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| Standard Operating Procedure |
| Oxygen gas |

*This is an SOP template and is not complete until: 1) lab specific information is entered into the box below 2) lab specific protocol/procedure is added to the protocol/procedure section and
3) SOP has been signed and dated by the PI and relevant lab personnel.*

 Print a copy and insert into your
*Laboratory Safety Manual* and *Chemical Hygiene Plan*.
Refer to instructions for assistance.

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| --- | --- |
| School / Department: |  |
| SOP Preparation Date: |  | SOP Approval Date: |  |
| Principal Investigator: |  |
| Lab Manager Name: |  |
| Laboratory Phone: |  | Office Phone: |  |
| Emergency Contact: |  | Contact Phone: |  |
| Laboratory locations covered by this SOP (building / room number): |
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| Type of SOP: | ☐ | Process | ☒ | Hazardous Chemical | ☐ | Hazardous Class |

**Purpose**

Oxygen gas cylinder will be used for oxygenation of cell culture medium.

**Physical and Chemical Properties / Definition of Chemical Group**

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| CAS: | 7782-44-7 | Gas Cylinder |
| Class: | OXIDIZING GASES - Category 1 GASES UNDER PRESSURE - Compressed gas |
| Molecular Formula: | O2 |
| Form (physical state): | Gas |
| Color: | None |
| Boiling Point: | -183°C (-297.4°F) |

**Potential Hazards / Toxicity**

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| **Potential Health Effects** |
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| **Target Organs:** | No specific target organs. |
| **Inhalation:** | No known significant effects or critical hazards. |
| **Skin:** | Contact with rapidly expanding gas may cause burns or frostbite. |
| **Eyes:** | Contact with rapidly expanding gas may cause burns or frostbite |
| **Ingestion:** | As this product is a gas, refer to the inhalation section. |

**Personal Protective Equipment (PPE)**

**Respiratory Protection**

Respiratory protection is not expected to be necessary unless there has been an oxygen leak for an extended period of time. If you have any reason to suspect that a hyper-oxygenated environment may exist in the lab, evacuate the lab and call EHS.

**Hand Protection**

* Wear new nitrile gloves. Make sure they are clean, to avoid any contact of combustible materials with pure oxygen.

**Eye Protection**

* Wear chemical splash goggles to protect from any cold burns or frostbite from rapid expansion, and to avoid risk of infection or chemical splash/splatter. A face shield in addition to the goggles is optional.

**Skin & Body Protection**

* Lab coat
* Full-length pants
* Close-toe rubber or leather shoes

**Hygiene Measures**

Rapid expansion of the gas may cause cold burns or frostbite. Avoid contact with skin and eyes.

**Engineering Controls**

Compressed oxygen can generally be used inside a lab as long as the apparatus is not actively leaking.

Oxygenation procedure should be carried out in a biological safety cabinet.

**First Aid Procedures**

**If inhaled…** Move to fresh air. If the person is not breathing, give artificial respiration. Avoid mouth to mouth contact. Call 911 from a campus phone.

Then call EH&S at (480) 965-1823.

**In case of skin contact…** If burns are suspected or found, remove clothing around the injury and immerse in a bath of warm (40-42°C) or room temperature water. Avoid running water, as this may cause further tissue damage. Call 911 from a campus phone. Then call EH&S at (480) 965-1823.

**In case of eye contact…** If burns are suspected or found, hold the eyes open and immerse in a bath of warm (40-42°C) or room temperature water. Avoid running water, as this may cause further tissue damage. Call 911 from a campus phone. Then call EH&S at (480) 965-1823.

**In case of fire…** If a fire starts on any part of your clothing or body, step back from the oxygen apparatus and do one of the following, based on which is faster to do at that time:

* “Stop, drop, and roll” to smother out the fire
* Use an immediately-available (less than about 10 ft. away) safety shower or drench hose (depending on the size of the fire) to put the fire out

Call 911 from a campus phone. Then call EH&S at (480) 965-1823.

