www.imperial.ac.uk/safety/forms/) template exists for this purpose.

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| --- | --- | --- |
| **PERSON RESPONSIBLE FOR THIS WORK (THE PRINCIPAL INVESTIGATOR)** | | |
| Name: | | Position: |
| Department / Section: | Division: | Faculty: |

|  |  |
| --- | --- |
| **PERSON CONDUCTING THIS ASSESSMENT** | |
| Name: | Position: |
| Department/ Section: | Date risk assessment undertaken: |
| Assessment reference No: | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **LOCATION OF THE ACTIVITY** | | | | | | |
| Campus: | | | Building: | | Floor: | Room(s): |
| Access control status of the room: | | | | | | |
| If location of the cryogenic liquids is identical to the location of the activity, please tick this box  and continue to Select the facility type. Otherwise, please provide location of the cryogenic liquids below. | | | | | | |
| **LOCATION OF THE CRYOGENIC LIQUIDS** | | | | | | |
| Campus: | | | Building: | | Floor: | Room(s): |
| Other (i.e. outside), please provide any relevant details: | | | | | | |
| Access control status of the room where the cryogenic liquids are stored: | | | | | | |
| What is the type of facility where the cryogenic liquids are stored? | | | | | | |
|  | **Type 1** | Biorepository / Cryostore supplied with cryogen from an external vessel via a super insulated vacuum line (SIVL) | | | | |
|  | **Type 2** | Internal area where pressurised vessels are used or stored | | | | |
|  | **Type 3** | Internal area containing non-pressurised vessels | | | | |
|  | **Type 4** | Spectroscopy facilities involving the use of cryogenic liquids | | | | |
|  | **Type 5** | External storage area for transportable cryogenic vessels | | | | |
| Number of vessels stored: | | | | \*Volume (L) of the largest vessel: | | |

***\*If cryogenic vessels with a volume equal or larger than 25 L are in use, this form needs to be submitted to and approved by the*** [***Safety Department***](mailto:safetydept@imperial.ac.uk)***.***

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| **DESCRIPTION OF THE ACTIVITY** |
| Describe the activity involving cryogenic liquids and reference any other relevant Standard Operating Procedures (SOPs) and associated Risk Assessments (RAs), e.g. COSHH, Lone working, Manual handling etc / Local Codes of Practice (CoPs): |

**1. IDENTIFICATION OF THE CRYOGENIC LIQUIDS AND HAZARDS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **\*Cryogenic liquid** |  | **Hazardous properties** | **Boiling point** | **Liquid to gas expansion factor** |
| **Liquid Nitrogen** |  | **- Risk of asphyxiation in high concentrations**  **- Cryogenic burns**  **- Frostbite & hypothermia** | **-196oC** | **683** |
| **Liquid Helium** |  | **-269oC** | **739** |
| **Liquid Argon** |  | **-186oC** | **824** |

***\*If you intend to use any other cryogen, please contact*** [***Safety Department***](mailto:safetydept@imperial.ac.uk)***.***

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| **OXYGEN DEPLETION CALCULATION** |
| Please complete the oxygen depletion calculation spreadsheet integrated in this assessment by following the steps below:   * **Open** the Excel spreadsheet by double clicking on the Excel icon below * **Complete the Orange cells** – Note that in the Cryogen cell, Nitrogen appears as default, but this cell is a dropdown list from where you can select the relevant cryogenic liquid and the gas expansion ratio will auto populate accordingly. If you are using a cryogen that is not in the list, please contact [Safety Department](mailto:safetydept@imperial.ac.uk) * Once the Orange cells are completed you will be able to **see the result of the O2 depletion calculation**. Please use this information when considering appropriate control measures for your application in the Risk Assessment (RA). * Click ‘**Save**’ on the Excel spreadsheet and then **close** it – in this way the calculation result remains attached to your RA and can be easily verified when the form is submitted to Local Safety Personnel and/or [Safety Department](mailto:safetydept@imperial.ac.uk). * If multiple (up to three) cryogens are present, please use an Excel spreadsheet for each cryogen by repeating the steps above. * Continue completing the RA and save it once finalised. * If more than three cryogenic liquids are present and additional calculations are necessary, please contact [Safety Department](mailto:safetydept@imperial.ac.uk). |

**2. IDENTIFICATION OF THOSE AT RISK OF EXPOSURE**

Are there any personnel other than laboratory workers who may be at risk from exposure resulting from an uncontrolled release? (e.g. maintenance workers, cleaners etc.)

