

Anesthetic Gases

Nonflammable anesthetic gases include two different classifications of chemicals - nitrous oxide and halogenated agents (i.e., isoflurane, halothane, enflurane, desflurane, sevoflurane, and methoxyflurane). These gases are typically clear, colorless, volatile liquids at ordinary temperature and pressure, and are commonly used as inhalation anesthetics. Exposure to these substances can occur as vapors escape into the work environment during the anesthetic administration process. These gases possess very poor warning properties and therefore provide no indication (such as odor) that exposure to these substances is occurring.

Health Hazards

In addition to central nervous system effects, epidemiological studies have also indicated that adverse reproductive effects, congenital abnormalities, and adverse effects on the liver and kidneys are possible as a result of over exposure to anesthetic gases.

Exposure Limits

OSHA has not established a permissible exposure limit (PEL) for anesthetic gases. NIOSH has a recommended exposure limit (REL) for halogenated agents of 2 ppm or 15.1 mg/m³ as a ceiling limit (average over 1 hour), and an REL for nitrous oxide of 25 ppm as a time-weighted average during the period of anesthetic administration. The ACGIH threshold limit value (TLV) for nitrous oxide is 50 ppm as an 8-hour TWA.

Approved Scavenging methods

In order to reduce the risk of exposure to escaped vapors, one of the following control measures should be in place during the anesthetic application process:

- **First Choice:** Placement of entire gas mixing and delivery system inside a fume hood.
- **Second Choice:** Installation of local exhaust over isoflurane delivery system to address a single source of anesthetic gas such as that shown in the photo to the right or a slot or canopy exhaust for procedures that involve multiple sources of anesthetic gas (e.g., knockout box, procedure table, etc.).
- **Third Choice:** Capture of waste gas using gas scavenging canisters. This method is only recommended as a control measure under the following circumstances:
 - There is no fume hood or other local, hazardous exhaust system available for use.
 - Leak checks are performed routinely on equipment.

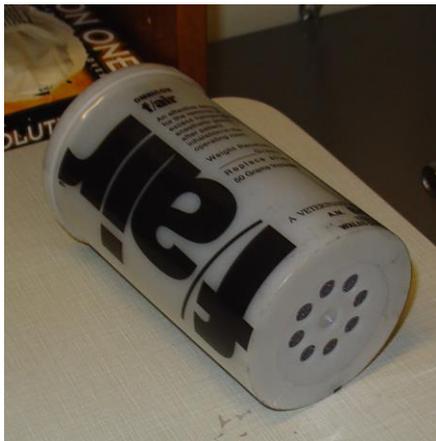


Fact Sheet

- Saturation levels of canisters are checked prior to each use.
- Researchers are well trained and supervised in proper use and maintenance of the anesthetic equipment. If not properly used or maintained, gases may escape into the work area resulting in overexposure.

Notes on use of gas scavenging systems:

- Absorption canisters with exhaust ports located on the top work better than those with the exhaust ports on the bottom. Both types of cylinders should be used in the upright position; however, the location of the exhaust ports on the top of the canister alleviates back pressure and minimizes development of open channels through the charcoal which results in better capture.



f/air gas scavenging canister with exhaust ports on the bottom



VaporGaurd gas scavenging canister with exhaust ports on the top

- Decreasing oxygen flow rates during anesthetic gas administration can also reduce the concentration of waste gases in the work environment. For example, reducing the oxygen flow rate from 2 to 0.4 for a single mouse on a nose cone will still anesthetize the mouse while reducing the concentration of waste gases in the work environment to more acceptable levels.

Filtering Fume Hoods (absorb contaminants on filters instead of exhausting to the outside) are **NOT** allowed for use as a control measure in university facilities for the following reasons:

- The filters require a high degree of attention and maintenance
- Users must be thoroughly trained and diligent about properly using and maintaining such as system
- If not properly maintained, hazardous chemicals exhaust back into the room
- Gases (such as anesthetics) with poor warning properties will provide no indication (such as odor) if the filters become overloaded or otherwise leak.
- Long term, ducting to the outside tends to be less expensive and more effective than changing filters.

Fact Sheet

DEHS (626-6002) will conduct evaluations of engineering systems used to control exposures to anesthetic gases and conduct personal exposure monitoring for laboratory workers upon request.

Personal Protective Equipment

Gloves, lab coats and eye protection should be worn to prevent contact with liquid anesthetic gases.

Work Practices

Anesthetic gases should be stored in cool, well-ventilated areas away from direct sunlight and sources of ignition or open flames.

SIGNS & SYMPTOMS

- **Acute Exposure:** nausea, vomiting, skin irritation, nose/throat/respiratory irritation, headache, dizziness, and drowsiness
- **Chronic Exposure:** hypotension, tachycardia, respiratory depression, elevated blood glucose

EMERGENCY EXPOSURE PROCEDURES

- **Eye Care:** If anesthetic gases come in contact with eyes, immediately flush them with copious amounts of water for at least 15 minutes, preferably in an emergency eyewash.
- **Skin Care:** In the event of skin exposure, remove contaminated clothing and immediately wash the affected area with soap and water.
- **If Swallowed or Inhaled:** In the case of ingestion, obtain medical attention immediately. If anesthetic gases are inhaled, move the victim to a source of fresh air.

Additional Information

Contact University of Minnesota DEHS at (612) 626-6002 for an evaluation of your control system or to have personal exposure monitoring conducted in your work area.

References:

[Federal OSHA Fact Sheet Number 91-38 \(Waste Anesthetic Gases\)](#)

[OSHA Guidance Document – ANESTHETIC GASES: Guidelines for Workplace Exposures](#)

[University of Minnesota Research Animal Resources](#)