

Use of Isoflurane as an Anesthetic in Animal Protocols

Procedure: 6.14
Version: 1.0
Effective: 11/17/2016

A. Purpose:

Columbia University is committed to keeping all exposures to hazardous materials below statutory or recommended levels and otherwise as low as reasonably achievable.

B. Applicability/Scope

Volatile anesthetics are effective and for the most part free of adverse effects on the animals to which they are administered. However, human exposure to waste anesthetic gases has been associated with reproductive effects, and in the case of halothane, rare instances of transient hepatitis. In 1977, the National Institute of Occupational Safety and Health (NIOSH) established an exposure limit of 2 ppm, for no greater than one hour, on the halogenated anesthetics halothane, enflurane, and methoxyflurane. At the time **isoflurane** was not in widespread use and even though the indications are that it poses a lower risk than older halogenated anesthetics, the recommended maximum exposure level remains 2 ppm.

This policy applies to users of isoflurane as an anesthetic in animal procedures. It specifically seeks to decrease the potential exposure of users to this material through proper use of engineering controls, administrative controls, and personal protective equipment.

C. Definitions:

- Charcoal canister - a cartridge loosely containing powdered activated charcoal. Gases of vaporized anesthetic substances are directed through the activated charcoal enabling the removal of at least 95% of anesthetic substances.
- Engineering Control - focus on eliminating or reducing the actual source of the hazard. To the extent feasible, the work environment should be designed to reduce exposure to hazardous materials
- Isoflurane – halogenated ether used for inhalational anesthesia; most common volatile anesthetic used in veterinary medicine
- Protocols – animal care and use proposal
- Small animal – mice, rats, gerbils, hamsters and other small rodent species
- Vacuum pump – an instrument used for efficient collection of waste anesthetic gases through a vacuum

E. Procedures

1. Delivery and Maintenance of Isoflurane for Induction of Anesthesia

a. Set-up location

- i. The ideal set-up location for delivery and use of isoflurane in a small animal procedure is inside a Chemical Fume Hood or a **Ducted** Biological Safety Cabinet
- ii. If the vaporizer, nose cone set-up, and the induction box are all located inside a chemical fume hood or **ducted** biological safety cabinet, no carbon canisters are needed. If only the induction box is located inside the fume hood a charcoal canister **must** still be used. A best practice for this scenario would be to use a vacuum pump in conjunction with a charcoal canister.

b. Bell Jar in a Chemical Fume Hood or a Ducted Biological Safety Cabinet

- i. A bell jar system can **only** be used inside a chemical fume hood or ducted

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biological safety cabinet.

2. Safety Considerations for Set-Up
 - a. Filling the anesthetic gas vaporizer should be done inside a chemical fume hood or ducted biological safety cabinet.
 - b. **Charcoal canisters must be weighed before and after each use.** Each canister has a maximum weight and once the canister reaches this maximum weight, it **must** be disposed of as hazardous materials through EH&S. This weight depends on the size of the canisters. For example, once a small charcoal canister increases in weight by 50g it must be disposed of compared to a large canister, which must be disposed of after an increase of 200g.
 - c. Users must wear appropriate personal protective equipment during the procedure. This includes a lab coat, safety glasses, and gloves.
 - d. Leak check system by using a KimWipe air flow test.
3. Pre-procedure and Induction
 - a. Weigh scavenger canister:
 - i. If its weight has increased more than the allowable weight increase for that canister, discard in regular trash and connect a new canister to scavenger line.
 - b. Add isoflurane to reservoir on vaporizer if necessary, closing bottle and reservoir as quickly as possible. If possible, do this in a fume hood.
 - c. If using a compressed gas cylinder, ensure that there is adequate supply of oxygen to last the entire procedure.
 - d. Tighten all tubing connections. Ensure that all compressed gas cylinders are safely contained.
 - e. Adjust the stop cock on the y-piece tubing so that the isoflurane/oxygen mixture will flow into the induction chamber, returning to the scavenger canister, and not through the tubing going to the nose cone.
4. Procedure
 - a. Place the animal in the clean induction chamber, making sure to close the chamber securely.
 - b. General recommendations for anesthesia are 1-5% with oxygen flow at 1 L/min.
 - c. When animal loses righting reflex, **it is recommended that you turn off isoflurane flow and flush induction chamber with oxygen for 20 seconds.**
 - d. Remove animal onto a clean procedure surface; snugly attach a nose cone then turn isoflurane flow on.
5. Availability of Isoflurane System Equipment
 - a. Precision vaporizers must be calibrated annually by manufacturer or other authorized party, with verification provided by an attached sticker or other readily accessible documentation.
 - b. Induction chambers and breathing circuits must be appropriately sanitized after each use. Alcohols should not be used for sanitization of induction chambers as it may weaken the structure of acrylic and may cause clouding

D. Responsibilities

1. User

- a. Properly follow the guidelines listed in this policy and to ensure proper techniques and procedures are being utilized.
- b. Ensure that the equipment in use is working properly and has been calibrated according to recommendations.
- c. Ensure isoflurane has been listed as a chemical in use in the submitted IACUC protocol and accurate procedures are described in the Appendix E.

2. Environmental Health & Safety (EH&S)

- a. Provide personal monitoring for exposure to isoflurane as deemed necessary requested and provide written reports of monitoring results to lab manager.
- b. Keep records of current users of isoflurane throughout all campuses.
- c. EH&S will provide personal monitoring of isoflurane exposure upon request or as deemed necessary.
- d. Expired or unused quantities of isoflurane must be disposed through EH&S's Hazardous Waste program.

L. References:

NOISH: Waste Anesthetic Gases - Occupational Hazards in Hospitals:
<http://www.cdc.gov/niosh/docs/2007-151/>

OSHA: Anesthetic Gases: Guidelines for Workplace Exposures:
<http://www.osha.gov/dts/osta/anestheticgases/index.html>

K. Records:

1. The precision vaporizer should have a label verifying annual service and calibration, or else such verification must be readily available.
2. Upon initial use, the scavenging canister must be labeled with the date and its initial weight. Prior to each subsequent use, label the canister with date and current weight. ICM staff will follow the approved departmental SOP for maintenance. Canisters must be disposed of in regular trash when their weight increases beyond what the manufacturer of the canister has identified as the maximum weight increase for that specific canister.
3. Staff referred to Workforce Health and Safety as part of program for those working with animals must indicate their potential exposure to halogenated anesthetics as part of their surveillance program.