SOPs FOR USE OF LIQUID OXYGEN TANK

Process Description:

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work Medical Oxygen, which is used for:

During anesthesia and for recovery following surgery

- To treat or prevent oxygen deficiency in the body in many different situations such as:
  - Surgery or major trauma such as a road traffic accident
  - Heart attacks
  - Severe blood loss
  - Carbon monoxide poisoning
  - Severe lung and heart conditions
  - Very high fevers
- For resuscitation of adults, children and babies.

1. **Name of the medicinal product:** Medical oxygen.

2. **Qualitative and quantitative composition:**

   Liquid medical oxygen is supplied to the following specification: medical oxygen purity 99.5% (min). The liquid medical oxygen cylinder specification complies with the current European Pharmacopoeia monograph (0417).

3. **Pharmaceutical form:** Medicinal gas, cryogenic.

Things to consider before use:

Medical Oxygen is only prescribed to you by a healthcare professional. Ensure that your healthcare professional is aware of any medical conditions that you may have.

Take special care when using Medical Oxygen if:

- Your baby requires extra oxygen and is premature.
- Only give the amount of Medical Oxygen advised by your healthcare professional
- You are suffering from chronic lung disease, such as bronchitis or emphysema. The amount of Medical Oxygen used must be carefully controlled to the flow rate you have been advised to use by your healthcare professional
- You have accidentally taken Paraquat (a type of weed killer), advise your healthcare professional before using Medical Oxygen, as there is a possibility of toxic effects to the lungs.

4. Clinical particulars:

4.1 Therapeutic indications:

Liquid medical oxygen is widely used in clinical practice to provide a basis for most modern anesthetic techniques including pre and postoperative management.

To restore the tissue oxygen tension towards normal by improving oxygen availability in a wide range of conditions such as:

- Cyanosis of recent origin as a result of cardio-pulmonary disease
- Surgical trauma, chest wounds and rib fracture
- Shock, severe hemorrhage and coronary occlusion
- Carbon monoxide poisoning
- Hyperpyrexia
- Major trauma, i.e. road traffic accidents and gunshot wounds
- In the management of sudden cardiac and respiratory arrest, whether drug induced or traumatic
- In the resuscitation of the critically ill, when the circulation is impaired
- In neo-natal resuscitation.

In all cases, the liquid medical oxygen is vaporized to a compressed gas at ambient conditions before being administered to the patient.

4.2 Special warnings and precautions for use Liquid medical oxygen SPC:

Special care is needed when liquid oxygen is administered:

- To neonates where the inspired concentration should not exceed 40% because of the risk of retro lenticular fibroplasia
- To elderly chronic bronchitis patients in whom the inspired concentration should only be raised in stages of 1% and probably should not exceed 30%
- In hyperbaric chambers in the management of conditions such as carbon monoxide poisoning, anaerobic infections and acute ischemic disease. Convulsions may occur at 3 bar (g) after a few hours.

Oxygen levels should be monitored as required in the breath, blood and tissue to ensure that appropriate concentrations are not exceeded.

Where the patient has been exposed to agents which are toxic to the lungs, such as Paraquat, the use of gases containing more than 21% oxygen should be avoided liquid medical oxygen is nonflammable but strongly supports combustion and should not be used near sources of ignition. Smoking should be prohibited when using liquid medical oxygen.

Under no circumstances should oils or grease be used to lubricate any part of the medical liquid oxygen storage vessel/cylinder or the associated equipment used to deliver the gas to the patient.

Where moisturizing creams are required for use with a facemask or in nasal passages. Oil based creams should not be used.

Check that hands are clean and free from any oils or grease. Where alcohol gels are used to control microbiological cross-contamination ensure that all alcohol has evaporated before handling liquid medical oxygen cylinders or equipment.

Care is needed when handling and using liquid medical oxygen cylinders.

Pregnancy and lactation:

Oxygen does not adversely affect pregnancy and lactation.

Effects on ability to drive and use machines:

In normal circumstances, medical oxygen does not interfere with the conscious level but patients who require continuous oxygen support are obviously not fit either to drive or to operate machinery.