**Special Storage & Handling Requirements**

**Storage**

* Ensure the container is tightly closed at all times.
* The oxygen container must be kept separated from any flammable or combustible materials (including flammable/combustible gas cylinders, such as carbon monoxide) by one of the following methods:
	+ Separate by a noncombustible barrier at least 5 ft. tall, which has at least a half-hour fire resistance rating
	+ Separate by a full enclosure which is vented to the outside, such as a gas cabinet or chemical storage cabinet
	+ Separate by a minimum distance of 20 ft.

**Handling**

* Do not use oxygen in the presence of volatile flammable solvents (such as ethanol).
* Allow at least two air changes between the use of a volatile flammable solvent and the use of oxygen.
	+ As of July 2018, the known air change rate for labs in ISTB1 was once every 15 minutes. Two air changes would be 30 minutes.
* The lab where the material is being handled has an approved / certified emergency eyewash and safety shower.
* Ensure you are wearing the following minimum PPE: tightly fitting safety goggles, lab coat, full length pants, close-toe rubber or leather shoes, a pair of nitrile gloves.
* Lab emergency contact information must be readily posted. Easy access to a cellular phone or land line is readily available.
* Optional: keep a fire extinguisher nearby in case any small-scale fires start.
	+ You are never obligated to put out fires, no matter how small, so this is not necessary.
	+ We do not recommend attempting to extinguish anything larger than a small office trash can sized fire – instead, just evacuate and call 911.
	+ If any fire does break out, no matter how tiny the flame is, you must stop immediately and re-assess the equipment setup. Contact your PI, lab manager, and the FSE Office of Health & Safety to figure out how to prevent possible fires *before* you attempt the experiment again.

**Spill and Accident Procedure**

**Personal precautions**

Avoid breathing gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Do not attempt to stop leaks without clean PPE.

**Environmental precautions**

Prevent further leakage – if safe to do so.

**Methods and materials for containment and clean-up**

1. Immediately assess amount leaked, follow posted ASU Emergency Response Guide procedures for hazardous materials incidents. Do not attempt to fix leaks if you suspect there was enough leaked gas to create an oxygen-rich atmosphere.
2. If a burn injury has occurred or if the atmosphere is suspected to be unsafe, a fellow lab worker shall call 9-1-1, and then EH&S at (480) 965-1823.
3. Wear clean PPE if not already being worn.
4. Shut off the main cylinder valve.
5. Detach the oxygen tube. Inspect the barb outlet port of the gas cylinder and the oxygen tube for any contaminants or defects. If no problem is found, re-connect parts together.
6. Re-open the main cylinder (following the usual process to prevent back-flow into the tank) and use soapy water to check for leaks.
7. Repeat the above steps or replace possibly-damaged equipment until the leak is resolved.

**Empty Cylinder Disposal Procedure**

Tear off “full” tag, return the empty cylinders to storage room at ISTB1 room 135.

**Protocol / Procedure**

Oxygen gas cylinders should be properly secured at all times. Always make sure there are no flammables/ignition sources within 2 meters from the cylinder.

**Experiment setup**

**Installation**

\*Do not grease or oil the regulator thread of a cylinder valve. Ensure gloves are clean and free of any oily residues.

**During experiment**

**IMPORTANT NOTE:** Any deviation from this SOP requires advance PI approval.

This SOP is based on the expectation that the lab this work is performed in will have 4 air changes per hour, or 1 air change every 15 minutes. If the lab location is changed or building air systems are altered, this SOP must be updated to reflect the need for 2 room air changes between the use of ethanol and the use of oxygen.

**Documentation of Training**

* Prior to conducting any work with this material, Principal Investigator or designee must provide to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
* The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the Safety Data Sheet (SDS) provided by the manufacturer.
* The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate/required laboratory safety training or refresher training within the last one year.

**I have read and understand the content of this SOP.**

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| Employee Name | ASU Affiliate No. | Signature | Date |
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