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ give details: |

**3. PREVENTIVE MEASURES**

|  |  |  |
| --- | --- | --- |
| Briefly justify the need to use cryogenic liquids and why **elimination** or **substitution** with a safer alternative is not possible: | | |
| Has the number of vessels containing cryogenic liquids and their size been minimised? | **Yes**  **No**  **N/A** | Briefly justify the answer provided: |

**4. CONTROL MEASURES**

**4.1 VENTILATION**

a) What type of ventilation is present?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Natural** | **Mechanical** | If ‘**Mechanical**’, what is the estimated number of \*air changes per hour (ACH)?  \*Building Manager may be able to provide this information | | |
| Is there any means of increasing the ventilation above normal level in the event of an uncontrolled release? | | | **Yes**  **No** | If ‘**Yes**’ give details: |

b) If mechanical ventilation is present, does this include extract at low level with grilles free from obstructions?

|  |  |  |  |
| --- | --- | --- | --- |
| **Yes** | **No** | **N/A** | Give details: |

c) Is there any system in place (e.g. airflow monitor or magnehelic gauge) to warn occupants if there is a failure of a mechanical ventilation system?

|  |  |  |  |
| --- | --- | --- | --- |
| **Yes** | **No** | **N/A** | If ‘**Yes**’ describe the type and position of the monitor / gauge: |

d) Is the ventilation system interlocked with the cryogenic liquid supply system?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ give details: |

e) Are all occupants of the area familiar with the ventilation alarm and what action to take if it activates?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ give details: |

**4.2 OXYGEN MONITORING AND DETECTION**

a) Are there any oxygen monitors and alarms present?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Yes** | If ‘**Yes**’, which type of monitors and alarms are present? | **Fixed** | | **Portable** | |
| Describe the type and positioning of any existent sensors and visual/audible alarms (including portable alarms): | | | | |
| If fixed oxygen monitors are present, give last test date: | | | | **N/A** |
| Are portable monitors within calibration date? | | **Yes** | **No** | **N/A** |
| **No** | If ‘No’, justify why they aren’t required: | | | | |

b) If fixed oxygen detection is present, is this interlocked with any safety devices that will stop flow?

|  |  |  |  |
| --- | --- | --- | --- |
| **Yes** | **No** | **N/A** | If ‘**Yes**’ give details: |

c) Are all occupants of the area familiar with oxygen monitoring alarms and what action to take if they activate?

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| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’, give details: |

**4.3 CRYOGENIC LIQUID SUPPLY TYPE**

a) Select what type of cryogenic liquid supply is being used:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Fixed installation**  **Transportable vessel** | If ‘**Transportable vessel**’ please select: | | | **Pressurised vessel** | **Non-pressurised vessel** | |
| If a ‘**Pressurised vessel**’ is used, does the vessel require a \*Written Scheme of Examination (WSE)? | | | | | **Yes** | **No** |
| If ‘**Yes**’ above, does the WSE exist? | | **Yes** | **No** | If ‘**Yes**’, provide reference number: | | |
| If ‘**No**’, give details: | | |

***\*Any vessels with a pressure x volume equal or larger than 250 bar litres require a WSE. If the system requires a WSE, users need to hold a local copy and it also needs to be recorded in the College insurance register, please see*** [***here***](https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/safety/internal/pressure-systems/Pressure-Systems-Guidance-Note.doc) ***for more information. If unsure whether a WSE is required,*** ***please contact*** [***Safety Department***](mailto:safetydept@imperial.ac.uk)***.***

b) Is the installation/vessel subject to a Planned Preventative Maintenance (PPM) scheme and do suitable inspection records exist?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ give details (including frequency): |

