**PURPOSE**

To ensure that all personnel within a work area with a fixed gas detection system know how to respond and what actions are to be taken when the fixed gas detection system alarms are activated.

\*Note: It should be noted that an alarm can be activated as a result of sensor failure. See Sensor Failure definition in Section 6.0 of the Fixed Gas Detection System Standard.

\*Note: All personnel are required to receive training on the fixed gas detection system display panel. Prior to entering the area, personnel will look at the display panel to verify it is safe to enter, and no sensor failures are indicated. Any questions or concerns should be directed to the Supervisor responsible for this area, or to Facilities at 403.220.7555.

**HAZARD IDENTIFICATION FOR CRYOGENIC LIQUIDS**

Extreme Cold

Contact with cryogenic liquids can cause cryogenic burn (instant frostbite) and tissue damage. Loss of vision may result from eye contact.

Pressure Build up

Cryogenic liquids pose a high pressure hazard as the liquid form expands 700x to the gaseous state, thus, enclosed containers risk rupture and for this reason must be vented.

Oxygen Deficiency

Asphyxiation may result from buildup of inert gas in an enclosed space causing an oxygen deficient atmosphere.

**RESPONSE PROCEDURES IN THE EVENT WARNING AND/OR EVACUATION ALARMS ARE ACTIVATED IN RELATION TO LABORATORY ACTIVITIES**

Alarm Set Points

* Normal (ambient) oxygen level is 20.9%
* Warning Alarm is activated when the oxygen level is less than 20.3%
  + provides time to correct a procedure and evaluate
* Evacuation Alarm is activated when the oxygen level is less than 19.5%
  + evacuate and assess from outside of the laboratory space
  + evacuation alarm for oxygen sensors are to evacuate the space ONLY, not the building

ATTACH at the end of this document, the most recent version of the Fixed Gas Detection Notification, Specification, & Operational Parameters sheet as provided by Facilities – Maintenance & Planning.

Warning Alarm Activation (has been verified not to be sensor failure)

* Notify all occupants of the space.
* Stop the flow of asphyxiant gas(es) or cryogenic liquids such as liquid nitrogen, liquid argon, or liquid helium, and stop any activities.
* Go to the gas detection display panel and determine which sensor location has been activated *(i.e. sensor near floor vs. sensor near ceiling)* and oxygen concentration levels – this information will need to be communicated to Campus Security.
* Ventilation procedures *(i.e. turn on exhaust fan, open doors to lab space for oxygen sensors ONLY, etc.)*.
  + INSERT VENTILATION PROCEDURES
* Notify Campus Security (403-220-5333) and Supervisor INSERT PHONE NUMBER that warning alarm has been activated, and suspected cause of the alarm (see Appendix II for potential causes).

Evacuation Alarm Activation

* All personnel to evacuate the space.
* Notify Campus Security (403-220-5333) and Supervisor INSERT PHONE NUMBER that evacuation alarm has been activated.
* One individual to meet Campus Security at Fire Panel located at INSERT BUILDING & ROOM NUMBER
* One individual (if available) to remain by gas detection system display panel and ensure no one else enters the space
* Inform Campus Security of the suspected cause of the alarm. (See Appendix II of this document, Alarm Causes and Resolution Flow Chart)

**ACTIVITIES THAT MAY ACTIVATE A GAS DETECTION ALARM**

* INSERT ACTIVITIES / KNOWN PROCESSES / SOP, ETC.

\*Note: All gas detection system sensors have a life expectancy and replacement schedule. The manufacturer’s specifications must be followed for the replacement of sensors.

*Examples:*

*1) NMR’s contain large amounts of cryogenic liquids that can create an oxygen deficient atmosphere during the filling process or during venting of the vessels.*

*2) Ventilation in the laboratory or space has been reduced or is not functioning normally. If the supply or exhaust fans shutdown due to failure the lack of new air being blown into the room may cause an oxygen deficient atmosphere.*

**Engineering / Ventilation Controls:**

Describe any specific engineering / ventilation controls that have been implemented to prevent employee exposures to hazards. *Examples: fume hoods, equipment interlocks, supplemental ventilation, safety features on equipment, etc.*

Controls:

* INSERT CONTROLS

*Example: Prior to filling an NMR*

* *Turn on supplemental exhaust fan (i.e. marked controls are on west wall).*
* *Open the north door*

**SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS**

Storage Requirements:

* INSERT REQUIREMENTS (i.e. ventilated cabinet)

Transportation Methods:

* INSERT METHODS (i.e. gas cylinder cart)

Transfer of Material Protocols:

* INSERT PROTOCOLS

Method for Determining When Containers are Full:

* INSERT METHODS (overfilling of equipment will cause the excess to spill or vent into the laboratory space).

**WASTE DISPOSAL**

\*Note: Cryogenic liquids are NOT to be discharged or poured into any sewer or sink drain.

Waste Disposal Procedures and/or Packaging Requirements:

* INSERT PROCEDURES AND/OR REQUIREMENTS

**APPROVAL REQUIRED**

Indicate if, and when an approval from the Principal Investigator/Supervisor and/or Environment, Health and Safety is required.

