

Waste Anesthetic Gas Safety Guideline

Version 1.0, Approved 10/18/2023

Purpose

Waste anesthetic gases are a concern when working with any anesthetic gases during surgical procedures. Anesthetic gases can include halogenated compounds such as enflurane or isoflurane, as well as nitrous oxide. It is important to use anesthetic gases safely to avoid potential health hazards to laboratory personnel.

Overexposure to Anesthetic Gases

Overexposure to anesthetic gas vapors may include some or all the effects listed below.:

- Acute effects from short term exposure: eye or skin irritation, respiratory tract irritation, drowsiness, irritability, headaches, dizziness, nausea, impaired coordination, and reasoning.
- Chronic effects from long term exposure: liver and kidney damage, possible adverse reproductive effects.

How to Use Anesthetic Gases Safely

There are several things you can do to use anesthetic gases safely:

- Use the smallest amount of anesthetic necessary to achieve the desired effect.
- Work in a certified chemical fume hood.
- Localized exhaust systems.
- Use a scavenging system to remove waste gas from the breathing area (**do not use charcoal adsorption units for nitrous oxide**).
- Keep the anesthesia machine and other equipment in good working order.
- Perform regular maintenance on the scavenging system.
- Use personal protective equipment, such as gloves and a lab coat, when handling the anesthetic agents.

Disposal of Unused Anesthetic Agents

Anesthetic liquid should be disposed of properly. Do not flush anesthetic liquids down the drain or into the environment. Anesthetic agents should be disposed of as a chemical hazardous waste only. Bottles of anesthetics should not be discarded into biohazardous waste containers or broken glass boxes.

Waste Anesthetic Gas Safety Guideline

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Waste Anesthetic Gas Scavenging Methods

Waste gas scavenging is the process of removing waste anesthetic gases from the breathing area. This is important to do to prevent overexposure to anesthetic gas vapors. There are several different waste gas scavenging systems available, each with its own advantages and disadvantages.

Chemical Fume Hood

The most effective way to scavenge waste gas is to use a chemical fume hood. The entire gas mixing and delivery system should be placed inside the fume hood, so that all of the waste gas is exhausted directly to the outside air. This is the best way to prevent overexposure to anesthetic gas vapors.

Localized Exhaust Systems

If a fume hood is not available, a localized exhaust system can be used. This type of system uses a vacuum pump or a snorkel vent to remove the waste gas from the breathing area. The waste gas is then discharged directly to the outside air. Localized exhaust systems are not as effective as fume hoods, but they can be a good option in situations where a fume hood is not practical.

Building Vacuum Systems

Building vacuum systems can also be used to scavenge waste gas. However, it is important to consult with facilities management to make sure that the vacuum system is safe to use with anesthetic gases. In some cases, it may be necessary to use a charcoal canister in conjunction with the vacuum system to improve the effectiveness of the scavenging.

Charcoal Canisters

Charcoal canisters are a passive scavenging system that can be used in situations where other means of scavenging are not practical, but do not work with nitrous oxide. Charcoal canisters work by absorbing waste gas. However, they are not as effective as other scavenging systems, and they require regular maintenance.

Charcoal Canister Maintenance

Charcoal canisters have a finite effective life span, which can be monitored by weight.

- The weight of each new canister should be recorded before its first use.
- Before each subsequent use, the weight should be checked and recorded.

Waste Anesthetic Gas Safety Guideline

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- If the total increase is close to manufacturer specified limits, it should be replaced, or monitored closely during use by weighing between animals.
- To function appropriately, the carbon canister should be at a level below that of the vaporizer and in the upright/vertical position, to assist in passive scavenging.
- To ensure adequate air flow, the holes on the bottom (F/Air canister) or top of canister (VaporGuard) must not be blocked.

Which Scavenging System is Right for You?

The best scavenging system for you will depend on your specific needs and circumstances. If you are working in a well-ventilated area, you may be able to get away with using a passive scavenging system. However, if you are working in a small, enclosed space, you will need to use a more effective system, such as a chemical fume hood or a localized exhaust system.

It is important to consult with your safety officer to determine which scavenging system is right for you. They can help you choose a system that is effective and safe to use.

Here are some additional safety tips for using waste gas scavenging systems:

- Always use the scavenging system that is appropriate for your needs.
- Keep the scavenging system in good working order and regularly inspect it for leaks.
- Use personal protective equipment, such as gloves and a lab coat, when handling the scavenging system.
- Dispose of waste gas properly.

Anesthesia Machine

To ensure the safe use of the anesthesia machine, it is important to:

- Verify that the equipment is certified and in proper working order. Anesthetic vaporizers are required to be certified on a yearly basis.
- Fill the vaporizer using an anti-spill bottle adaptor. If possible, fill the vaporizer while it is inside a chemical fume hood. If a fume hood is not available, fill the vaporizer the day before surgery or procedures.
- Routinely inspect the anesthesia machine and scavenging system for leaks, defects, loose connections, and damage.
- Use a chamber with a tight-fitting cover. Make sure the cover remains closed except when the animal is being placed into or removed from the chamber. Chambers with sliding doors are preferred.

Waste Anesthetic Gas Safety Guideline

Version 1.0, Approved 10/18/2023

- Use the lowest necessary oxygen flow rate and concentration of anesthetic to achieve anesthesia.
 - For rodents, the typical induction flow rate is 1-1.2 L/min of oxygen with 3-5% anesthetic.
 - For rodents, the typical maintenance flow rate is 0.4-0.6 L/min of oxygen with 1-3% anesthetic.
- Always use a tight-fitting nose cone for all procedures with rodents. Avoid using custom-made nose cones or nitrile gloves to make nose cone diaphragms.
- Purge the induction chamber with oxygen for 5-10 seconds prior to opening the chamber and retrieving the anesthetized animal. If chamber flushing is not experimentally feasible, other active scavenging methods should be utilized.

Open-drop Method

The open-drop method of anesthesia is not recommended, but if it is experimentally necessary, it should be performed within a fume hood or with other EH&S-approved scavenging systems.

Personal Protective Equipment

When handling liquid anesthetic agents, always wear the proper personal protective equipment, such as gloves and a lab coat. When working in ABSL 2 areas, PPE use must be in accordance with facility policy.

Waste Handling

Anesthetic gas liquid should be disposed of properly. Do not flush anesthetic gas down the drain or into the environment. Anesthetic gas should be disposed of as a chemical hazardous waste only. Bottles of Anesthetic gas should not be discarded into biohazardous waste containers or broken glass boxes.

Anesthetic gas and used charcoal canisters must be disposed of as chemical hazardous waste only. If a small spill occurs, collect the liquid and absorbent materials in a glass or plastic container and tightly seal it for disposal as chemical waste. For spills larger than half a bottle of anesthetic gas, evacuate the area and call the Workorder desk at 740-593-2911.

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Evaluation and Monitoring

Safety is available to perform exposure assessments of your control system and, if appropriate, personnel exposure monitoring. If you would like to request an assessment in your laboratory, please contact Safety at 740-593-1666 or email us at safety@ohio.edu.