Safe Use of Isoflurane in Animal Research

Isoflurane is the most commonly used halogenated anesthetic in animal research at Binghamton University. Researchers can be exposed, via inhalation, to waste anesthetic gases (WAG), including isoflurane, if care is not taken to scavenge or prevent release into the laboratory environment.

Although the relationship between overexposure to isoflurane and adverse health effects is not well-defined, most references in the occupational health literature recommend precautions to control exposure during veterinary and research-related surgical procedures. These precautions include adequate general ventilation in the surgical areas, the use of well-designed and well-maintained scavenging systems, work practices to minimize leaks and spills while the anesthetic agent is in use, and routine equipment maintenance to minimize leaks.

Always consult with Laboratory Animal Resources veterinarians if you have animal care concerns related to the use of halogenated anesthetic gases.

Reducing Exposure to Anesthetic Gases

Use anesthetic gases in a laboratory equipped with adequate ventilation. Binghamton University laboratories are designed to provide a minimum of 6 air changes per hour (ACH). Our animal procedure labs provide 10 or more ACH. As with all hazardous chemicals, consult with Environmental Health and Safety (EHS) if you plan to use isoflurane or any other anesthetic gas outside of a laboratory.

Several methods to capture or scavenge WAG are available:

Chemical Fume Hood or Ducted (Exhausted) Biosafety Cabinet

A chemical fume hood or hard-ducted biosafety cabinet provide excellent protection from exposure to WAG. Hard-ducted biosafety cabinets are available in the Binghamton Neuroscience Institute rodent procedure rooms. If you administer isoflurane or other halogenated anesthetics within a chemical fume hood or ducted biosafety cabinet, you do not need to use a charcoal absorption canister. Chemical fume hoods and biosafety cabinets must be tested annually to ensure proper operation. Contact EHS for assistance.

Recirculating biosafety cabinets do not exhaust or remove WAG or other hazardous gases or vapors from the laboratory environment.

Downdraft tables, snorkel exhausts, ventilated chambers

Snorkel trunks, exhausted induction chambers, ventilated chambers, down draft tables, when connected to the building exhaust system, can prevent overexposure to WAG. Devices connected to the exhaust system should be tested annually by EHS. Charcoal canisters must be used to adsorb isoflurane or other halogenated anesthetics.

Waste Gas Scavenging (when local ventilation is not available)

Active systems: House vacuum system, with proper flow control, extracts waste gas from the anesthesia set up and discharges it outside of the building. Activated carbon canisters must be used to remove the waste anesthesia gas. Check with an LAR veterinarian for assistance with an active system set-up.

Passive systems do not use local ventilation or vacuum to actively remove the waste isoflurane. Charcoal canisters must be used to adsorb isoflurane or other halogenated anesthetics when working with a passive system. Connect one charcoal canister to the anesthesia set up and another to the induction chamber.

Charcoal Canisters

Canisters should be positioned horizontally, not upright. Record the baseline weight directly on the canister. After each use or before next use, weigh and record the value on the canister. Note that manufacturer's guidelines must be followed in regard to weight limits, and that canisters must be discarded through EHS once it reaches those limits.

Safe Work Practices

1. Before using anesthetic gas:

- Vaporizer should be inspected annually. Contact Laboratory Animal Resources for assistance.

- Verify that the chemical fume hood, ducted biosafety cabinet or ventilation system has been checked within the last year. Contact EHS for assistance.
- Fill the vaporizer in a chemical fume hood, if available. Always use an anti-spill adaptor. Wear lab coat, disposable nitrile gloves and eye protection.

2. Inductions

- Use the lowest concentration of anesthetic gases needed. Contact LAR veterinary staff for assistance.
- Whenever possible, place the induction chamber in a fume hood or ducted biosafety cabinet. If a fume hood or ducted biosafety cabinet is not available, attach a charcoal canister to the exhaust port.
- Place the animal in the induction chamber and then turn on the vaporizer.
- Purge induction chamber with oxygen prior to opening the chamber to retrieve the anesthetized animal.

Note: If the Institutional Animal Care and Use Committee (IACUC) has approved of the open-drop method, you must use a chemical fume hood or hard-ducted biosafety cabinet.

3. Surgical Procedures

- LAR veterinary staff can advise on the best fitting nose cone for the research animal. Nose cones with diaphragms that provide a seal around the nose of the animal are good options.
- If using a snorkel, position it as close as possible to the potential point of release. The capture zone of a snorkel is very limited.

Disposal

1 . Contact EHS to arrange for pick up and disposal of unused or expired anesthetic liquids. Do not dispose liquid into the drain or regulated medical waste receptacles.

2. Used charcoal canisters must be bagged and disposed of through EHS. Do not dispose into regulated medical waste.

Isoflurane Exposure Limits

The Occupational Safety and Health Administration (OSHA) has not issued a Permissible Exposure Limit for isoflurane. However, the National Institute for Occupational Safety and Health Administration (NIOSH) recommends that no worker should be exposed at ceiling concentrations greater than 2 ppm to any halogenated anesthetic agent over the course of 60 minutes. This exposure limit is based on the health effects attributed to halothane and methoxyflurane and has been extended by NIOSH to include newer halogenated agents such as isoflurane.

The American Conference of Governmental Industrial Hygienists (ACGIH) has set an 8 hour exposure concentration for enflurane at 75 ppm. Isoflurane is a structural isomer of enflurane.

Exposure Evaluation

If you have concerns about working with isoflurane or would like to have an exposure assessment performed, including sampling to determine isoflurane exposure levels, please contact EHS.

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