COLUMBIA UNIVERSITY

RESPONSE TO OXYGEN DEFICIENCY SENSING EQUIPMENT IN LABORATORIES

Procedure:4.25 **Created: 03/01/2009**
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A. Purpose

To inform the University research community and other staff members regarding response to oxygen deficiency equipment (O_2 sensors) installed in laboratories handling, using and storing liquid nitrogen or other cryogenic gases.

B. Applicability/scope

This policy covers all personnel including laboratory staff, faculty, students, Facilities, Public Safety and Environmental Health & Safety (EH&S) staff in areas O_2 sensors are installed or when responding to oxygen deficiency warning systems. This policy applies to Columbia University's Morningside (MS) and Medical Center (CUMC) campuses.

C. Responsibilities

1. Environmental Health & Safety/ Fire Safety are responsible to maintain records of alarm activations and perform semi-annual inspection of O_2 sensors.
2. All laboratory occupants should immediately notify EH&S/Fire Safety in case of an alarm or malfunction of O_2 sensors during work hours and Public Safety in off hours.

D. Definitions

Asphyxiation: to lose consciousness by impairing normal breathing, as by gas or other noxious agents; suffocate; smother.

Dewars: Vacuum flask that holds liquid air or helium for scientific experiments.

Hazardous Atmosphere: An atmosphere that may expose personnel to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness.

Oxygen Deficient Atmosphere: An atmosphere containing less than 19.5% oxygen by volume.

Oxygen Sensors: A device which measures the amount of oxygen in the atmosphere.

E. Procedures

1. Type and location of oxygen deficiency monitoring equipment.

   When New York Fire Department (FDNY) regulation or EH&S risk assessment requires O_2 sensors for the protection of laboratory workers using a cryogenic gas:

   a. An O_2 sensor shall be installed.
   b. The O_2 sensors shall be attached on the wall at a height of 3-5 feet above ground.
   c. Electrical powered sensors shall be directly connected to the electrical outlet and protected from accidental disconnect.
   d. Battery operated O_2 sensors shall be placed in locked protective covers.
   e. All O_2 sensors are equipped with a warning alarm and/or lights to warn both the room occupants and those outside the room of the hazard within.

f. All laboratories and/or areas where an O_2 sensor is present will be identified by the below signage in the following area:
   - On the door to room where O_2 sensor is located.
   - In close proximity to the O_2 sensor

2. Equipment Maintenance.
   a. The manufacturer's instructions should be followed regarding the frequency of maintenance and O_2 sensors and/or battery replacement.
   b. O_2 sensors should be calibrated to alarm when oxygen concentrations fall below 19.5% (low level alarm) or exceed 23.5% (high level alarm) and it should automatically reset (no alarm) when between these two values.
   c. Laboratory personnel must visually check O_2 sensors daily to ensure that they are operational. Any malfunctioning of the O_2 sensors shall be reported to EH&S.

3. Procedures in the event of an O_2 sensors alarm.

Note that the following situations may be indications that there has been a release of liquid nitrogen (LN) or other cryogenic gas creating a possible O_2 sensor alarm activation and an oxygen deficient atmosphere:

- A port of a LN tank release.
- An audible hissing noise from a LN tank.
- A fog or cloud condition in the area of a LN tank.
- A recently delivered tank off-gassing excess pressure in tank.

a. Laboratory Staff Response
   - *In all cases assume the alarm to be valid.*
   - All staff in the area must evacuate the room immediately.
   - Do not enter the room while the alarm is sounding.
   - Immediately make notifications - inform the PI or other designated person about the alarm and await their arrival. Do not take any action by yourself.
     - If the alarm occurs during normal hours contact EH&S (212-3056780 at CUMC and 212-854- 8749 at Morningside).

- If the alarm occurs outside normal hours contact the Public Safety (212-305-7979 at CUMC and 212-854-5555 at MS). Do not take any action by yourself; await arrival or instruction from Public Safety.

- Do not open the door as gas could escape into the corridor exposing others. Door should be left closed for *at least one hour* to allow the ventilation system to clear any gas.
  - During normal working hours seek EH&S help to monitor ambient oxygen concentrations if the alarm has not cleared.

- If the alarm has not cleared within one hour then wedge the door fully open to increase the amount of air entering the room and wait to re-enter the room until the alarm clears. ○ If the O_2 sensor alarm cannot be silenced, unplug the O_2 sensor or call EH&S during normal business hours to replace.
  - If the alarm does not clear or the sensor has been disconnected, relocate cryogenic processes to another laboratory where oxygen deficiency monitoring is available until such time as the defective sensor is replaced or reinstated.
  - If the O_2 sensor alarm is found by EH&S to be false due to O_2 sensors failure, the sensor will be replaced.

b. Public Safety Response:

When notified of O_2 sensor alarm:

- Respond with two way radio equipped personnel along with a portable O_2 sensor, if available.
- **Do Not Immediately Enter Room!** Knock on the door to ascertain if anyone is in the room.
- If portable O_2 sensor is available, monitor the area by door. Briefly open the door to verify that there is no unconscious worker in the room. If O_2 sensor remains above 19.5%, perform a quick survey by walking through the room to ensure that O_2 measurements are above 19.5%.
- If the room is unoccupied, keep door closed and make phone notifications as per Public Safety's "EH&S Emergency Contact List"
- If an unconscious person is present:
  - Do not enter the room, immediately notify 911 for FDNY and EMS response.
  - Leave door in the open position to allow corridor air to enter the room, which will dilute the concentration of gas.

- When O_2 levels reach 19.5% or above the alarm will automatically silence and reset.

c. Facilities Operations Response:

- When notified, or become aware of, an activated O_2 sensor alarm, immediately notify :

- During working business hours: EH&S (212-305-6780 at CUMC and 212-854-8749 at MS)
- During off hours: Public Safety (212-305-7979 at CUMC and 212-854-5555 at MS)

d. Environmental Health and Safety Response:

- During normal working hours contact EH&S to perform additional monitoring before re-entry.

F. Emergency contacts

Public Safety – 212-305-7979 (CUMC), 212-854-5555 (Morningside)
EH&S - 212-305-6780 (CUMC), 212-854- 8749 (Morningside)

G. Cross References like URL, Forms, web addresses, etc. N/A

H. Medical Surveillance

For persons working in area that had an alarm activation, monitor health conditions and if any indications of illness or effects from possible exposure to hazardous atmosphere, have person report to Workforce Health and Safety and/or local Emergency Room

I. Recordkeeping

EHS-Fire Safety will maintain records of O_2 sensor locations, alarm activations

J. Appendices

Appendix I: Signage for Laboratories and Areas with O_2 Sensors (See page 5)

K. Forms

N/A

L. References

Compressed Gas Association pamphlet P-12 *Safe Handling of Cryogenic Liquids* available from the Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Arlington, VA 22202-4102 Telephone (703) 412-0900.

NYC 2014 Fire Code – Section 3205.4.1.1.1 http://www1.nyc.gov/assets/fdny/pdfviewer/viewer.html?file=Chapter32.pdf&section=firecode_2014

MSDS for Liquid Nitrogen

M. Acknowledgements (optional)

APPENDIX I – Sample Signage for Laboratories and Areas with O_2 Sensors

Sample

(Morningside Campus)