



IACUC Guidance:	<b>TAMU-G-003</b>	Title:	<b>Guidelines for the Safe Use of Inhalant Anesthesia</b>
	Location	Effective Date	Review By
	<b>College Station/Dallas/Galveston/Kingsville</b>	04/01/2023	03/31/2026
	<b>Houston</b>	07/01/2020	06/30/2023

**1. PURPOSE**

- 1.1. Anesthetic vaporizers and gas anesthesia units are designed to deliver an accurate level of inhalant anesthetic in a controlled and safe manner to animals to induce and reliably maintain an appropriate depth of anesthesia with minimal exposure to personnel. This document provides information to be used when planning and performing procedures using gas/inhalant anesthesia in vertebrate animals used for research, teaching, or other purposes at Texas A&M University.

**2. SCOPE**

- 2.1. Anesthetic agents/drugs will be discussed elsewhere. See TAMU-G-002.

**3. RESPONSIBILITY**

- 3.1. It is the PI’s responsibility to inform personnel of the hazards (health effects, signs of exposure) of working with anesthetic gases.
- 3.2. It is the PI’s responsibility to properly train personnel in the safe and effective use of anesthetic gases.
- 3.3. It is the IACUC’s responsibility to confirm date of calibration of anesthetic vaporizers during semi-annual inspections.

**4. DEFINITIONS AND/OR ACRONYMS**

- 4.1. **AUP:** Animal Use Protocol. Document submitted by the PI indicating the housing and research procedures involving animals.
- 4.2. **(Office of) Biosafety:** Supports the Institutional Biosafety Committee (IBC) administratively.
- 4.3. **EHS:** Environmental Health and Safety
- 4.4. **IACUC:** Institutional Animal Care and Use Committee. Institutional body responsible for ensuring adherence to federal regulation and institutional policy relating to the care and use of animals in teaching, testing and research. Appointed by the Institutional Official.
- 4.5. **MS222:** Tricaine Methanesulfonate is an FDA-approved drug (“Tricaine-S”) for temporary immobilization (sedation, anesthesia) of finfish, amphibians, and other aquatic, cold-blooded animals.
- 4.6. **PI:** Principal Investigator. The individual who has ultimate administrative and programmatic responsibility for the design, execution, and management of a project utilizing vertebrate animals.
- 4.7. **Scavenging:** The process of removing toxic components from the air stream or venting the exhaled air (which will contain anesthetic gas) safely out of the room.

**5. GUIDELINES OR PROCEDURE**

- 5.1. Procedures to Reduce Exposure
  - 5.1.1. Equipment and system maintenance
    - 5.1.1.1. All anesthetic vaporizers must undergo calibration verification by a professional service technician and be serviced if necessary.
    - 5.1.1.2. If no manufacturer recommendation exists, the following schedules apply:
      - 5.1.1.2.1. Halothane vaporizers – Calibration verification must be performed annually.
      - 5.1.1.2.2. Isoflurane/sevoflurane vaporizers – Calibration verification must be performed at least every 2 years.
      - 5.1.1.2.3. 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.
    - 5.1.1.3. A copy of the manufacturer’s guidelines for calibration verification must be available in the laboratory.

