



Johns Hopkins University

Animal Care and Use Committee

Use of Anesthetic Gases: General Guidelines/Vaporizer Calibration¹

PURPOSE: The Animal Care and Use Committee (ACUC) has developed the following guidelines to control risk of exposure to waste anesthetic gases in the workplace.

A. INTRODUCTION

Inhalant anesthetic gases (e.g. isoflurane, halothane, sevoflurane, desmoflurane etc.) are halogenated gases that are commonly used in animal research. Halogenated anesthetics are typically clear, colorless, highly volatile liquids at normal temperature and pressure. Exposure to these substances occurs when vapors escape into the work environment during the anesthetic administration process.

Waste anesthetic gases possess very poor warning properties so odor is not an adequate indication of overexposure. Long-term exposure to waste anesthetic gases has been linked to genetic mutations, cancers, spontaneous abortions, hepatic and renal disease and psychomotor changes in humans. Health hazard information is available from the Toxnet database at <http://toxnet.nlm.nih.gov/>.

B. PROCEDURES TO REDUCE EXPOSURE

Equipment and system maintenance for anesthesia machines and vaporizers

1. All anesthetic vaporizers must undergo calibration verification by a professional service technician as recommended by the manufacturer and be serviced if necessary.
2. If no such recommendation exists, the following schedules apply:
 - Halothane vaporizers-** Calibration verification must be performed *annually* because halothane's properties lead to increased clogging of internal vaporizer components.
 - Isoflurane vaporizers-** Calibration verification must be performed at least *every 3 years*. If the machine is subject to extensive use (e.g., > 500 hrs/year) or is frequently moved to different locations, then verification must be performed annually.
3. A copy of the manufacturer's guidelines for calibration verification must be available in the laboratory to assist with oversight by the ACUC of proper maintenance of anesthetic equipment.
4. Documentation of equipment validation must be affixed to each anesthesia machine or vaporizer that is in service.

Environmental controls

1. Work in a well-ventilated area such as a laboratory or operating room.
2. Whenever possible, handle liquid anesthetic agents in a certified chemical fume hood, hard-ducted biosafety cabinet, downdraft table, or use another suitable local exhaust system.

Protective garb such as gloves, lab coat, and eye protection (face shield or goggles) should be worn when dispensing anesthetic agents.

3. Use a reliable gas scavenging system to collect, remove and dispose of waste anesthetic gases. Scavenging options include:
 - a. Dedicated exhaust system: A dedicated exhaust system such as an active vacuum waste gas line or an “elephant trunk” exhaust system is the preferred method to remove waste gases from the work environment.
 - b. Non-circulation ventilation systems: These discharge waste gases through an exhaust vent or grill (e.g., hard-ducted biosafety cabinet or downdraft table).
 - c. Chemical fume hood: The anesthetic can be delivered to the animal while it is inside the fume hood or an exhaust gas line from the anesthesia machine can be vented inside the hood.
 - d. Adsorption devices: Charcoal canisters such as F-Air or Enviro-Pure can be used to absorb halogenated waste gases. These canisters must be properly placed so that the vent holes on the bottom of the canister are not obstructed. Usage must be documented and accompanied by the method used to determine canister life as supplied by the manufacturer. For F-Air canisters this involves weighing the canister before and after use and discarding the canister when there is a 50 g increase from the initial weight.

C. TRAINING AND SOP REQUIREMENTS

PI's are responsible for training their staff who work with anesthetic gases before use.

D. ADDITIONAL USEFUL INFORMATION

1. Fish, R., Danneman, P., Brown, M., Karas, A., (Eds.). *Anesthesia and Analgesia in Laboratory Animals*, New York: Academic Press (2008).
2. Federal OSHA Fact Sheet Number 91-38 (Waste Anesthetic Gases)
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FACT_SHEETS&p_id=128
3. OSHA Guidance Document – ANESTHETIC GASES: Guidelines for Workplace Exposures <http://www.osha.gov/dts/osta/anestheticgases/index.html>
4. For help with anesthesia delivery systems and techniques contact a Research Animal Resources (RAR) veterinarian at 410-955-3273.

[1] Approved by the Animal Care and Use Committee: October 15, 2009; reviewed 2015, 2018, 2021

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