BACKGROUND

Purpose

PURPOSE: Isoflurane is a halogenated anesthetic gas commonly used in University animal research facilities and individual laboratories. This document establishes procedures for the safe handling and use of 1-chloro-2,2,2-trifluoroethyl difluoromethyl ether (CAS# 26675-46-7), commonly known as isoflurane or Forane®.

Health Effects

Isoflurane is a halogenated hydrocarbon that is a clear, colorless volatile liquid at standard temperature and pressure with a mild ether-like odor. It is known to cause serious eye irritation and human exposure to waste anesthetic gases has been associated with reproductive effects. Signs of acute exposure: nausea, vomiting, nose/throat/respiratory irritation, headache, dizziness, drowsiness, skin irritation. Signs of chronic exposure: hypotension (low blood pressure), tachycardia (increased heart rate), respiratory depression, elevated blood glucose.

Regulatory limits

The Federal Occupational Safety and Health Administration (OSHA) do not have a Permissible Exposure Limit (PEL) for isoflurane. The National Institute of Occupational Safety and Health (NIOSH) have established a Recommended Exposure Limit (REL) of 2 ppm as a ceiling limit over a 1-hour time period for all halogenated anesthetic agents (1977). Isoflurane was developed later and was not included in this standard setting process so its applicability is questionable. However, based on potential risks it is recommended that no worker be exposed to greater than 2 ppm of any halogenated anesthetic agent including isoflurane.

REQUIREMENTS

Based on the risk associated with the use of waste anesthetic gases the safety procedures outlined below are required by all research staff when working with isoflurane.

Administrative Controls

IACUC protocols that include isoflurane should reference this SOP to verify that the standard operating procedures are being followed. Anyone who handles isoflurane is required to review this SOP and be competent in the procedure prior to work.

Engineering Controls

Isoflurane must be used in a well-ventilated room.
Active scavenging is optimal for scavenging waste gas and can include any of the following:

- Delivery of anesthetic inside a certified chemical fume hood or ducted biological safety cabinet (BSC). Use of the “drop method” should always be done using this method unless air monitoring has verified exposure levels below REL.
- Use of a snorkel hood connected to the building exhaust system, used for controlling and exhausting waste vapors during animal procedures.
- Connection of vaporizer and/or induction box exhaust hose into a certified chemical fume hood, ducted BSC, or house vacuum.

Passive scavenging can be used safely if specific procedures are followed. Passive scavenging relies on the positive pressure from the anesthetic gas delivery system and/or the exhalation effort of the animal to drive contaminated exhaled air through a specially designed activated carbon charcoal filter (such as F/AIR). The charcoal canister will adsorb and remove the waste gas before being discharged back into the room. Charcoal canisters have a finite effective life span, which can be monitored by weight. The weight of each new canister should be recorded before first use and before each subsequent use. If the total increase is close to 50 g, the canister should be replaced, or monitored closely during use (weigh between animals). To function appropriately, the carbon canister must be at a level below that of the vaporizer, to assist passive scavenging and the holes on the bottom of the carbon canister must not be blocked.

Personal Protective Equipment (PPE)

Nitrile gloves, a lab coat, and safety glasses. When in rodent facilities, PPE use must be consistent with the facility policy.

Use in Animals

- To fill the vaporizer, unscrew the fill cap and pour solution from the open bottle into the filler stem, use a pour spout, or use a filler key attached to the bottle and fill to the liquid full line in the window. See below.
- Set oxygen flow to 1-3% to deliver through the vaporizer to the induction chamber and face mask.
- Set vaporizer to % dosage for animal induction or maintenance as described in the approved IACUC protocol.
- Place animal into induction chamber or face mask for proper anesthesia delivery. Face mask should properly fit the size of animal and provide removal of waste anesthetic gases (ie. Double nose cone.) The nose cone should seal around the snout to prevent leaks. See examples of nose cones below.
- When complete, set vaporizer to 0% delivery and recover animal from anesthesia in a warmed, oxygenated area.

Waste Disposal

Unused solutions of isoflurane are to be disposed of as hazardous material through EHS.

Accidents

If isoflurane is splashed on an individual or in eyes, flush for 15 minutes with copious quantities of water.
Spill Procedures

Do not attempt to clean-up if you are uncertain of your ability to do so or if you perceive the risk to be greater than normal laboratory operations. Small volumes of isoflurane evaporate readily at normal room temperatures, and may dissipate before any attempts to clean up or collect the liquid are initiated. If a small spill occurs rapidly absorb any liquid with absorbent pads or paper towels and place in chemical fume hood for safe evaporation. If a large spill occurs notify others in the area and evacuate room immediately, and contact EHS.
Filling the Vaporizer:

1. Open isoflurane bottle by removing cap:

   ![Image of isoflurane bottle](image)

   Un螺丝 remove this cap.

2. Pour onto stem under the filler cap on vaporizer to fill the vaporizer:

   ![Image of vaporizer](image)

   Remove filler cap to expose stem underneath.

3. Fill to just under the full line in the level window. DO NOT OVERFILL.

   ![Image of vaporizer level window](image)

   Level window with fill lines.
Example nose cones:

REFERENCES

SDS Product information:
https://www.pattersonvet.com/Sds?publicItemNumber=078931389&effectiveDate=2017-01-24T00:00:00