4.3 Undesirable effects:

Medical oxygen toxicity can occur as manifested by:

- Retro lenticular fibroplasia in premature infants exposed to oxygen concentrations greater than 40%
- Convulsions appear after a few hours exposure to medical oxygen at pressures above 3 bar (g)
- Retrosternal soreness associated with coughing and breathing difficulties, made worse by smoking and exposure to cold air after breathing pure oxygen at atmospheric pressure for several hours.

4.4 Overdose: As detailed above in 'Undesirable effects'

Shelf life: 6 months

Special precautions for storage:

Liquid medical oxygen cylinders should be:

- stored upright under cover, preferably inside in a well ventilated area, kept dry and clean and not subjected to extremes of heat and away from stocks of combustible material
- stored separately from industrial and other non-medical cylinders
- stored to maintain separation between full and empty cylinders • used in strict rotation so that cylinders with the earliest filling date are used first
- Stored separately from other medical cylinders within the store.

Liquid medical oxygen bulk storage tanks should be sited at least 3 meters from boilers and other sources of naked lights, fuel stores, paint stores and other volatile flammable materials.

Warning notices prohibiting smoking and naked lights must be posted clearly in the cylinder storage area and the emergency services should be advised of the location of the cylinder stores and bulk stores.

Special precautions for disposal and other handling:

All personnel handling liquid oxygen cylinders should have adequate knowledge of:

• Properties of the gas

• correct operating procedures for the liquid oxygen cylinder

• Precautions and actions to be taken in the event of an emergency.

Use of cylinders:

When liquid medical oxygen cylinders are in use ensure that they are:

- Only used for medicinal purposes
- kept upright at all times
- turned off, when not in use, using only moderate force to close the valve
- Only moved with the appropriate size and type of trolley or handling device
- handled with care and not knocked violently or allowed to fall
- Firmly secured to a suitable cylinder support when in use
- Not allowed to have any markings, labels or batch labels obscured or removed
- Not used in the vicinity of persons smoking or near naked lights.

After use:

When the liquid medical oxygen cylinder is empty ensure that the:

- Outlet valves are closed using moderate force only
- Empty liquid cylinders are immediately returned to an empty cylinder storage area
- For return to BOC.

Hazards:

Classification labelling and packaging regulations

- ✓ Danger.
- ✓ May cause or intensify fire; oxidizer (H270).
- ✓ Contains gas under pressure;
- ✓ May explode if heated (H280).
- ✓ Keep/Store away from clothing,
- ✓ Hydrocarbons and combustible materials (P220).
- ✓ Keep reduction valves free from grease and oil (P244). In case of fire: stop leak if safe to do so (P370 + P376).
- ✓ Protect from sunlight: store in a well-ventilated place P410 + P403).

Dangerous Preparations Directive:

- ✓ Contact with combustible material may cause fire (R8).
- ✓ Keep out of the reach of children (S2).
- ✓ Keep away from combustible material (S17).

Additional safety statements

- o Contact with combustible material may cause fire.
- o No smoking or naked flames near medical oxygen cylinders.
- o Refrigerated liquefied gas.
- o Contact with product may cause cold burns or frost bite.
- o Liquid medical oxygen may cause cold burns if the liquid comes into contact with
- o Exposed skin. Always wear suitable protective equipment when handling vessels.
- o Use no oil or grease.
- o Use cylinder upright.
- o Keep away from extremes of heat and combustible material.
- o Store vessels under cover in a clean, dry and well ventilated area.

Liquid medical oxygen is a refrigerated liquefied gas which may cause cold burns or frostbite if it comes into contact with unprotected skin.

Liquid medical oxygen is a non-flammable gas but is a very strong oxidant.

It will strongly support and intensify combustion. It may react violently with combustible materials such as oils and grease.

Firefighting measures:

If liquid medical oxygen vessels are involved in a fire:

If it is safe to do so,

- Close supply valve to stop the flow of product if it is not safe,
- Cool with water from a protected position.

All types of fire extinguishers may be used when dealing with a fire involving liquid medical oxygen cylinders.

No special protective equipment for fire fighters is required.

There are no hazardous combustion products released from the gas.

