Institutional Animal Care and Use Committee
UNIVERSITY OF GEORGIA

Isoflurane Safety Guidelines

I. Introduction

Isoflurane, a halogenated anesthetic gas, is a potential health hazard and safety procedures should be followed during its use to reduce risks; safety data sheets are available online. Isoflurane is commonly used to anesthetize research animals. While safer than previous generations of halogenated anesthetic agents, efforts must be made to limit exposure risks. Additionally, certain people may be especially susceptible to health risks (e.g., during pregnancy). People working with isoflurane and other volatile anesthetics can be exposed to waste anesthetic gas (WAG), especially in certain situations frequently encountered when anesthetizing small animals:

1. When using a nose cone/face mask that does not form a tight seal around the animal's face. WAG can leak around the mask into the room.
2. When using an induction chamber. Opening the charged chamber to retrieve the induced animal releases WAG into the room. Sliding induction chambers are safer than hinged.
3. When using an open system (bell jar, conical tube) rather than a vaporizer with scavenging.
4. When using a stereotaxic surgery device. WAG is released below the animal's head.
5. When a non-rebreathing system is not used, which allows more waste gas to be released from the supply tubing

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.

OSHA: OSHA has not established a permissible exposure limit, but it is recommended that no worker should be exposed to greater than 2ppm of any halogenated anesthetic agent such as isoflurane.

Monitoring: Periodic monitoring for WAG levels is recommended. Companies sell and analyze 'personal monitoring systems' which measure the level of halogenated anesthetic gas, such as isoflurane, a person is exposed to during a specific period of time of anesthetic use.

II. Safety Procedures for Use with a Vaporizer (anesthesia machine) with a Scavenging System

A vaporizer system with a scavenging system can be used safely, if procedures are properly followed. Some systems actively remove WAG from the room by direct connection to an exhaust system (tubes attach to the wall or ceiling), but these are rare outside of a surgery suite. Most portable, table top (rodent) systems rely on a carbon filter to passively scavenge WAG.

Before Procedure:

- Check vaporizer system for leaks
    - With only Oxygen on, inflate bag, close pop-off valve and check for leaks in system. Open the pop-off valve again after testing.
- To fill vaporizer
    - Wear gloves and long sleeves to avoid skin contact
    - Wear eye protection to avoid eye exposure
    - Ideally fill with pin index or at least with funnel tip
- Carbon filter (e.g. F/AIR) canister
    - Carbon filters have a finite effective life span, which can be monitored by time in use, or weight. The weight of each new canister must be recorded before its first use. A weight increase in 50g from the original weight means the canister should be discarded and replaced with a new one.
    - Before each use, the weight should be checked and recorded. If the total increase is close to 50g, it 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.
    - To function appropriately, the carbon canister must be in an upright/vertical position.
    - To function appropriately with adequate air flow, the holes on the bottom of the carbon canister must not be blocked.

During Procedure:

- Induction chambers present high areas of exposure
    - Hinged: Open chamber with hinge facing operator
    - Sliding: Slide chamber open perpendicular to operator
    - Best if done in non-recirculating hood or down draft table

End of Procedure:

- Before turning off the flow or disconnecting animal from circuit:
    - Turn off isoflurane, leaving oxygen flowing
    - Dump remaining anesthetic from bag (if using) to the scavenge system
- Allow animal to breath oxygen for a few minutes or until recovered
    - This scavenges the gas being eliminated from the lungs

III Open drop (Bell Jar/Conical tube) Technique

Isoflurane may be used without a vaporizer. The liquid anesthetic is applied to gauze or cotton which is placed into a container for induction (bell jar), or in a conical tube for maintenance of anesthesia. Because of the high risk for WAG exposure, this method should be performed on a down draft table, or in a non-recirculating (fume) hood or special biosafety cabinet with a carbon filter.

- A 1000 ml container exposes the user to significantly less WAG than a 500 ml jar
- Keep back a sensible distance when opening the container

IV. General Information

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- For the best seal around the animal's face, a diaphragm should be used on the nose cone/face mask. If using latex gloves to modify facemasks, use gloves with 12 mm thickness.
- Ideally, a proper coaxial non-rebreathing system should be used

- Stereotaxic Devices
    - Since WAG can escape below the animal's head, it is best to perform stereotaxic surgery in downdraft table/non-recirculating hood
    - A system made specifically to scavenge this WAG is commercially available

❖ Contact your Attending Veterinarian with any questions or concerns.

❖ Training modules for the use of volatile anesthetics and the set-up of gas anesthetic systems can be found at the AALAS Learning Library. If you do not have a Username and Password, please contact Lisa Kelly, Training Coordinator, at lmkelly@uga.edu or 706-583-0816.

V. References

- Commentary and recommendations on control of waste gas anesthetics in the workplace. JAVMA, Vol 209, No 1, July 1,1996, pp. 75-77
- Isoflurane Waste Anesthetic Gas Concentrations Associated with the Open-Drop Method. JAALAS, Vol 48, No 1, January 2009, pp. 61-64
- Isoflurane leakage from non-rebreathing rodent anesthesia circuits: comparison of emissions from conventional and modified ports. Laboratory Animals, Vol 40, May 25, 2005, pp. 200-209.
- Isoflurane Fact Sheet, UCLA Environmental Health and Safety Staff. 2002.