- 5.1.1.4. Documentation of equipment validation must be affixed to each anesthesia machine or vaporizer that is in service.
- 5.1.2. Working in a well-ventilated space, including the use of a functioning, certified chemical fume hood (whenever feasible). Please note: A biosafety cabinet cannot be used unless TAMU Biosafety or EHS has determined that it is a non-recirculating biosafety cabinet suitable to the proposed use.
- 5.1.3. Placing warning signage where occupational exposure can occur
  - 5.1.3.1. Women of childbearing age should be aware that, although the risks are not completely understood, exposure to anesthetic gases such as halothane and isoflurane may pose risks to a developing fetus and therefore exposure during pregnancy is not recommended. For more information contact EHS.
- 5.1.4. Using properly fitting face masks when directed by EHS
- 5.1.5. Using appropriate personal protective equipment (gloves, lab coats, safety glasses)
- 5.1.6. Labeling anesthetic gas appropriately
- 5.1.7. Filling vaporizers when few people are around and utilizing a functioning, certified chemical fume hood for dispensing anesthesia indoors. As noted previously, biosafety cabinets must not be utilized for this purpose.
- 5.1.8. Using keyed filler systems or bottle adapters with spout
- 5.1.9. For Anesthetic Machines:
  - 5.1.9.1. Leak-testing equipment, where applicable
  - 5.1.9.2. Connecting tubes and fittings properly
  - 5.1.9.3. Using appropriately sized endotracheal tubes
  - 5.1.9.4. Correctly inflating endotracheal tube cuffs
  - 5.1.9.5. Using low fresh-gas flow rates
  - 5.1.9.6. Turning off the gas prior to removing animal from anesthetic machine
  - 5.1.9.7. Maintaining oxygen flow until the scavenging system is flushed
- 5.1.10. For Open-Drop Systems:
  - 5.1.10.1. **Important Human Safety Considerations:** Because of risks to human health, the use of inhalant anesthetic is not recommended on open bench tops. The open-drop procedure should only be performed in a certified chemical fume or biosafety cabinet as described above. EHS should be consulted concerning the use of dosimetry to determine exposure levels to personnel when open-drop method is used on the open bench top.
  - 5.1.10.2. Method should be reserved for instances where short duration anesthesia is desired, or it is impractical to use a precision vaporizer.
  - 5.1.10.3. Use of open-drop method of anesthesia requires identification of delivery method and scientific justification within the protocol
  - 5.1.10.4. Use a chamber with a tight-fitting cover, where chamber and lid are constructed of non-porous material, easily sanitizable and allow for constant visualization of the animal
  - 5.1.10.5. Use a chamber with the smallest diameter mouth possible
  - 5.1.10.6. Ensure separation of animal from anesthetic soaked material to prevent contact with skin
  - 5.1.10.7. Take into account the size of the chamber when dispensing anesthetic
  - 5.1.10.8. Keep the lid on except when the animal is being placed into or removed from the chamber
- 5.1.11. Equipment that involves direct animal contact (anesthetic masks, nose cones, induction chambers, scales, and balance baskets) must be inspected, cleaned, and disinfected before and after use to ensure a proper fit and working condition and to prevent microbial cross-contamination.
- 5.1.12. Use a reliable gas scavenging system
  - 5.1.12.1. EHS should be consulted regarding appropriate scavenging methods to mitigate human exposure to excess anesthetic agent.
  - 5.1.12.2. 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.

- 5.1.12.3. Non-circulation ventilation systems: These discharge waste gases through an exhaust vent or grill (e.g., hard-ducted biosafety cabinet (**non-recirculating**) or downdraft table).
- 5.1.12.4. 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.
- 5.1.12.5. 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 50g increase from the initial weight.
  - 5.1.12.5.1. When charcoal canisters are used for passive scavenging, documentation of routine weight monitoring for loading must be maintained in the laboratory.

## 6. EXCEPTIONS

- 6.1. The PI may request an exception to the above standards by describing the departure in the AUP
- 6.2. For programmatic exceptions, the facility director or manager may submit a request for the exception using TAMU-F-013

## 7. REFERENCES, MATERIALS, AND/OR ADDITIONAL INFORMATION

### 7.1. Resources:

- 7.1.1. Training in proper anesthetic techniques and methods for pressure-testing anesthetic machines for leaks are available from:
  - 7.1.1.1. CMP at (979) 862-8047
  - 7.1.1.2. ARU: at (214) 828-8149
  - 7.1.1.3. PAR: at (713) 677-7471
  - 7.1.1.4. PRF: at (361) 221-0770
  - 7.1.1.5. **Sea Life Facility: at (409) 740-4574**
- 7.1.2. Anesthetic Machine Service may be provided by the manufacturer or a third party service provider such as:
  - 7.1.2.1. Veterinary Anesthesia Systems Inc. Mr. Paul T. Holloway, Texas Branch Manager at 800.498-5575. <http://www.vasinc.net>
  - 7.1.2.2. JB Anesthesia Service. Mr. Jeff Barowitz at 523 Chasewood Dr., Grapevine, TX 76051. 817.437.3710. [J.barowitz@verizon.net](mailto:J.barowitz@verizon.net)
  - 7.1.2.3. Handlebar Anesthesia Service. Mr. William Connery at 402A W. Palm Valley Blvd. Round Rock, TX. 78664. 512.670.2906. [handlebaranesthesia@yahoo.com](mailto:handlebaranesthesia@yahoo.com)
- 7.1.3. Questions or concerns about gas exposure, proper handling and disposal of anesthetic liquids, or other safety components should be directed to Environmental Health and Safety (EHS) at (979) 845-2132, [ehsd@tamu.edu](mailto:ehsd@tamu.edu). Environmental monitoring to determine the concentration of anesthetic gas vapors in the workplace is available through EHS.