Accidental release measures:

If a large volume of liquid medical oxygen is released, if safe to do so, you should:

- Close supply valve
- Where possible, eliminate all sources of ignition.

Prevent the product from entering sewers, basements and work pits, or any place where its accumulation can be dangerous.

If the release continues, evacuate the area and ensure that the affected area is adequately ventilated and any spilled liquid has evaporated before re-entry.

Complete evaporation of liquid will be observable by the ground being free from frost.

Self-contained breathing apparatus is not required to be used if liquid medical oxygen is released in a confined area.

Exposure controls:

- When using liquid medical oxygen ensure adequate ventilation.
- If clothing becomes impregnated with oxygen (due to a leak),
- Keep away from sources of ignition or open flames.
- Clothing impregnated with oxygen should be ventilated in fresh air for a minimum of 15 minutes.
- Protect eyes, face and skin from liquid splashes from the liquid oxygen by wearing protective clothing and gloves.
- If liquid medical oxygen makes contact with the eye, flush thoroughly with water for at least 15 minutes.
- If liquid medical oxygen comes into contact with the skin, frostbite may occur, due to the extremely cold temperature of the product.

- To treat frostbite, spray damaged skin area with water for at least 15 minutes and apply a sterile dressing. Obtain medical assistance in both instances.

Control of Hazards- General:

- Only work with cryogenic liquids in well-ventilated areas to avoid localized oxygen depletion or buildup of flammable or toxic gas.
- Handle objects that are in contact with cryogenic liquids with tongs or proper gloves.
- Transfers or pouring of cryogenic liquids should be done carefully to avoid splashing
- Containers and systems containing cryogenic liquids should have pressure relief mechanisms.
- Cryogenic liquid cylinders and other containers (such as Dewar flasks) should be filled no more than 80% of capacity to protect against thermal expansion.
- Cryogenic liquid/dry ice baths should be open to the atmosphere to avoid pressure build up.
- Keep liquid oxygen away from organic materials and ignition sources.
- Transfer of liquid hydrogen in an air atmosphere can condense oxygen in the liquid hydrogen, creating an explosion risk.
- Cryotube thawing – In addition to wearing proper safety equipment, when thawing cryotubes, place the cryotube in a heavy-walled container (e.g., a desiccator) or behind a safety shield to protect yourself in the event that the tube shatters.
- Shield or wrap fiber tape around glass dewars to minimize flying glass and fragments should an explosion occur. Note: Plastic mesh will not stop small glass fragments.

Engineering/Ventilation Controls:

If the process does not permit the handing of cryogenic liquids in well-ventilated areas (i.e., lab ventilation having a minimum of 6 air changes per hour), contact Environmental Health and Safety to determine necessity of an oxygen-deficiency monitor.

Personal Protective Equipment:

In addition to proper street clothing (long pants (or equivalent) that covers legs and ankles, and close-toed non-perforated shoes that completely cover the feet), wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks involving cryogenic liquids:

- ❖ Safety glasses (If splash potential exists, use goggles + face shield instead)
- ❖ Lab coat
- ❖ Insulated cryogenic gloves

Special Handling Procedures and Storage Requirements:

It should be stored in well-ventilated areas. Storage in unventilated closets, environmental rooms, and stairwells is prohibited. Large dewars must be tethered/ anchored to a wall. Store

flammable cryogenic liquids and liquid oxygen away from combustible materials and sources of ignition. Additionally, follow all substance-specific storage guidance provided in MSDS documentation.

Spill and Accident Procedures:

Do not attempt to clean up any spill of cryogenic liquid. If a large spill or dewar leak occurs, immediately exit the area and call for emergency assistance. For further general guidance, refer to "Response to Chemical Spills and Exposures". Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:

- A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
- Symptoms or signs of exposure to a hazardous chemical develop.

Waste Disposal:

Coordinate w/ vendor for return of dewar(s).

Minimum Training Requirements:

- Compressed Gas Safety (EHS 2200)
- General Safety & Emergency Preparedness (EHS-4200)
- Chemical Safety for Laboratories (EHS-1900)
- Laboratory-specific training

Designated Area:

For this facility, a designated area shall be established per the other applicable SOP(s).