

Anesthetic Gas

Control Exposures to Isoflurane and Nitrous Oxide During Anesthetic Administration

The waste anesthetic gases and vapors of concern are halogenated agents such as isoflurane, halothane, enflurane, and desflurane and also nitrous oxide. Take the following steps to protect yourself from anesthetic gases (AGs):

- ❑ **Be aware that anesthetic gas may cause adverse health effects:**
 - Decreases in mental performance, audiovisual ability, and manual dexterity
 - Nausea, dizziness, headaches, fatigue, and irritability
 - Liver and kidney disease
 - Adverse reproductive effects (sterility, miscarriages, birth defects, infertility)
 - Cancer

Always read the Material Safety Data Sheet ([MSDS](#)) for your anesthetic gas!

- ❑ **Prevent anesthetic gas exposure to yourself while working:**

- Use an induction chamber with tight fitting seal (gasket) and ports for scavenging system hook up for small animals
- Use tight fitting masks secured to animal
- Use an appropriate scavenging system for the gas being used: halogenated compounds use an activated charcoal adsorption system
- Leak test equipment before starting the procedure
- Always perform the drop system in the fume hood



- ❑ **Prevent leakage from the anesthetic delivery system through proper maintenance and inspection of equipment. Eliminate the following:**

- Loose-fitting connections
- Defective or worn seals, gaskets, breathing bags, and hoses

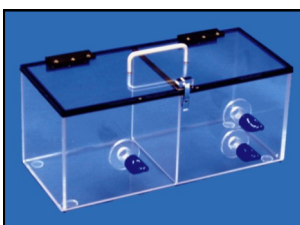
- ❑ **Control AGs with a well-designed and maintained scavenging system:**

- Change filters and vaporizers at recommended times
- Use meter to ensure sufficient flow rates for the exhaust system
- Properly vent vacuum pumps



- ❑ **Make sure that the room ventilation is effectively removing AGs:**

- Monitor air in the worker's personal breathing zone and room air
- Occupational Exposure Limit is 2 ppm over 60 minutes (halogenated agents) and 25 ppm Ceiling (N₂O)



Contact EH&S for assistance with monitoring or improving your anesthetic gas controls.

Injectable anesthetics (e.g. urethane) are also hazardous, but are not covered in this handout.

Veterinary Clinics and Hospitals

Inhalation anesthesia in veterinary hospitals is practiced in a manner similar to that in human hospitals. Generally, animals are initially given an injectable anesthetic, followed by general anesthesia maintained by an inhalation technique. In animal anesthesia, there are five basic methods by which inhalation anesthetics are administered: open-insufflation, semiopen without nonrebreathing valves, semiopen with nonrebreathing valves, semiclosed, and closed. Oxygen and anesthetic are transported to the animal's lungs from the anesthesia machine through a face mask or tracheal tube. An inflatable cuff on the distal end of the tracheal tube facilitates a seal with the inner wall of the trachea.

Unidirectional valves allow flow from the vaporizer to the animal upon inspiration and route the exhaled gases through a carbon dioxide absorber during expiration. High fresh-gas flows are typically used with all techniques except closed-system breathing circuits. During expiration, excess or waste gas exits the breathing circuit at the adjustable pressure-limiting (APL) or pop-off valve and escapes into the room unless it is appropriately scavenged.

Non-rebreathing systems allow exhaled gases to be immediately expelled from the system into the room air. Because these systems do not include a carbon dioxide absorber, greater fresh-gas flows are required to ensure removal of carbon dioxide from the system. A higher fresh-gas flow may lead to an increase in ambient waste gas levels.

- a. **Engineering Controls** The basic principles of scavenging used to capture excess anesthetic gases in hospital surgical suites are appropriate for application in veterinary anesthesia. The APL or pop-off valve is connected to the scavenging interface valve. A waste gas reservoir bag is attached to the interface valve and collects excess anesthetic gases. In general, the disposal pathway for waste anesthetic gases generated in a veterinary facility can be any one of those mentioned (e.g., ventilation system, central vacuum system, dedicated blower [exhaust] system, passive duct system, or adsorber). A vacuum source, if present, is connected to the interface valve and waste gas reservoir bag, where gas is stored until the vacuum can move it to the outside air. If only halogenated compounds are used, an activated charcoal adsorption system can be used.
- b. **Work Practices** The following are recommended work practices for reducing gas leakage:
- Avoid turning on N₂O or a vaporizer until the circuit is connected to the animal. Switch off the N₂O and vaporizer when not in use. Maintain oxygen flow until the scavenging system is flushed.
 - Select the optimal size tracheal tube for the animal and make sure the cuff, if present, is adequately inflated. Adequacy of cuff inflation may be evaluated by delivering a positive-pressure breath while the APL or pop-off valve is closed and listening for a leak originating from around the tracheal tube cuff.
 - Occlude the Y-piece if the breathing circuit must be disconnected during surgery.
 - Once anesthesia is discontinued, empty the breathing bag into the scavenging system rather than into the room. Releasing anesthetic gases into the room could significantly increase the overall waste gas concentration within the room.
 - At the end of the surgical procedure, continue to administer non-anesthetic gases/agents as long as clinically necessary, using high oxygen flow rates through the breathing circuit to wash the anesthetic gases out of the system and the animal. This allows exhaled anesthetic gases to be collected by the scavenging system.
 - It is possible to close an anesthetic circle and reduce fresh-gas flow rates. In a circle system where oxygen is the only carrier gas, the amount of fresh gas flowing to the animal should be adjusted to closely match the animal's metabolic oxygen requirement.
 - Select masks to suit various sizes and breeds encountered in veterinary practice. When a mask is used for induction or maintenance of anesthesia, use a mask that properly fits the contour of the animal's face to minimize gas leakage. Minimize the time of mask anesthesia to reduce waste.
 - Use a box for induction of anesthesia in small, uncooperative animals. As with the mask technique, the induction box method requires high gas-flow rates, with substantial anesthetic spillage. Methods to minimize this spillage include tight seals on the box and placement of the box near the ventilation port of a well-ventilated room. The box can also be connected to an anesthetic gas-scavenging system to evacuate the gases in the box prior to removing the animal.
 - Make certain that the reservoir bag, used to store excess anesthetic waste gas until the vacuum system can remove it, is adequate to contain all scavenged gas. This reservoir bag is especially designed to connect to anesthetic gas-specific fittings.

ADAPTED FROM: **Anesthetic Gases: Guidelines for Workplace Exposures.** Occupational Safety and Health Administration. May 2000. <http://www.osha.gov/dts/osta/anestheticgases/index.html>