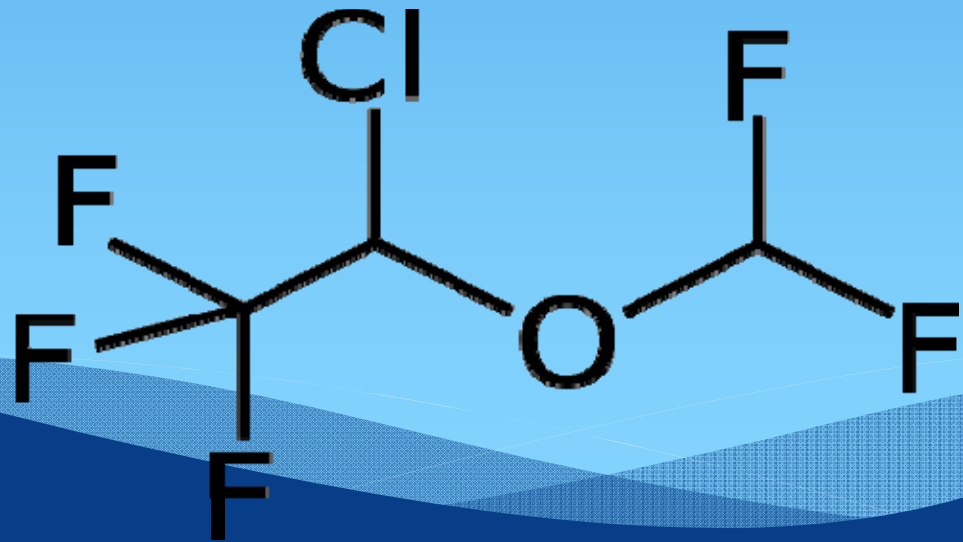


# Isoflurane: Safe Use Guidelines

(2-chloro-2-(difluoromethoxy)-1,1,1-trifluoro-ethane) is a halogenated ether used for inhalational anesthesia.



# Symptoms of Exposure

- **Acute exposure:** nausea, vomiting, skin irritation, nose/throat/respiratory irritation, headache, dizziness, and drowsiness.
- **Chronic exposure:** hypotension, tachycardia, respiratory depression, and elevated blood glucose levels. Isoflurane produces fluorides, which are potentially nephrotoxic.

# EXPOSURE LIMITS AND TOXICOLOGY

It is recommended that no worker should be exposed to greater than 2 ppm (15.09 mg/m<sup>3</sup> for isoflurane) of any halogenated anesthetic agent, based on the weight of the agent collected for a 45-liter air sample by charcoal absorption over a sampling period not to exceed one hour.

# Common Causes of Exposure

1. Benchtop delivery of inhalant anesthetic without adequate scavenging.
2. Poorly fitted face masks.
3. Turning on flow meters or inhalants before attaching the breathing system to the subject.
4. Disconnecting subjects from the anesthesia machine before waste anesthetic gases have been adequately scavenged.
5. Leaks in the anesthetic delivery system.

# Equipment and System Maintenance

1. Leak test anesthesia machines, breathing systems, and scavenging systems before each use.
2. Conduct regular equipment and system maintenance to ensure reliable performance.

# Required Training

1. PI or an experienced person must train new users before starting to work with anesthetics
2. Perform a hazard evaluation before beginning work
3. Consult Safety Resources before beginning work (e.g., MSDSs)
4. Consult with OEHS staff about questions or concerns related to work with anesthetic gases

# Emergency Practices

- Never work alone.
- Clean up small, incidental spills promptly .
- Review your MSDS.
- Know the location and how to operate safety equipment, including:
  - ◆ Emergency Guide
  - ◆ Emergency Eyewash and Shower
  - ◆ First aid kit
  - ◆ Fire Extinguisher & fire alarm pull station

# Labeling

- **Label all containers as follows:**
  - Name of the material
  - Concentration
  - Warnings
  - Date, when appropriate
  - Preparer's initials, when appropriate

Buy the least amount of product the work requires. Do not buy in large quantities to "save money", is a losing strategy when it comes to disposal costs



# Hazard Control

## **Engineering controls:**

Isoflurane must be administered by an approved anesthetic gas machine with a scavenging system in a well-ventilated room or in a certified fume hood.

**Active Scavenging Models:** Minimize or eliminate the possibility of workplace exposure by using 1 of the 3 active scavenging models listed below.

# Order of Priority

Model 1

Model 2

Model 3



**Model 1 (preferred)** – Handle inhalants and waste products under:

- Certified chemical fume hood
- Certified hard-ducted biosafety cabinet
- Other local exhaust device (e.g., snorkel, etc)

**Model 2** – Handle inhalants and waste products in a ductless device that allows rapid elimination of waste gases by adsorption in activated charcoal:

# Managing Charcoal filters

- Not effective for adsorption of nitrous oxide.
- Activated charcoal filters become saturated with anesthetic gas: must be changed out regularly.
- Efficiency depends on the amount of time and quantities of material being used.
- Maintain a log sheet to the filter to better manage the change out interval.



**Model 3** – Handle inhalants and waste products using house vacuum that allows rapid elimination of waste gases from the workplace:

Use them only if other more reliable techniques are not available.

Model 1 is preferred whenever possible.

# Passive Scavenging

- Discharging directly into the working environment
- Adsorption devices, such as canisters containing activated charcoal, can be used as waste-gas disposal systems in lieu of other types of scavenging systems, especially when portability is an issue. Activated charcoal is not effective for adsorption of nitrous oxide.

# Additional Required Controls

- Work in a well-ventilated room
- Wear this personal protection equipment:
  - Lab coat
  - Safety glasses
  - Disposable surgical gloves
  - Closed-toed shoes
- Use the least hazardous product and delivery system available for the task.
- Keep container sizes and quantities as small as possible in the work area.
- Store and transport stock bottles in a secondary container.
- Avoid techniques that make scavenging difficult or impossible (ex: open drop)

# Work practices

- Liquid isoflurane must be stored under lock in a cool, well-ventilated place away from direct sunlight and sources of ignition or open flames.
- Spills of liquid anesthetic agents should be cleaned up immediately.
- Carry out a complete anesthesia apparatus checkout procedure each day before the first case.
- Carry out an abbreviated inspection process before each use.



# Delivery Techniques for Inhalant Anesthetics

## Precision Vaporizer:

- Optimal delivery of inhalant anesthetic in all animals
- Allows the level of anesthesia to be precisely titrated for procedures lasting minutes or several hours.
- Always used for the inhalant anesthesia of large animals.
- Waste anesthetic gases can be scavenged either passively or actively.

# Delivery Techniques for Inhalant Anesthetics

## Open Drop technique

- Not an optimal technique for anesthetizing rodents: can overdose and subsequent death if not monitored properly .
- Generally used in rodents for procedures lasting 30-45 seconds (e.g. blood collection, tail clipping).
- Must use a clear glass or plastic induction chamber to facilitate observation of the animal
- The chamber should be of sufficient size that the animal can move freely and will not become hypoxic
- A grid or other barrier must be used to prevent direct physical contact with the liquid inhalant to avoid skin irritation.
- Do **not** work on bench top with this delivery technique.

# Emergencies

- **Train everyone working with anesthetics**
- **Never work alone, follow a buddy system**
- Keep MSDS easily accessible
- Have a spill kit easily accessible for small spills and keep everyone trained to use it.
- Clean up small spills promptly if you are trained. All other spills should be cleaned up by specially trained personnel.
- Know the location and how to operate safety equipment, including:
  - Eye wash/Shower
  - Fire extinguisher and alarm pull station
  - First aid kit