

University of Pittsburgh Safety Manual	EH&S Guideline Number: 03-021	
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Normal oxygen levels range between 19.5 and 23 (nominal 20.8%). Serious health effects, fires or death by asphyxiation can occur quickly when oxygen levels are unsafe (below 16% or above 21%). Liquefied cryogenics and inert gases can displace oxygen and create low oxygen levels in confined spaces or poorly ventilated areas. Many sources of liquid cryogenics and inert gas exist in teaching and research facilities, including MRI or NMR magnets, cylinders of carbon dioxide, helium, argon and nitrogen, anaerobic incubators, -80°C freezers, and analytical instruments. Any room or space containing inert gas or other sources of oxygen depletion should be evaluated for safeguards to protect users and those potentially entering these spaces. These guidelines address installation criteria, maintenance and response to oxygen gas sensor alarms.

1. Identification of Sites for Oxygen Gas sensors

- 1.1 Cylinder, tank and dewar failures, magnet quenches or sudden releases from pressure relief valves can overwhelm standard ventilation systems. In most research environments, gas volumes are limited and potentially asphyxiating gases quickly dissipate.
- 1.2 Air exchange rates in many labs are relatively high (6-15 ACH) further minimizing the risk of low oxygen levels. Cryogen tanks and compressed gas systems are designed as “fail safe,” venting slowly rather than rupturing. All of these features reduce the need for detection equipment.
- 1.3 Oxygen monitors should be placed in areas that are poorly ventilated or where confined spaces allow the build-up of asphyxiating gases to reach dangerous levels. The entry to the area should be posted for “oxygen deficiency potential.”
- 1.4 Oxygen monitors must be equipped with local alarms that can be heard and/or observed both inside and outside the room. It is recommended that oxygen alarms be connected to monitoring stations or command centers where automated ventilation controls can be activated to restore safe atmospheric conditions.
- 1.5 The installation, testing and maintenance costs for oxygen monitors and associated engineering controls shall be the responsibility of the department or responsibility center using cryogenics or asphyxiant gases.

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2. Maintenance/Calibration:

- 2.1 All oxygen monitors should be calibrated and tested every six months at a minimum. Required maintenance will vary by manufacturer and may involve electronic checks, challenge tests using known gas concentrations, or full instrument calibration.
- 2.2 Device owners must make arrangements with University personnel such as a departmental technician, a trained research staff member, or with third party technicians, consultants or manufacturer representatives to maintain oxygen monitors per specifications.
- 2.3 Oxygen monitors should be replaced every 2 years, unless specified otherwise by the manufacturer. Oxygen monitors or replacement sensors should not be purchased in advance, as they deteriorate in storage.
- 2.4 Challenge tests should always be performed when new monitors are installed or after sensor replacement to assure proper response.
- 2.5 All sensor changes and meter calibrations must be documented by the individual servicing the device, and the responsibility center should maintain service logs and test results for each instrument.

3. Alarm Response

- 3.1 For identifiable oxygen alarm causes, such as a magnet quench or a leak of carbon dioxide gas, the individual must stop work, control the leak source if safe and possible, and leave the room. The oxygen alarm should return to normal in minutes.
- 3.2 If the alarm continues, contact EH&S at 412-624-9505 during business hours (M-F 7:30 am – 5:00 pm). During non-business hours, active alarms should be reported to the campus emergency number 412-624-2121. Indicate the type of sensor and any potential or known leak sources.
- 3.3 If a faulty sensor is suspected, user departments must have the room tested and the oxygen sensor replaced or checked by service personnel as soon as possible. Use of potential asphyxiant gases or cryogenics should be avoided until the sensor is replaced.

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4. Emergency Response

Oxygen monitors alarm at 19% and all alarms and must be investigated. Humans will not detect ill effects for short duration exposures until oxygen levels reach 14-16 %, but caution is required. If an oxygen meter detects levels at or below 14%, an extreme emergency condition exists. If people are unconscious or the condition can't be resolved immediately, call 412-624-2121 and request the City of Pittsburgh Hazmat Team. The following response actions should be followed by each group.

4.1 Laboratory Personnel Response to Oxygen Alarm:

- 4.1.1 Evacuate the room immediately and close door.
- 4.1.2 Do not enter the room while the alarm is sounding.
- 4.1.3 Immediately inform others in potential danger and notify your supervisor.
- 4.1.4 During business hours, call EH&S at 412-624-9505. If the alarm occurs outside business hours contact the University Police at 412-624-2121.
- 4.1.5 Wait for the emergency responders at the building entrance and inform them of situation.
- 4.1.6 If a faulty oxygen sensor is suspected after the emergency has been abated, relocate cryogenic processes to another laboratory where oxygen deficiency monitoring is available until the defective sensor is replaced.

4.2 Public Safety Response to an Oxygen Alarm:

- 4.2.1 **Do not enter room**
- 4.2.2 Ascertain if anyone is inside the room in alarm by looking through window.
 - 4.2.2.1 If an unconscious person is present, immediately request Pittsburgh Hazmat and emergency medical response. Do not enter room. No one should attempt a rescue without a self-contained breathing apparatus (SCBA). Wait for City of Pittsburgh responders and provide information.
 - 4.2.2.2 If room is unoccupied, notify EH&S during business hours or Pittsburgh HazMat unit during non-business hours. Do not enter the room until safe oxygen levels are assured.

4.3 Environmental Health and Safety Response to Oxygen Alarm:

- 4.3.1 Assess any oxygen monitor and alarm condition as requested.