### 7.2. References:

- 7.2.1. Fish, R., Danneman, P., Brown, M., Karas, A., (Eds.). Anesthesia and Analgesia in Laboratory Animals, Second Edition. New York: Academic Press (2008).
- 7.2.2. Institute for Laboratory Animal Research. Guide for the Care and Use of Laboratory Animals, 8<sup>th</sup> Edition. National Academies Press, 2011.
- 7.2.3. Occupational Health and Safety in the Care and Use of Research Animals, Institute of Laboratory Animal Resources, National Academy Press, Washington, D.C., 1997.
- 7.2.4. USDA National Agricultural Library. Final Rules: Animal Welfare; 9 CFR Parts 1, 2, and 3. Federal Register, Vol. 54, No. 168, August 31, 1989, P. 36112-36163.



- 7.2.5. United States Department of Labor, Occupational Safety and Health Administration, Code of Federal Regulations, Title 29, Part 1910.1200 – [Occupational Safety and Health Standards, Subpart Z – Toxic and Hazardous Substances.](#)
- 7.2.6. United States Department of Labor, Occupational Safety and Health Administration, [Anesthetic Gases: Guidelines for Workplace Exposures.](#) Revised May 18, 2000.
- 7.2.7. United States Department of Labor, Occupational Safety and Health Administration, [Waste Anesthetic Gases.](#)
- 7.2.8. Itah et al. 2004. A replacement for methoxyflurane (Metofane) in open-circuit anesthesia. *Lab.Anim.* 38:280-5.
- 7.2.9. Nagate, T., T. Chino, et al. (2007). "Diluted isoflurane as a suitable alternative for diethyl ether for rat anaesthesia in regular toxicology studies." *Journal of Veterinary Medical Science* 69(11): 1137-1143.

7.3. [IACUC/AWO Referenced Documents:](#) (requires TAMU NetID authentication)

- 7.3.1. TAMU-F-013 Request for Programmatic Exception from Animal Welfare Standards **(available upon request)**

**7.4. Acknowledgements**

- 7.4.1. This document contains content that was partially adapted from materials obtained from the University of Texas at Austin, **Kentucky**, and Johns Hopkins University.

**8. HISTORY**

Effective Date	Version #	Description
07/18/2019	000	College Station/Galveston: New document
12/16/2019	001	Houston/Kingsville: New format and updated content; replaces IBT-202
12/17/2019	002	Dallas: New format and updated content; replaces CD-202
07/01/2020	003	College Station/Galveston: Renewal of expiring document; addition of location-specific definitions and contact information for individual centrally managed vivaria; reviewed & approved via email.
07/01/2020	004	Houston/Kingsville: Renewal of expiring document; addition of location-specific definitions and contact information for individual centrally managed vivaria; reviewed & approved via email.
07/21/2020	005	Dallas: Renewal of expiring document; addition of location-specific definitions and contact information for individual centrally managed vivaria.
03/24/2022	006	College Station/Dallas/Galveston: Merging of Dallas animal care and use program with College Station/Galveston
10/20/2022	007	College Station/Dallas/Galveston/Kingsville: Merging of Kingsville animal care and use program with College Station/Dallas/Galveston.
04/01/2023	008	College Station/Dallas/Galveston/Kingsville: Renewal; modification of definitions, clarification of use of chemical fume hoods, expansion in open drop procedure description, addition of exceptions section, expansion of references section. Reviewed & approved via email.
		<b>(Items noted above in Red have only been approved by the College Station/Dallas/Galveston/Kingsville IACUC)</b>