TITLE:

**EHS-339, OXYGEN MONITORING SYSTEM GUIDELINES**

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# 1.0 Introduction

## 1.1 Purpose

This guideline establishes guidelines and procedures for regularly maintaining oxygen sensors in laboratories. Regular maintenance ensures the accuracy and reliability of oxygen sensor readings, which is crucial for maintaining a safe working environment and ensuring the integrity of experimental results.

Oxygen deficiency monitors shall be selected, installed, and maintained in accordance with this policy in workspaces with asphyxiation risks posed by the storage and use of inert compressed gases and cryogenic liquids.

## 1.2 Scope

This policy applies to all workspaces where oxygen sensors are installed to measure oxygen levels.

## 1.3 Definitions

**Asphyxiant:** a substance that can cause unconsciousness or death by suffocation (asphyxiation).

**Calibration: to** determine, check, or rectify the response of any instrument giving quantitative measurements.

**Cryogenic Liquids:** gases at normal temperature and pressures. However, at low temperatures, they are in their liquid state. These extremely cold liquids have boiling points less than -150°C (-238°F). Vapors and gases released from cryogenic liquids are very cold.

**Inert Gas:** a chemically non-reactive gaseous element.

**Maintenance:** preserving the serviceability of equipment or systems through routine preventive or corrective actions.

**Risk Assessment:** the formal process of identifying and quantifying potential negative events, including harm to people, property, or the environment.

## 1.4 Responsibilities

**Environmental Health and Safety Office (EHSO)**

- As the administrative department for the Oxygen Monitoring System Guideline, EHSO is responsible for:
    - Conducting workplace risk assessments to determine the need for oxygen sensors.
    - Guiding the selection of oxygen sensors.

- Development of the Oxygen Monitoring System Guidelines.
- Reviewing, updating, and evaluating the overall effectiveness of the Oxygen Monitoring System Guidelines.

**Directors, Supervisors, and Managers/Principal Investigators (PIs)**

- The PIs, Directors, Supervisors, and Managers are primarily responsible for managing and enforcing the Oxygen Monitoring System Guidelines in their areas. They must ensure that:
  - Compliance with the Oxygen Monitoring System Guidelines is enforced.
  - Employees are aware of these guidelines and informed of their content.
  - Ensure proper maintenance of equipment as defined in Section 3.

**Employees**

- Employees are responsible for complying with the rules set forth by this Program.

## 2.0 Procedures

Compressed inert gases and cryogenic liquids are used in laboratories and other locations for various lab applications and work procedures. Nitrogen and Helium are the most used compressed gases and cryogenic liquids used primarily for freezing specimens or cooling equipment such as Magnetic Resonance Imagers (MRI) and Nuclear Magnetic Resonance (NMR) systems.

These gases are classified as simple asphyxiants that displace oxygen, thus creating the potential for an oxygen-deficient atmosphere. An oxygen-deficient atmosphere is a serious occupational hazard and, in extreme cases, can be lethal in seconds.

Oxygen deficiency monitors are required where, under normal use or accidental conditions, the released gases may exceed the capacity of engineered protection systems (principally the general ventilation system) to maintain a safe atmosphere.

### 2.1 Risk Assessment

The requirement for an installed oxygen deficiency monitor is established by risk assessment. The risk assessment considers the application of the gas, volume of gas, room size, ventilation exchange rate, spill, leak, and other accident scenarios, and engineered protection systems. EHSO conducts risk assessments in Emory workspaces.

Monitoring other asphyxiants, including liquid Carbon Dioxide, Carbon Monoxide, and Hydrogen Cyanide, is outside the scope of this policy. For example, liquid Carbon Dioxide is toxic in addition to being a simple asphyxiant. Leaked liquid Carbon Dioxide may create a toxic atmosphere before detecting oxygen depletion. For this reason, an

oxygen monitor is ineffective in liquid carbon dioxide environments.

### 2.2 Selection Criteria

The following selection criteria are established:

- Permanently installed, fixed monitoring systems designed for a 110/120v AC power supply.
- Detection range of 0% - 25% oxygen concentration.
- Long-life sensor. Most existing oxygen deficiency monitors incorporate an oxygen sensor with a two-year service life. Newer sensor technology has a service life of up to ten years.
- Underwriter's Laboratories (UL) certification.

### 2.3 Pre-installation Notifications

Departments are required to notify Campus Services and EHSO before installing an oxygen deficiency monitor.

### 2.4 Installation

- Install oxygen monitors in accordance with the manufacturer's instructions and the following requirements.
- Position the device per the manufacturer's instructions at the proper height corresponding to the gas's density. For liquid nitrogen applications, the recommended height is typically 4 – 6 feet from the floor. Helium is lighter than air and may require higher placement.
- Ensure the system is accessible for viewing the display and performing maintenance.
- Leak test sample lines and fittings.
- Where possible, interlock the monitor to an emergency ventilation fan.
- Do not place sensors near entrances or fresh air vents, as incoming air will dilute sample concentrations.

### 2.5 Alarm and Signaling

The Oxygen Sensor shall be both audible and visual, with a warning light both inside and outside of the room/area.

### 2.6 Calibration and Testing

- The end user is responsible for obtaining calibration and testing services.
- Initial and annual calibration and testing are required to verify the oxygen monitor's proper operation.
- The manufacturer's representative or qualified Laboratory Equipment Services staff member will perform calibrations and testing.

## 3.0 Maintenance

- The end user is responsible for daily operational checks conducted by the manufacturer's instructions.

- The manufacturer or Campus Services shall maintain or repair oxygen monitors. A preventive maintenance schedule shall be established in accordance with the manufacturer's instructions. The laboratory shall maintain maintenance records.

- The critical component of most oxygen deficiency monitors is an electrochemical sensor with a 2-year service life. Vendors manufacture replacement sensors on demand to avoid service life loss in storage. Operating an oxygen monitor to failure may result in an extended out-of-service period while a replacement sensor is obtained. A predictive component replacement schedule (planned sensor replacement) is required to avoid loss of monitoring capability.

## 4.0 Response to Alarms

- Treat all alarms as real.
- Alarms are warning devices and not protective. On alarm, evacuate the room immediately and close the door.
- Call EPD 404-727-6111.
- Call EHSO Spill Team 404-727-2888.
- Remain outside the room. Do not enter for any reason. Do not attempt a rescue.
- Call the Fire Department if a rescue is necessary. Only trained responders in self-contained breathing apparatus can conduct a rescue in an oxygen-deficient atmosphere.
- When the gas release abates, or if a faulty sensor is suspected, EHSO can clear the area for re-occupancy using a hand-held gas monitor. Do not re-enter the area until it is cleared by EHSO or the Fire Department.

## 5.0 References

- National Fire Protection Association (NFPA), Standard 55-2020. Compressed Gases and Cryogenic Fluids Code.
- NIH Design Requirements Manual (DRM). Section 13.10.7 Liquid Nitrogen (2016).