Activities Requiring Approval:

* INSERT ACTIVITIES REQUIRING APPROVALS AND BY WHOM

*Examples:*

*1) Changing the methodology for transferring cryogenic liquids to equipment/vessels – must be approved by the Principal Investigator/Supervisor.*

*2) Increasing the volume of cryogenic liquids being stored in the space – must be reported to Environment, Health and Safety.*

**UNIVERSITY NOTIFICATION**

Activities where University Stakeholders Need to be Notified Prior to the Start of a Hazardous Protocol:

* INSERT ACTIVITIES AND FROM WHOM i.e. Environmental Health and Safety / Facilities / Dean

*Examples:*

*1) Intentionally* quenching an NMR.

*2) Operation of an NMR with loss of gas detection system.*

*3) Change in the Dewar storage requirements of the facility or operations*

**AUTHORIZATION**

Authorization to work in a laboratory where fixed gas detection is installed, should be limited to occupants who have completed required operational and safety training. A training record is provided in Appendix I of this document which outlines training requirements.

**RESPONSE PROCEDURES IN THE EVENT OF AN EMERGENCY UNRELATED TO LABORATORY ACTIVITIES (e.g. building fire alarm)**

* INSERT / ATTACH RESPONSE PROCEDURES

*Examples for consideration:*

* *Turn off / shut down…*
* *Evacuate the laboratory via…*
* *Evacuate the building via…*
* *Notify Principal Investigator / Supervisor at…*
* *Go to the assembly point located at…*
* *Any information to be communicated to Campus Security about a potential cause, report to the fire panel located at…*

**RESPONSE PROCEDURES IN THE EVENT OF AN EMERGENCY RELATED TO LABORATORY ACTIVITIES – EXCLUDING THE ACTIVATION OF WARNING AND/OR EVACUATION ALARMS (e.g. smoke from equipment)**

* INSERT / ATTACH RESPONSE PROCEDURES

*Examples for consideration:*

* *Identify areas/equipment that may trigger an emergency…*
* *Turn off / shut down…*
* *Evacuate the laboratory via…*
* *Activate the building fire alarm located at…*
* *Evacuate the building via…*
* *Notify Campus Security / Principal Investigator / Supervisor at…*
* *Go to the assembly point located at…*
* *Any information to be communicated to Campus Security about a potential cause, report to the fire panel located at…*

Signed:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Supervisor/Principal Investigator***

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| **APPENDIX I:** | **TRAINING RECORDS FOR INDIVIDUALS AUTHORIZED TO WORK IN AREA WITH FIXED GAS DETECTION SYSTEM** |

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| --- | --- |
| **Principal Investigator / Supervisor:** | INSERT NAME |

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| --- |
| The undersigned have completed the following and understand the risks of working in proximity to devices that may create a hazardous or oxygen deficient atmosphere. |
| * Received training and understand how to read the display panel prior to entering the area. * Reviewed the University of Calgary Fixed Gas Detection System Standard. * Reviewed the SOP Response to Gas Detection System Alarms – Oxygen Sensors. * Reviewed the Safety Data Sheet (SDS).(ATTACH SDS) |
| * Reviewed the manufacturer’s operating instructions for equipment. * Reviewed the laboratory instructions for filling of the NMR. * INSERT any other REQUIRED TRAINING here |

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| **Authorized Participant Name** | **Principal Investigator /**  **Supervisor Name** | **Date Reviewed** |
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| **APPENDIX II:** | **POTENTIAL ALARM CAUSES AND RESOLUTION CHART** | | |
| Warning Alarm is Activated – Oxygen level is less than 20.3% | | | |
| Possible Cause | | Action | Resolution |
| Leaking lines / disconnecting regulator / changing cylinders, etc. | | 1) STOP PROCESS that may be causing the issue.  2) Wait 5 minutes and monitor readings on the gas detection display panel.  3) Escalate as needed. | If alarm ceases, notify Campus Security as to the cause of the alarm.  If alarm persists, follow the Response Procedures for warning alarm activation. |
| Suspected sensor failure | | 1) Monitor display panel to see if readings fluctuate or if display panel indicates a sensor failure.  2) May require no working alone or suspension of work activities until sensor has been replaced. | Contact Campus Security and inform them that the alarm may be due to sensor failure.  Campus Security to contact Life Safety to attend and verify function of sensors. |
| Ventilation system not working / no exhaust fans / no supply air, etc. | | 1) STOP PROCESS that may be causing the issue. | Contact Campus Security and inform them that the alarm may be due to ventilation failure.  Campus Security to contact Facility Manager and/or CHCP to verify ventilation operation. |
| No known or obvious cause | | 1) STOP PROCESS that may be causing the issue.  2) Wait 5 minutes and monitor readings on the gas detection display panel.  3) Escalate as needed. | If alarm ceases, return to work while monitoring display panel and alarm notifications.  If alarm persists, follow the Response Procedures for warning alarm activation and wait for Life Safety to verify detection operation. |
| INSERT OTHER AS IDENTIFIED | |  |  |
| Evacuation Alarm is Activated – Oxygen level is less than 19.5% | | | |
| Possible Cause | | Action | Resolution |
| Filling / dispensing / venting of cryogenic liquids | | 1) STOP PROCESS that may be causing the issue, if safe to do so. | Follow the Response Procedures for evacuation alarm activation. |
| INSERT OTHER AS IDENTIFIED | |  |  |

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| **APPENDIX III:** | **Fixed Gas Detection Notification, Specifications & Operational Procedures** |

***ATTACH DOCUMENT***