***Note: This is often carried out by BOC and the users should hold copies locally.***

**4.4 STORAGE AND TRANSPORT**

a) Are all relevant areas spacious enough and adequately lit for manoeuvring transportable vessels in and out?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | Give details: |

b) Is the flooring material in the area where the vessels are stored and used suitable, levelled and in good condition?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | Give details about the material of floor covering and its current condition: |

c) Are cryogenic vessels stored and used away from sources of excessive heat and emergency escape routes?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | Give details: |

d) Does the room have a vision panel or another means of seeing the occupants inside?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | Give details: |

e) Is a lift used to transport cryogenic vessels between floors?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ specify the type of lift (i.e. goods or passenger), its location and give any additional details including key control, barriers, signage etc.: |

***NOTE: If any vessels are transported off site, this must be in compliance with all regulations concerning the carriage of dangerous goods. Contact your local Safety Adviser / BOC /*** [***Safety Department***](mailto:safetydept@imperial.ac.uk)***.***

f) Are there any significant manual handling issues involved for departmental staff?

|  |  |  |
| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’ describe any particular difficulties and what precautions are in place, including manual handling training attended: |

**4.5 LONE WORKING**

\*Lone working permission:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Is lone working permitted for this activity? | Yes  No | | If ‘**No**’, please continue to Section 4.6 | |
| Is specific consent required for lone working? | Yes  No | If ‘**Yes**’, describe all specific activities and instances when consent for lone working is required: | | |
| Are there any restrictions as to when lone working can take place? | Yes  No | If ‘**Yes**’, describe the restrictions and why these are in place: | | |
| Describe additional precautions to be implemented to overt risk to the lone worker (e.g. safe access to facility, safe use of equipment, adequate emergency procedures): | | | | SOP/CoP/Protocol Reference: |

***\* Lone working is not permitted for any activities in facilities type 1.***

**4.6 EMERGENCY PROCEDURES**

Describe the \*emergency procedures for dealing with an uncontrolled release of cryogenic liquid:

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|  |

***\* If emergency procedures involve automated safety controls, please include the ‘Cause and Effect’ table with this assessment.***

Describe the first aid procedures for dealing with exposure to an uncontrolled release of cryogenic liquid:

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**4.7 INFORMATION, INSTRUCTION AND TRAINING**

a) Does appropriate signage warning of the presence of cryogenic liquids exist in the areas where cryogenic vessels are stored and used?

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| --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’, describe the signage in place: |

b) Have users received adequate information (e.g. RA, SOP, emergency procedures), instruction and on-the-job training (i.e. including use of emergency equipment) within the department?

|  |  |  |  |
| --- | --- | --- | --- |
| **Yes** | **No** | If ‘**Yes**’, describe how this has been achieved: | Give name of instructor and date(s) when on-the-job training took place: |

c) Have users attended formal cryogenics training courses?

|  |  |  |
| --- | --- | --- |
| Cryogenic Liquids and Decanting Liquid Nitrogen – E-Learning |  | Name(s) of user(s) and date(s) of completion: |
| Cryogenic Liquids and Decanting Liquid Nitrogen |  | Name(s) of user(s) and date(s) of completion: |
| Other course(s) |  | Give name(s) of course(s) and location(s) where attended: |
| Name(s) of user(s) and date(s) of completion: |

***Note: Training records should be maintained locally within the department.***

**4.8 PERSONAL PROTECTIVE EQUIPMENT (PPE)**

Select and describe what \*PPE is available:

|  |  |
| --- | --- |
| Gloves  Type: | Eye / face protection  Type: |
| Breathing apparatus (BA)  Type: Self contained  Airline fed | Body / foot protection  Type:  (in addition to lab coats) |
| State which parts of the process PPE is required for (e.g. routine use or emergencies only): | |
| If breathing apparatus is available for emergencies, describe the location, the names of the trained users and the procedures for maintenance: | |

***\*Please note respiratory protection equipment (RPE) such as respirators is of no use in oxygen depleted atmospheres and should NEVER be used to enter such environments.***